Comprehension

Part I

Vocabulary
Instruction

Introduction

The importance of vocabulary in reading achievement has been recognized for more than half a century. As early as 1925, in the National Society for Studies in Education (NSSE) Yearbook, this quotation appears:

> Growth in reading power means, therefore, continuous enriching and enlarging of the reading vocabulary and increasing clarity of discrimination in appreciation of word values (Whipple, 1925, p. 76).

Even today, evidence of the importance of vocabulary is usually attributed to Davis (1942), who presented evidence that comprehension comprised two "skills": word knowledge or vocabulary and reasoning in reading. The Panel reflects this position with the inclusion of the current analysis of research on vocabulary instruction with the other comprehension research analyses. Since Davis' work, there have been questions regarding the "skills" perspective, but the finding that vocabulary is strongly related to comprehension seems unchallenged.

Given the prominence of vocabulary in the reading process, the comprehension subgroup determined that vocabulary instruction merited a specific review. Therefore, the purpose of this report was to examine the scientific evidence on the effect of vocabulary instruction on reading achievement. This was done is two stages: first examining the literature on vocabulary instruction and, second, the literature on the measurement of vocabulary.

Vocabulary Instruction

Vocabulary occupies an important position in learning to read. As a learner begins to read, reading vocabulary encountered in texts is mapped onto the oral vocabulary the learner brings to the task. That is, the reader is taught to translate the (relatively) unfamiliar words in print into speech, with the expectation that the speech forms will be easier to comprehend. A benefit in understanding text by applying letter-sound correspondences to printed material only comes about if the resultant oral representation is a known word in the learner's oral vocabulary. If the resultant oral vocabulary item is not in the learner's vocabulary, it will not be better understood than it was in print. Thus, vocabulary seems to occupy an important middle ground in learning to read. Oral vocabulary is a key to learning to make the transition from oral to written forms, whereas reading vocabulary is crucial to the comprehension processes of a skilled reader.

Despite the clear importance of vocabulary, recent research has focused more on overall comprehension than on vocabulary. This appears to be a function of the more inclusive nature of many contemporary comprehension methods, which seem to incorporate at least some vocabulary instruction. Even in traditional methods of teaching reading, lesson formats always include vocabulary instruction.

Many studies have shown that reading ability and vocabulary size are related, but the *causal* link between increasing vocabulary and an increase in comprehension has not been demonstrated. That is, it has been difficult to demonstrate that teaching vocabulary improves reading ability.

Why this should be so difficult is sometimes obscured by the imprecise nature of the definitions of vocabulary and comprehension. Both vocabulary and comprehension involve the meaning of the text, albeit at different levels. Vocabulary is generally tied closely to individual words while comprehension is more often thought of in much larger units. To get to the comprehension of larger units requires the requisite processing of the words. Precisely separating the two processes is difficult, if not impossible.

Measurement of Vocabulary

Even the measurement of vocabulary is fraught with difficulties. Researchers distinguish between many different "vocabularies." Receptive vocabulary is the vocabulary that we can understand when it is presented to us in text or as we listen to others speak, while productive vocabulary is that vocabulary we use in writing or when speaking to others. It is generally believed that receptive vocabulary is much larger than productive vocabulary since we often recognize words

that we would rarely use. Vocabulary is also subcategorized as oral vs. reading vocabulary, where oral refers to words that are recognized in speaking or listening while reading vocabulary refers to words that are used or recognized in print. Sight vocabulary is a subset of reading vocabulary that does not require explicit word recognition processing. Conclusions about some of these different types of vocabularies often do not apply to all; what may be true for one may or may not be true for another.

At a conceptual level, vocabulary can be measured in many ways. One major distinction in the measurement of vocabulary parallels the receptive/productive distinction. Vocabulary that is *recognized* by an individual is often different from vocabulary that is *produced.* Another distinction is made between reading vocabulary and writing vocabulary—the vocabularies that are available to the reader or writer—and between speaking and listening vocabularies. Still another type of vocabulary is often referred to as sight vocabulary—those words that can be identified without explicit decoding during reading.

Because there are so many definitions of vocabulary, the format for assessing or evaluating vocabulary is an important variable in both practice and research. One way of assessing recognition vocabulary is to have the learner select a definition for a word from a list of alternatives. Conversely, the task *could* be to select a word for the definition. In many cases, such as standardized tests, this method is used as a means of obtaining efficiency in testing. A second method of assessing vocabulary is by having the learner generate a definition for a word. Because this method requires a judgment about the response, it is often deemed less efficient than a recognition method. Most often, recognition vocabulary is measurably larger than productive vocabulary.

Another difficulty with the measurement of vocabulary is that we can only ask a learner for a relatively small number of words. Those words must be representative of a larger pool of vocabulary items. In short, we can never know *exactly* how large a vocabulary an individual has. Instead, we often measure only specific vocabulary items that we want the individual to know, for example, in the context of a reading or a science lesson. Standardized tests attempt to deal with this by selecting words that differ widely in their familiarity. Persons who can correctly identify unfamiliar words are assumed to have larger vocabularies. The more unfamiliar words that can be identified, the larger the vocabulary. However, these are estimates, rather than precise measurements. Furthermore, the definition of "familiar" or "known" words is difficult to pin down outside of a specific context. What does it mean if a learner "almost" knows a word? The assessment of such a circumstance has no objective answer.

Finally, evaluation of vocabulary knowledge is measured either by standardized tests or by informal, experimenter- or teacher-generated tests on one dimension and by receptive vs. productive techniques on another dimension.

Methodology

Database

A search using Endnote 3.0 connected to the ERIC online database with a Z39.50 connection was initiated. Using the term "vocabulary" alone (in any field) yielded 18,819 citations. A search using "vocabulary" and "instruction" and "reading" and "research" and "method" yielded 141 citations. A similar search undertaken using the PsycINFO database yielded a total of 56 nonoverlapping citations. The 197 citations were downloaded into an Endnote library for further analysis. From this set, citations were removed if they were not reports of research, did not report experimental or quasi-experimental studies, dealt with foreign languages or non-English-speaking groups, or dealt exclusively with learning disabled or other special populations, including second-language learners.

There are many studies that describe aspects of vocabulary without specifically addressing the questions of how vocabulary instruction is conducted. The Panel does recognize the importance of many of these studies in designing vocabulary instruction, but the Panel did not analyze these studies unless they contained at least some experimental work on instructional methods.

Additional bibliographic searching was conducted, guided by three meta-analyses (Stahl & Fairbanks, 1986; Klesius & Searls, 1990; Fukkink & de Glopper, 1998) and two reviews of the literature on vocabulary instruction research (Nagy & Scott, in press; Blachowicz & Fisher, in press). These procedures

yielded a total of 50 studies that were candidates for further analysis. The studies were coded in a Filemaker 4.0 database, using the categories established by the NRP.

As the Panel analyzed the studies in the database, the Panel found no research that met the NRP criteria that explicitly addressed the issues of measuring vocabulary. This is clearly a gap in our knowledge and a research need.

Analysis

An exhaustive inquiry into recent research in vocabulary instruction techniques failed to elicit a numerically large database of studies that satisfied the NRP criteria for inclusion. Although the small size of the database of experimental research might temper some of the conclusions from the data, important and interesting trends do appear in the body of available studies. Following is a discussion of some salient observations from the extant data set, as well as some preliminary analyses of trends and important findings.

Three meta-analyses included in the original search were analyzed separately from the instructional research studies. Although these analyses do not meet the formal criteria for inclusion in the analysis, they are relevant to the issues at hand. Consequently, they are included in the discussions of findings.

Consistency With the Methodology of the National Reading Panel

The methods of the NRP were followed in the conduct of the literature searches and the examination and coding of the articles obtained. A formal meta-analysis was not possible. Inspection of the research studies that were included in the database revealed a heterogeneous set of methodologies, implementations, and conceptions of vocabulary instruction. As noted, the Panel found no research on vocabulary measurement that met the NRP criteria; therefore, implicit evidence is presented below on this issue.

Results

Summary and Preliminary Taxonomy of Instruction Methods

Because so many of these studies examined involve unique instructional programs, it was deemed appropriate to provide a summary of the methods used to study vocabulary. Table 1 in Appendix A lists the methods, a description of the basic techniques, and some sample citations for the method.

Because there were so many different methods represented in the database, a scheme for categorizing the methods was attempted. There are so many dimensions on which vocabulary instruction can be categorized that each implementation often appears to be unique. This seems to be the case for two reasons. First, there are typically so few vocabulary studies that each seems to distinguish itself from others by its differences from rather than its similarities to other methods. The second reason is that the similarities between methods have not been systematically organized at the conceptual level. The following scheme is an attempt to produce a simplified taxonomy of methods for vocabulary instruction.

Explicit Instruction

In explicit instruction, students are given definitions or other attributes of words to be learned. They are often given specific algorithms for determining meanings of words, or they are given external cues to connect the words with meaning. A common example of this technique is the pre-teaching of vocabulary prior to reading a selection. Other common methods of explicit instruction involve the analysis of word roots or affixes.

Indirect Instruction

In indirect instruction, students are exposed to words or given opportunities to do a great deal of reading. It is assumed that students will infer any definitions they do not have. At least one version of the implicit methods simply suggests that students should be encouraged to do wide reading to increase vocabulary.

Multimedia Methods

In these methods, vocabulary is taught by going beyond text to include other media. Semantic mapping and graphic representations of word attributes are among these methods (Margosein, Pascarella, & Pflaum, 1982; Levin, Johnson, Pittelman, Levin, Shriberg, Toms-Bronowski, & Hayes, 1984.) Newer developments like hypertext go beyond the single medium of text in attempts to enhance vocabulary learning. American Sign Language (Daniels, 1994, 1996) has been used to increase vocabulary, capitalizing on encoding in a haptic medium.

Capacity Methods

At least a few methods attempt to reduce the cognitive capacity devoted to other reading activities by practicing them to make them more nearly automatic. These methods assume that the additional capacity freed up can be used for vocabulary learning. These methods work to allow the student to concentrate on meaning of words rather than their orthographic or oral representations.

Association Methods

In this category of methods, learners are encouraged to draw connections between what they do know and words they encounter that they do not know. Sometimes these associations are semantic or contextual. At other times, they are based on imagery students invoke in learning the words.

Conclusion About the Taxonomy

Although the taxonomic scheme developed above describe the research at a general level, the Panel found that the differences between studies within the taxonomy were too great to be useful. In addition, many of the studies seemed to combine elements that would place them in one or more categories when the actual methods were developed. Consequently, although the Panel thinks it is important to think about vocabulary along these dimensions, the taxonomy was only used in a conceptual manner in subsequent analyses of the vocabulary instruction studies.

Analysis of the Research Studies

In the following analysis, the reading instruction database was reviewed for trends across studies, accounting for the great diversity in methods and the relatively small number of studies. The fact that the same studies are represented in more than one finding testifies to the complex nature of the instruction represented by many methods. For each of the trends, representative examples of studies are included with brief sketches of the findings.

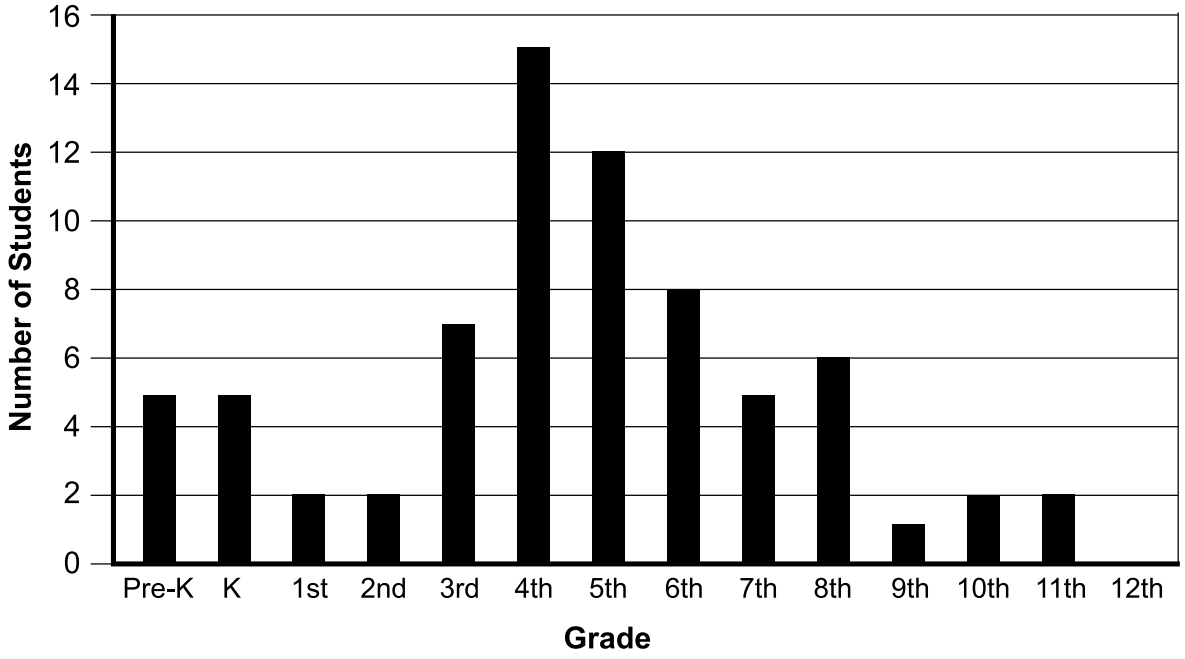
Age and Ability Effects on Vocabulary Learning

The distribution of research studies in vocabulary instruction as a function of grade level is shown in Figure 1 on the next page. What is most striking in these data is the fact that there are relatively few studies outside the range of 3rd to 8th grade. For the 50 studies categorized, there were 73 different grade samples because some studies used more than one grade level. Of these 73 grade samples, 53 were grades 3 to 8, with relatively little research on vocabulary instruction in the early grades. One possible explanation is that there is less emphasis on methods in the early grades. Another is that teaching of vocabulary is often not separate from other instruction in the early grades. As students begin to read content material they may need to learn vocabulary specific to the material, giving rise to the instructional need for vocabulary learning. Another possibility is that much of early reading is, at least theoretically, done with texts that do not exceed the vocabularies of most early readers. In this event, there would be little need for vocabulary instruction.

Despite the restricted range of studies, one trend in the database suggests that various ability levels and age differences can significantly affect learning gains from vocabulary instruction methods. The studies underscore the need to consider carefully the different impacts that various vocabulary instruction techniques can have for students of different ages and abilities, and, accordingly, the importance of selecting appropriate methods.

- Senechal and Cornell (1993) found that a single book reading was enough to significantly improve children's new expressive vocabulary of ten target words in the stories, and that after 1 week, the 5-year-olds remembered more than 4-year-olds.

Figure 1. NIH Vocabulary Studies: Distribution of Grades Studied in Research (N = 72 Grade samples in 47 studies)



- Meyerson, Ford, and Jones (1991) found that 5th graders were more likely than 3rd graders to assign science vocabulary into conceptual groupings.
- Tomesen and Aarnoutse (1998) studied reciprocal teaching and direct instruction in deriving word meanings from context as provided to 4th graders; the instruction was more helpful for poor readers rather than average readers.
- Robbins and Ehri (1994) found that storybook readings helped teach children meanings of unfamiliar words; those with larger entering vocabularies learned more words.
- Nicholson and Whyte (1992) explored how 8- to 10-year-old students learned vocabulary from incidental exposure (listening to stories). The largest effects were for high-ability students. They propose that low-ability and average students should do more independent reading with a dictionary than listening to stories.
- McGivern and Levin (1983) reported positive effects for the keyword method, with greater effects for low- than for high-ability students; the low-ability students had more difficulty in operationalizing dual components of the task.

Computer Use for Vocabulary Instruction

A small but clear trend in recent years shows computer technology making inroads in literacy and literacy instruction. Four studies that employ computers for vocabulary instruction appear in the database. These studies show learning gains with computer use as compared to traditional methods or when computers are used as an ancillary aid.

- Heller, Sturner, Funk, and Feezor (1993) examined the issue of cognitive demands of technology for preschool learners, by studying the effect of different input devices (touch screen vs. keyboard) on vocabulary identification. They concluded that the greater cognitive demands of keyboard use disrupted the children's ability to process the limited acoustic information available in speech.
- Reinking and Rickman (1990) found that 6th grade students receiving computer instruction of difficult text words with electronic text scored higher on vocabulary measures than students reading printed pages with dictionaries or glossaries.
- Heise, Papelweis, and Tanner (1991) compared 3rd and 6th through 8th grade students in conditions with computer-assisted and conventional direct instruction; the trend was for improved

performance with computer assistance, although the difference was not statistically significant.

- Davidson, Elcock, and Noyes (1996) used a computer that gave speech prompts when the learner requested them; 5- to 7-year-old students improved on three measures of vocabulary with these prompts.

Vocabulary Instruction Effects on Comprehension

In this category are studies that attempt to map the causal relationships between vocabulary and comprehension. The following studies underscore the notion that comprehension gains and improvement on semantic tasks are results of vocabulary learning. Although all of these studies focus on vocabulary, they also typify the heterogeneity among definitions and implementations of vocabulary instruction.

- Beck, Perfetti, and McKeown (1982) demonstrated that 4th graders receiving vocabulary instruction performed better on semantic tasks than those who did not receive instruction.
- McKeown, Beck, Omanson, and Perfetti (1983) also found that vocabulary instruction had a strong relation to text comprehension for 4th grade students.
- Wixson (1986) examined teaching the concept vs. dictionary definitions and showed that pre-teaching vocabulary words for understanding was effective, although the precise effects were unclear because of interaction with story.
- Carney, Anderson, Blackburn, and Blessings (1984) found that for 5th grade students, pre-teaching vocabulary words had a significant effect on retention and acquisition of social studies content.
- Kameenui, Carnine, and Freschi (1982) found that substitution of easy for hard vocabulary words, inclusion of redundant information, and instruction on difficult words facilitated comprehension.
- Stahl and Fairbanks (1986) conducted a meta-analysis and concluded that vocabulary instruction was an important component for comprehension. The best instructional techniques were mixes of definitional and contextual programs; the keyword method produced some significant gains in recall. Repeated exposures to words were also found to be effective.
- Medo and Ryder (1993) found that text-specific vocabulary instruction prior to reading expository texts helped 8th grade students to make causal connections and that this method benefited both average and high-ability students.

However, one study found that vocabulary instruction did not transfer to general reading comprehension. Tomesen and Aarnoutse (1998) conducted vocabulary instruction in the context of reciprocal teaching for 4th grade students. They used direct instruction in deriving word meanings from context and found it to be more helpful for poor readers than for average readers, but they reported a lack of transfer to general reading comprehension.

Keyword Method

In the database, some positive findings with the keyword method research indicate that this method may significantly augment recall, and may be more helpful than many other vocabulary instruction methods. One study found that the keyword method interacts with student ability levels, and that low-ability students had considerably more difficulty with certain keyword methods than high-ability students. However, another study reported that the initial keyword gains were temporary, fading out within a week.

- Levin and colleagues (1984) noted gains for 4th and 5th grade students with the keyword method as compared to semantic and contextual analysis methods in the short term. However, the advantage had faded in the 1-week-delayed test.
- Levin, McCormick, Miller, and Berry (1982) found that 4th grade students outperformed controls in vocabulary acquisition with the keyword method as compared to the picture context, control and experiential context conditions.
- Levin, Levin, Glasman, and Nordwall (1992) found strong effects for 3rd, 4th, 7th, and 8th grade students when comparing the keyword method to free study and science context vocabulary methods.
- McGivern and Levin (1983) found that 5th grade students showed positive effects of the keyword method. However, there was more of a difference for low-ability students than for high-ability students, although low-ability students had more difficulty in operationalizing the components of the task.

Indirect Learning Effects

Because of the rapid rate at which vocabulary is acquired, it has always been assumed that much vocabulary was learned incidentally. One instantiation of this method is found in vocabulary learning in the context of storybook reading. Recent research studies in the area suggest that indirect learning can definitely occur, and that vocabulary can be acquired through incidental exposure. In addition, one particular study (Schwanenflugel, Stahl, & McFall, 1997) is important because it looks beyond the issue of whether word acquisition occurs from reading, examining the characteristics of words and texts that were most amenable to vocabulary acquisition from stories. In this study of 4th grade students, researchers found that non-noun words (adverbs, verbs, and adjectives) were easier to learn than nouns and that words with high imageability were easier to learn from the stories.

- Robbins and Ehri (1994) demonstrated that storybook readings helped teach children meanings of unfamiliar words. However, those with larger entering vocabulary learn more words.
- Leung (1992) studied kindergartners and 1st grade students, finding that the frequency of a target word in stories influenced the occurrence of the word in the child's retellings and that read-aloud events seemed to help children to learn new words by incidental learning.
- Senechal and Cornell (1993) found that for 4- to 5-year-old children, one single book reading was enough to significantly improve new expressive vocabulary of ten target words in the stories. In a delayed transfer test after 1 week, 5-year-old children remembered more than 4-year-olds.
- Nicholson and Whyte (1992) explored student vocabulary learning through incidental exposure by having children 8 to 10 years old listen to stories; the largest effects were for high-ability students. They proposed that low-ability and average-ability students do more independent reading with a dictionary than listening to stories.
- Stewart, Gonzalez et al. (1997) examined acquisition of sight-reading vocabulary learned incidentally during articulation training and found that this learning generalized beyond printed words on cards to words on a list.
- Stahl, Richek, and Vandevier (1991) evaluated the indirect learning of vocabulary words among 6th grade students designated as less able readers and found that the students were able to learn a significant number of vocabulary words from listening to orally presented passages.

Two studies revealed great detail about the actual process of vocabulary learning by examining the characteristics of words that were most conducive to vocabulary acquisition. Schwanenflugel, Stahl, and McFalls (1997) found that among their 4th grade sample, certain word characteristics had a significant impact on vocabulary learned from reading stories. In particular, non-noun words (verbs, adverbs, and adjectives) were learned better than nouns, and concrete words (high in imageability) were learned more readily than less easily imageable words. The authors conclude that the characteristics of vocabulary words are more important variables in the learning of vocabulary words from stories than are text features (word repetitions, contextual support, etc.). Another study, McFalls, Schwanenflugel, and Stahl (1996), examined the impact of semantic variables related to concreteness on the development of reading vocabulary among a predominantly African American and low SES 2nd grade sample. They found that the children read abstract words with less accuracy than concrete words on tasks of recognition and reading accuracy and that the concreteness of the words determined whether children were able to remember them and to learn to read them more easily.

The nature of the interaction (emphasizing active participation) during storybook readings may also have an impact on learning. Three studies found that student-initiated talk or active participation was important.

- Dickinson and Smith (1994) examined storybook readings for preschoolers and the effects of teacher talk on vocabulary acquisition and concluded that the amount of child-initiated analytic talk was important for vocabulary gains.
- Senechal (1997) found that for pre-kindergarten children, repeated readings of a story created greater performance gains in vocabulary. Students learned more from answering questions during readings than they did when simply listening to the narrative.

- Drevno, Kimball, Possi, Heward, Gardner, and Barbetta (1994) examined the effects of active student response (ASR) error correction on the learning of science vocabulary for a small group of elementary students. In the ASR condition, when a student made an error, the teacher modeled the correct definition and the student repeated it, but in the no response (NR) condition, students would not repeat the definition. ASR was found to be superior to the NR error-correction condition on all the dependent variables.

Vocabulary Gains From Repeated, Multiple Exposures

One trend that was strongly reflected in the database was that high frequency and multiple, repeated exposures to vocabulary material are important for learning gains. In accordance with this finding, a trend was also noted that extended and rich instruction of vocabulary (applying words to multiple contexts, etc.) was superior to less comprehensive methods. The following studies share this finding:

- Senechal (1997) found that for pre-kindergarten children, repeated readings of a story were associated with greater performance gains in vocabulary.
- Leung (1992) studied kindergarten and 1st grade students, finding that the frequency of a target word in stories influenced occurrence of the word in a child's retellings.
- Daniels, M. (1994) showed that pre-K students who learned American Sign Language (ASL) did significantly better than controls on the Peabody Picture Vocabulary Test (PPVT). In a 1996 study, Daniels also found that kindergarten students who learned ASL did significantly better on language development and vocabulary growth measures of the PPVT than those who had not learned ASL.

Effect of Rich Contexts on Vocabulary Growth

- McKeown, Beck, Omanson, and Pople (1985) found that 4th graders performed well with instruction that extended beyond single class periods and involved multiple exposures in authentic contexts. The instruction added activities to extend use of learned words beyond the classroom and high-frequency encounters with words.
- Kameenui, Carnine, and Freschi (1982) found that providing redundant information facilitated comprehension and that instruction on difficult vocabulary words also helped vocabulary learning in grades 4 through 6.
- Dole, Sloan, and Trathen (1995) worked with 10th grade students on an "alternative" vocabulary treatment condition: teach students how to select relevant words, learn the words on a deep level, and discuss them. These students outscored students taught with the traditional conditions in which students did not learn this criterion or discuss the words in context.

Pre-instruction of Vocabulary Words

It has been a given for reading instruction in almost every formal lesson format that vocabulary instruction will occupy a central part of the lesson, typically prior to reading. This pre-instruction has often been justified on the basis of making the passage easier to comprehend by reducing the cognitive load during subsequent reading. In fact, a few studies suggest that pre-instruction of vocabulary words facilitates both vocabulary acquisition and comprehension.

- Brett, Rothlein, and Hurley (1996) found that 4th grade students who were given pre-instruction of target words in the story had greater vocabulary gains than the children in the non-instructional control group.
- Wixson (1986) pre-taught vocabulary words to grade students. Although there were some gains in understanding, the instructional treatment (concept vs. dictionary) effects were unclear because of interaction with story.
- Carney, Anderson, Blackburn, and Blessing (1984) also pre-taught vocabulary to 5th grade students; the treatment had a significant effect on retention and acquisition of social studies content.

Restructuring the Task

One emergent trend in the database is the restructuring of the task (materials or procedures) in various ways to facilitate vocabulary acquisition and comprehension. A way of doing this is to alter the passage, such as substituting easy for hard words. Another is clarifying the task of learning vocabulary definitions for students, such as teaching what components make a good definition, and selecting relevant words. Group-assisted

reading in student dyads also yielded significant vocabulary gains over the comparison, unassisted group. Although the diversity among these studies is a salient feature, the following studies did found positive results with a wide range of task alterations:

- Kameenui, Carnine, and Freschi (1982) found that providing redundant information facilitated comprehension and that instruction on difficult vocabulary words also helped vocabulary learning in grades 4 through 6.
- Gordon, Schumm, Coffland, and Doucette (1992) revised text versions to help define vocabulary words for 5th grade students. Using these revised texts helped students understand passages better.
- Schwartz and Raphael (1985) clarified the task of defining a word for 4th and 5th grade students, giving them the components of a definition; this increased students' independent vocabulary acquisition.
- Scott and Nagy (1997) evaluated the effect of altering presentation of vocabulary definitions (traditional dictionary definition with or without a sample sentence and definitions that were specifically written to be easier to understand) on the learning of novel vocabulary words. In general, regardless of the type of definition given, both the 4th and 6th grade students scored poorly on the task of assessing whether vocabulary usage was consistent with the definition in sentence fragments. However, small but significant gains were found when students were given sample sentences along with the definitions.
- Wu and Solman (1993) investigated the effects of extrapictorial prompts on the learning of words by kindergartners. They found that the best learning occurred equally in two circumstances: in the absence of the pictorial prompts where words were presented alone, and in a feedback cueing condition.
- Eldredge (1990) devised a group-assisted reading method for 3rd grade students. The vocabulary gains for students reading in dyads were greater than for the comparison group of unassisted students who did independent reading.
- Malone and McLaughlin (1997) compared reciprocal peer tutoring with a traditional vocabulary program. The 7th and 8th grade students in the reciprocal peer-tutoring group had significantly higher scores on weekly vocabulary quizzes.

Context Method

The research dealing with contextual approaches to vocabulary acquisition yielded some interesting findings on the role of context and definitional approaches. In accordance with the research findings on rich, extended instruction and multiple exposures to words, one emerging trend was the possibility that the mix of definitional and contextual approaches worked better than either method used alone. Two studies reflect this finding. Kolich (1991) provided computer-assisted practice for 11th grade students; those receiving mixed instruction (context optional word choices and definitional) scored highest. Similarly, Stahl (1983) found those 5th grade students receiving a mixed treatment (definitional and contextual) outscored both students receiving the definitional alone and the students in the control conditions.

However, some studies found specific gains using a single approach. Margosein, Pascarella, and Pflaum (1982) worked with junior high school students and found significant effects for semantic mapping over context-rich or target-word treatment; their work suggests that students should focus on word with similarities to other known words. Gipe and Arnold (1979) compared several vocabulary methods for 3rd and 5th grade students: instruction from context, association, dictionary, and category. They found the highest gains for the context method.

Several studies demonstrated that direct instruction in learning word meanings was helpful for vocabulary acquisition.

- Tomesen and Aarnoutse (1998) included vocabulary instruction for 4th grade students in a program of reciprocal teaching. Students were given direct instruction in deriving word meanings from context. This was found to be more helpful for poor than for average readers, but there was no transfer to general reading comprehension
- White, Graves, and Slater (1990) explored the need for assisting minority or disadvantaged children in grades 1 through 4 and found that direct instruction

in meaning and decoding may help them to an extent.

- Dole, Sloan, and Trathen (1995) worked with 10th grade students on an "alternative" vocabulary treatment condition: teaching students how to select relevant words, learn them on a deep level, and discuss them. These students outscored students taught with the traditional conditions in which students did not learn to this criterion or discuss the words in context.
- Rinaldi, Sells, and McLaughlin (1997) worked with 10.8- to 11.5-year-old students and 3rd graders with reading difficulties to examine effectiveness of a drill and practice intervention on sight word acquisition. During the intervention, all the students more than doubled their correct rates in oral reading and reduced their numbers of errors.
- Dana and Rodriguez (1992) studied the effects of the TOAST (test, organize, anchor, say, test) method of vocabulary learning as compared to various student-selected methods of vocabulary instruction among 6th grade students. They found that students using the TOAST method scored higher than those using student-selected methods on measures of both immediate and delayed retention of words.
- Stump, Lovitt, Fister, Kemp, Moore, and Schroeder (1992) assessed the effects of a precision teaching intervention for general and special education. Assessments of timed vocabulary quizzes supported the finding that the majority of students in the study scored higher on measures of accuracy and fluency.

Results and Discussion

Measurement of Vocabulary

What is available on the issue of measuring vocabulary, despite the noted research gap, is some implicit evidence, which the Panel provided in a breakdown of the types of measures that have been used by researchers studying vocabulary. To obtain this information the Panel tallied, for each study, whether the vocabulary assessment instrument was standardized or experimenter-generated. In some of the studies, vocabulary was assessed with a pretest as well as a posttest.

It was possible to determine what types of assessments (standardized of experimenter-generated) were used in 37 of the studies as dependent variables. Figure 2 on the next page shows the distribution of studies in the database as a function of the type of assessment used.

There were six studies that used standardized assessments as the only dependent variable. One of these studies used two measures. There was almost no overlap in the type of standardized measures used, with six different instruments represented.

One other feature in the data was that of the 50 studies coded, 32 administered pretests. Of these 32 studies, 17 used standardized tests. There were 11 different instruments represented in the total.

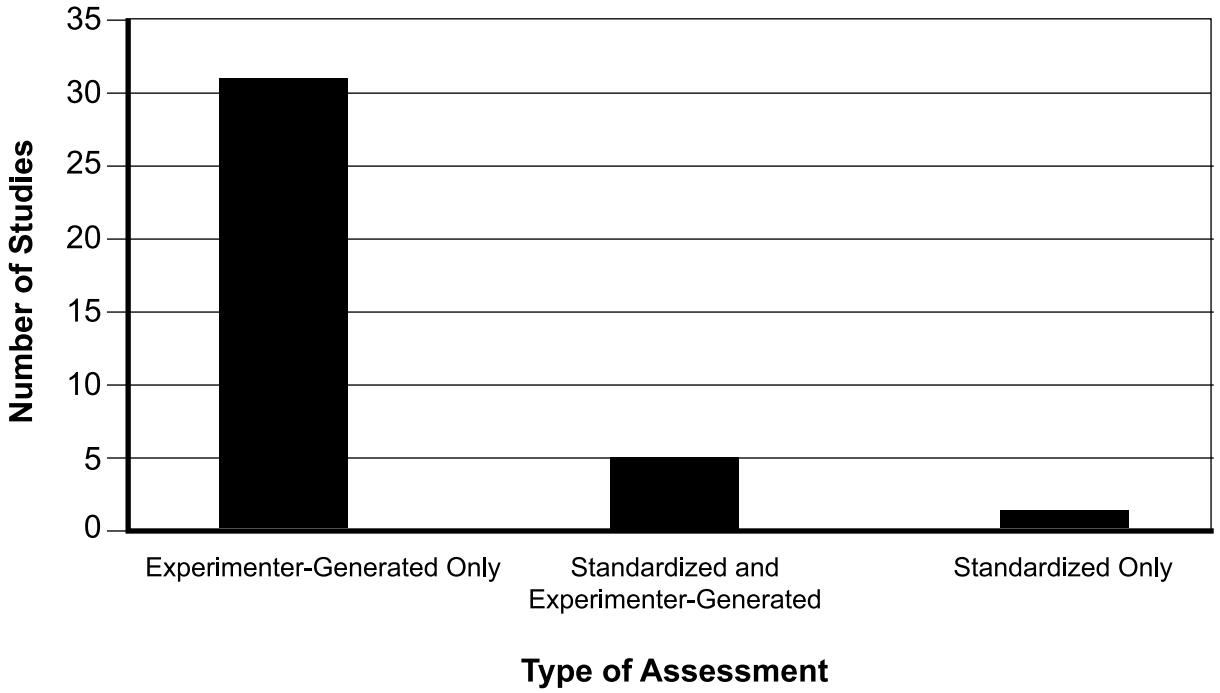
These analyses seem to suggest two implications that might be drawn for practice. First, the standardized tests did not seem to be sufficiently sensitive to vocabulary changes to be used as dependent measures. For practice, this would suggest that assessing vocabulary growth would be best done with teacher-generated instruments as at least one component of evaluation. It also suggests that there may be a need for the development of standardized measures that are much more sensitive to the nuances and complexities involved in vocabulary acquisition. A further implication is that standardized instruments appear to be useful for general screening pretests. Again, the implication for practice might be that standardized tests could be used to identify students who need vocabulary instruction. However, a note of caution is critical here. These implications are tentative and need to be researched before being implemented.

Despite the relatively small body of data available, the collective body of research clearly indicates that vocabulary increases with instruction of many different sorts.

Direct and Indirect Instruction

It is clear that vocabulary should be taught both directly and indirectly. Vocabulary instruction should be incorporated into reading instruction. There is a need for direct instruction of vocabulary items that are required for a specific text to be read as part of the lesson. Direct instruction was found to be highly effective for vocabulary learning (Tomeson & Aarnoutse, 1998; White, Graves, & Slater, 1990; Dole,

Figure 2. Distribution of Assessment Types Included in Database (N = 37 studies)



Sloan, & Trathen, 1995; Rinalid, Sells, & McLaughlin, 1997). In addition, the more connections that can be made to a specific word, the better it seems to be learned. For example, there is empirical evidence indicating that making connections with other reading material or oral language in other contexts seems to have large effects.

Pre-instruction of vocabulary in reading lessons can have significant effects on learning outcomes (Brett, Rothlein, & Hurley, 1996; Wixson, 1986; Carney, Anderson, Blackburn, et al., 1984). At least, it guarantees that there will be fewer unfamiliar concepts in the material to be read. It also helps in making the translation of print to speech meaningful by trying to guarantee that the vocabulary items are in the oral language of the reader. Because almost all early reading is based on oral language, this is a critically important implication.

Repetition and Multiple Exposures

It also seems clear from the Panel's data set that having students encounter vocabulary words often and in various ways can have a significant effect (Senechal, 1997; Leung, 1992; Daniels, 1994, 1996; Dole, Sloan, & Trathen, 1995). Although not a surprising finding, this does have direct implications for instruction. Students should not only repeat vocabulary items in learning; they should be given items that will be likely to appear in many other contexts.

Context

In much the same way that multiple exposures are important, the context in which a word is learned is critical (McKeown, Beck, Omanson, and Pople, 1985; Kameenui, Carnine, & Freschi, 1982; Dole, Sloan, & Trathen, 1995). Vocabulary words should be words that the learner will find useful in many contexts. To that end, a large portion of vocabulary items should be derived from content learning materials. This would serve at least two functions: first, it would assist the

learner in dealing with the specific reading matter in content area materials; second, it would provide the learner with vocabulary that would be encountered sufficiently often to make the learning effort worthwhile.

Task Restructuring

Direct vocabulary instruction often assumes that the learner is fully aware of what the task is and how to complete it. However, restructuring tasks can ensure this. Some empirical research has demonstrated the efficacy of being certain that students fully understand the task and the components of vocabulary learning, rather than creating a focus only on the words to be learned (Schwartz & Raphael, 1985). Restructuring the task, such as group learning or revising learning materials, can also lead to increased vocabulary learning (Kameenui, Carnine, & Freschi, 1982; Gordon, Schumm, Coffland, and Doucette, 1992; Wu & Solman, 1993; Eldredge, 1990; Malone & McLaughlin, 1997). This seems to be most effective for low-achieving or at-risk students.

Active Engagement

The few studies that addressed active engagement in learning all reported results consistent with conventional wisdom about learning: Active learning is best. When students were engaged in the tasks in which they were learning vocabulary, they had larger gains (Dickinson & Smith, 1994; Senechal, 1997; Drevno et al., 1994; Daniels, 1994, 1996). This suggests that vocabulary learning tasks that advance other knowledge would be more effective.

Computer Technology

While the use of computer technology in reading is still in its infancy, the few studies reported in the literature suggest that this may be a powerful way of increasing vocabulary (Reinking & Rickman, 1990; Heise et al., 1991; Davidson, Elcock, & Noyes, 1996; Heller, Sturner, Funk & Feezor, 1993). Two possibilities arise here. The first is that the computer might be used as an adjunct to direct vocabulary instruction. In this way, students could obtain more practice in learning vocabulary. A second possibility is that computer technology could bring to bear many different media. This is one way of adding a number of different modalities to the teaching of vocabulary and, consequently, helping ensure more effective vocabulary learning. The availability of online access to vocabulary definitions combines both of these possibilities.

Implicit Learning

It is both a theoretical and an empirical fact that not all vocabulary can or must be learned through formal instruction and that vocabulary words can also be learned through incidental and indirect ways (Robbins & Ehri, 1994; Leung, 1992; Senechal & Cornell, 1993; Nicholson & Whyte, 1992; Stewart et al., 1997). Estimates of vocabulary size seem to suggest that there would never be sufficient classroom time to instruct students to the level of their acquired vocabulary. This implies that much of a student's vocabulary will have to be learned in the course of doing things other than explicit vocabulary learning. Students may well pick up vocabulary in contexts different from the formal learning of a classroom reading group. It may even be that the vocabulary acquired in this way is more memorable, given the role of motivation in its acquisition because the vocabulary acquired in this way may be far more useful. Repetition, richness of context, and motivation may also add to the efficacy of incidental learning.

Assessment and Evaluation of Vocabulary

Although there is no research in the NRP database that bears *directly* on the issue of how vocabulary is assessed, the Panel believes that the way vocabulary is measured can have differential effects on instruction. The Panel bases this belief on several things. First, the plethora of ways in which vocabulary was measured and evaluated in the studies in our database clearly indicates that there is no single standard. Consequently, the Panel suggests that using more than a single measure of vocabulary is critical for sound evaluation. Second, each way of measuring vocabulary produces different results. Furthermore, the category of vocabulary being measured varies. Receptive vocabulary is clearly different from productive vocabulary, and sight vocabulary is yet another concept. Finally, the fact that the Panel found most of the researchers using their own instruments to evaluate vocabulary suggests the need for this to be adopted in pedagogical practice. That is, the more closely the assessment matches the instructional context, the more appropriate the conclusions about the instruction will be.

Standardized tests provide a global measure of vocabulary and may be used to provide a baseline. Few researchers depended on standardized instruments to assess the efficacy of the instruction they studied. The implication for practice is the same: instruments that match the instruction will provide better information about the specific learning of the students related directly to that instruction. The implications for the use of standardized instruments need to be viewed as tentative until the findings can be confirmed by instructional research.

Single vs. Multiple Methods of Instruction

The Panel is reluctant to suggest a single method of learning vocabulary because there were rarely more than a few studies on each individual method. The categories represented in the earlier discussion and the summary of specific methods in Table 1 (Appendix A) reinforce this point. A comprehensive analysis of the collective research studies suggests that a variety of direct and indirect methods of vocabulary instruction can be effective. Effective instructional methods emphasized multimedia aspects of learning, richness of context in which words are to be learned, active student participation, and the number of exposures to words that learners will receive.

Moreover, the age and ability effects discussed above suggest that different methods may be differentially effective. In light of this, dependence on a single method would be a risky course of action.

Implications for Reading Instruction

Based on these trends in the data, the Panel offers the following implications for practice:

1. Vocabulary should be taught both directly and indirectly.
2. Repetition and multiple exposures to vocabulary items are important.
3. Learning in rich contexts is valuable for vocabulary learning.
4. Vocabulary tasks should be restructured when necessary.
5. Vocabulary learning should entail active engagement in learning tasks.
6. Computer technology can be used to help teach vocabulary.
7. Vocabulary can be acquired through incidental learning.
8. How vocabulary is assessed and evaluated can have differential effects on instruction.
9. Dependence on a single vocabulary instruction method will not result in optimal learning.

Directions for Further Research

The following questions do not seem to have clear answers in the research reviewed for this report. They are questions at a relatively high level of generality and are not, in the present form, researchable. That is, they need to be translated into the appropriate variables, operations, and data collection techniques before research can be conducted.

The need in vocabulary instruction research is great. Our knowledge of vocabulary acquisition exceeds our knowledge of pedagogy. That is, the Panel knows a great deal about the ways in which vocabulary increases under highly controlled conditions, but the Panel knows much less about the ways in which such growth can be fostered in instructional contexts. There is a great need for the conduct of research on these topics in authentic school contexts, with real teachers, under real conditions.

1. What are the best ways to evaluate vocabulary size, use, acquisition, and retention? What is the role of standardized tests, what other measures should be used, and under what circumstances?
2. Given the preliminary findings that age and ability levels can affect the efficacy of various vocabulary instruction methods (Tomesen & Aarnoutse, 1998; Robbins & Ehri, 1994; Nicholson & Whyte, 1992; McGivern & Levin, 1983), what are the specific vocabulary instruction needs of students at different grade and ability levels?
3. What are the more general effects of vocabulary instruction across the grades?
4. Empirical support has been found for the facilitation of vocabulary learning with computers as ancillary aids and replacements of other technologies (Reinking & Rickman, 1990; Heise, 1991;

Davidson, Elcock, & Noyes, 1996). What is the optimal use of computer and other technologies in vocabulary instruction? What is the precise role of multimedia learning in vocabulary acquisition?

5. What is the precise role of multimedia learning in vocabulary instruction across the grades?
6. How should vocabulary be integrated into comprehension instruction for optimal benefit to the student?
7. What are the optimal combinations of the various methods of vocabulary instruction, including direct and indirect instruction, and of different methods within these categories?
8. What sort of professional development is needed for teachers to become proficient in vocabulary instruction?

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Appendix A

Vocabulary Instruction Methods

TABLE 1: A SUMMARY OF VOCABULARY INSTRUCTION METHODS

Vocabulary Method:	Description:	Representative Studies:
Keyword Method	Students are instructed to learn the meanings of new words by learning a keyword "word clue" for each vocabulary word. The keywords are usually words acoustically similar to a salient part of the vocabulary word. Sometimes, relational illustrations are shown to students, or students are asked to generate their own images linking the two words.	Levin, Levin, Glassman, & Nordwall, 1992; McCarville, 1993; Levin, Levin, Glassman, & Nordwall, 1992; Levin, Levin, Cotton, Bartholomew, Hasty, Hughes, & Townsend, 1990; Pressley, Levin, Kuiper, Bryant, & Mitchener, 1982; Atkinson, 1975.
Semantic Mapping	Students are taught the meanings of new vocabulary words by categorizing them into familiar topics with other known words. New words are learned by identifying similarities and differences with related, known words. Target words are often introduced in categories, and semantic maps are developed for each set of items.	Levin, Levin, Glassman, & Nordwall, 1992; McCarville, 1993; Levin, Levin, Glassman & Nordwall, 1992; Levin, Levin, Cotton, Bartholomew, Hasty, Hughes, & Townsend, 1990; Pressley, Levin, Kuiper, Bryant, & Mitchener, 1982; Atkinson, 1975.
Contextual Analysis	Students use context clues embedded in paragraphs to help them learn meanings of the target vocabulary words. Usually, the words and definitions are then reviewed.	Buikema & Graves, 1993; Friedl&, 1992; Gifford, 1993.
Sign Language	Enrichment of curriculum with sign language for pre-kindergarten hearing children to improve their receptive English vocabulary.	Daniels, 1994, 1998.
Wide Reading	Listening/reading stories (with or without pre-explanation of target words). Some salient variables to consider include the number of exposures to the words, frequency of book readings, nature of instruction (using questioning, etc.), word redundancy, and time between readings.	Anderson & Nagy, 1992; Riddell, 1988; Elley, 1988; Krashen, 1989.
Deriving Word Meanings	Students are taught strategies for deriving meaning of an unfamiliar word. One example of a strategy is the SCANR method (substitute a word for unknown word; check the context for clues; ask if substitution fits context clues; need a new idea?; revise idea to fit context)	Tomeson, 1998; Jenkins, Matlock, & Slocum, 1989.
Elaborate/Rich Instruction	Students learn to identify the relationship between words, respond to words both affectively and cognitively, and apply words to various contexts. Promotes a student's use of words outside of vocabulary class and elicits prior knowledge.	McKeown, Beck, Omanson, & Pople, 1985; Stanley & Ginther, 1991; Stahl, 1983.
Roots/Affix Analysis	Students use word origin clues and learn the meanings of common roots, prefixes, and affixes to determine vocabulary definitions.	Irwin, 1991; Ryder & Graves, 1994; Levin, Carney, & Pressley, 1988.

TABLE 1: A SUMMARY OF VOCABULARY INSTRUCTION METHODS (CONTINUED)

Vocabulary Method:	Description:	Representative Studies:
Dictionary/Glossary	Students are given dictionaries or glossaries to find the definitions of unknown words. Variations of this method include giving students passages to read along with a dictionary or glossary to find the definitions of unknown words, writing new sentences with the words, and completing worksheets and crossword puzzles.	Knight, 1994; Wixson, 1986; Gipe & Arnold, 1979.
Frayer Model	Frayer model (and Grave's modification). A method to teach specific new words using a seven-step model. Basic tenets of the Frayer model include: give word/name and its relevant attributes, eliminate irrelevant attributes, give examples, give nonexamples, and list subordinate, superordinate, and coordinate terms.	Frayer, Frederick, & Klausmeier, 1969; Graves, 1984, 1985; Ryder & Graves, 1994.
Task Clarification	With the premise that students have only a vague notion of what constitutes a definition, vocabulary instruction is designed to clarify the student's knowledge of the task. Students are instructed on ways to gather information from relevant sources to uncover the components of a definition.	Guzzetti, Snyder, Glass, & Gamas, 1993; Haggard, 1982, 1985; Fisher, Blachowicz, & Smith, 1991; Fisher & Danielsen, 1998; Palinscar & Brown, 1984.
Computer/Multimedia Instruction	Various methods incorporate computer and multimedia technology to aid in the instruction of vocabulary words. Examples include CD-ROM, talking software, Hypertext dictionary support, speech prompts, adaptive software, visual representations, and multisensory input.	Terrell & Daniloff, 1996; Reinking & Rickman, 1990.
Text Revision	Students are given revised versions of text passages. Variations include substituting easy for difficult vocabulary words, adding redundant information to facilitate word learning and comprehension, and writing vocabulary words with context information to constrain vocabulary word learning.	Britton, Woodward, & Binkley, 1993; Meyer, 1975.
Interactive Vocabulary Techniques	Various techniques that allow students to get actively involved in word learning. Examples include students acting out word meanings, self-selection of vocabulary words to learn, and allowing students to compare strategies and methods.	Duffelmeyer, 1980; Rekrut, 1993; Pressley & Levin, 1988.
Passage Integration Training	Teachers stop and prompt the students to generate the meanings of the difficult vocabulary words immediately after they encounter them during the passage reading.	Kameenui, Carnine, & Freschi, 1982.
Concept Method	Assists students in learning words as concepts rather than as dictionary definitions. Based on a concept-attainment model, this method relies more heavily on discussion than on independent activities. Students study examples and nonexamples to identify the critical attributes of each word or concept.	Frayer et al., 1969; Klausmeier, 1976,1979; Merrill & Tennyson, 1977.
Pre-Instruction of Vocabulary Words	Students are taught or exposed to the definitions of relevant vocabulary words before reading them in context. In addition to assessing effects on vocabulary acquisition, this is often researched as a way to enhance reading comprehension.	Koury, 1996; Ryder & Graves, 1994; Wixson, 1986.

TABLE 1: A SUMMARY OF VOCABULARY INSTRUCTION METHODS (CONTINUED)

Vocabulary Method:	Description:	Representative Studies:
Association Methods	Pairs unknown word with familiar synonym. Students must memorize the pairings to rewrite the original pairs.	Gipe & Arnold 1979; McKeown, Beck, Omanson, & Pople, 1985.
TOAST Program	Students are taught a method of vocabulary instruction by the acronym of TOAST that prompts students to: test, organize words, anchor words, and test target words.	Dana & Rodriguez, 1992.
Basic Mnemonic Techniques	Traditional memory techniques, including vocabulary drills, flash cards, vocabulary games, notebooks, repetitions, and recall tests. An example program is the Reading Racetrack, which uses error correction, timing, and drill and practice procedures to help build sight word acquisition and reading fluency.	McLaughlin, 1997; Rinaldi, Sells, & McLaughlin, 1997.
Decoding Instruction	To enhance reading fluidity with the intention of facilitating vocabulary comprehension, instruction is given in methods such as phonological training, phonemic awareness, or the whole-word approach	Eldredge, Quinn, & Butterfield, 1990.