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Vocabulary Acquisition: Synthesis of the Research

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We can directly access the meanings of only the words we already know. The referents of new words can be verbally explained only in terms of old words. This can be done either explicitly, by presenting their definitions, or implicitly, by setting them in a context of old words that effectively constrains their meanings. (Adams, 1990, p. 205).

Introduction

The enduring effects of the vocabulary limitations of students with diverse learning needs is becoming increasingly apparent. Nothing less that learning itself depends on language. Certainly, as Adams (1990) suggests, most of our formal education is acquired through language. Learning something new does not occur in a vacuum. Rather, new learning always builds on what the learner already knows. Adams suggests that new learning is the process of forming novel combinations of familiar concepts. Learning, as a language-based activity, is fundamentally and profoundly dependent on vocabulary knowledge. Learners must have access to the meaning of words teachers, or their surrogates (e.g., other adults, books, films, etc.), use to guide them into contemplating known concepts in novel ways (i.e., to learn something new). With inadequate vocabulary knowledge, learners are being asked to develop novel combinations of known concepts with insufficient tools.

Becker (1977) was among the first to highlight the importance of vocabulary development by linking vocabulary size to the academic achievement of disadvantaged students (Baumann & Kameenui, 1991). Thus, he asserted that vocabulary deficiencies were the primary cause of academic failure of disadvantaged students in grades 3 through 12. Almost a decade later, Stanovich (1986) proposed a model of school failure that emphasized the interrelated development of phonological awareness, reading acquisition, and vocabulary growth.

Research suggests that students can be taught the phonological awareness skills they need to become proficient readers (Liberman & Liberman, 1990; Stanovich, 1986). In addition, there is empirical support that students who begin school behind typical peers in important areas such as vocabulary and language development can master basic reading skills as quickly and as well as typical peers under optimal instructional conditions (Carnine, Silbert, & Kameenui, 1990).

However, as Becker (1997) observed, the primary difficulty with sustaining early gains in reading is the lack of adequate vocabulary to meet the broad academic demands that begin in the upper-elementary grades and continue throughout schooling. In contrast to phonological awareness and early reading achievement, no research evidence supports the contention that specific vocabulary development method or program can bridge the vocabulary gap that exists at the onset of schooling between groups of students with poor versus rich vocabularies, and which continues to widen throughout school and beyond.

A flurry of vocabulary research has been conducted since Becker's (1977) observations about the relation between vocabulary knowledge and academic achievement. Beyond Becker's findings, three additional reasons may account for this renewed interest in vocabulary development. First, because vocabulary and reading are closely related, the highly publicized concern about declining literacy levels, has affected vocabulary research (Adams, 1990). Second, as Beck and McKeown (1991) observed, "the shift to an information-processing orientation in psychology . . . provided rich theory from which to draw in conceiving the relationship between words and ideas" (p. 790). Research in vocabulary and literacy demonstrates that building knowledge requires more than accumulating facts about specific elements such as word definitions. Third, related to Beck and McKeown's (1991) comments about building knowledge, is a shift in education from emphasizing basic skills to problem-solving and higher-order thinking skills. This shift has resulted in additional research directed toward understanding language and vocabulary acquisition within the context of prior knowledge and constructivist pedagogy.

Defining Success in Vocabulary Development

It is necessary to distinguish between two contrasting ways of gauging the success of curricular and instructional programs designed to increase vocabulary development. On one hand, successful programs can be defined in an absolute sense by determining whether they lead to increases in vocabulary beyond what occurs during incidental learning opportunities, or as a result of other explicit attempts to increase word knowledge. Alternatively, successful programs can be defined in a relative sense by the extent to which they reduce the well-documented vocabulary gap between students with poor versus rich vocabularies (Stanovich, 1986; White, Graves, & Slater, 1990) .

The difference between these gauges of success is significant. For example, extensive research evidence supports the use of a number of methods of increasing vocabulary development in an absolute sense (Graves, 1986). However, there is no evidence that any single method or comprehensive program seriously decreases the vocabulary gap that

exists between students with poor vocabularies and those with rich vocabularies. The crucial issue, then, is whether implementation of a program designed to enhance vocabulary development significantly reduces the vocabulary gap between groups of students without restricting the vocabulary development of average- and high-achieving students.

Organization of Chapter

Our goal in this chapter is to identify and discuss areas of recent research on vocabulary development, especially as it relates to diverse learners. In the first part, we describe the methodology of the research review. In the second part, we present five areas of convergence in the research literature on vocabulary acquisition, highlighting issues related to diverse learners.

Methodology

Sources

Our review of vocabulary research included 7 secondary sources, and 16 primary sources. A brief description of the primary sources is listed in Table 1. The principal secondary sources included four book chapters (Anderson & Nagy, 1991; Baumann & Kameenui, 1991; Beck & McKeown, 1991; Kameenui, Dixon, & Carnine, 1987) and three review articles (Graves, 1986; McKeown & Beck, 1988; Paul & O'Rourke, 1988). A brief description of these primary and secondary sources is also presented in Table 1.

In addition to these seven principal secondary sources, eight sources (Adams, 1990; Becker, 1977; Biemiller, 1977-1978; Carey, 1978; Juel, 1988; Liberman & Liberman, 1990; Nagy & Anderson, 1984; Stanovich, 1986) were used to support important points or provide information not already covered in the secondary sources devoted specifically to vocabulary development.

Subject Characteristics

The studies reviewed included students identified as general low performers, students with learning or reading disabilities, remedial readers not considered to have learning disabilities, high achievers, as well as culturally disadvantaged, language delayed, and linguistically diverse students. Research sources were utilized only if they addressed diverse learners in some way. Diverse learners were defined as those students who by virtue of their instructional, experiential, cognitive, socioeconomic, linguistic, and physiological backgrounds bring different and often additional requirements to traditional instruction and curriculum.

Summarization of Methodology

Two independent reviewers read and coded each primary and secondary source, except the Graves (1986) and Kameenui et al. (1987) chapters which were read and coded by one reviewer because they were not included in the initial vocabulary search.

All references were coded on three dimensions: (a) general conclusions, (b) learner characteristics, and (c) instructional implications. Convergence within the dimensions was achieved through a multiple-step process. Reliability was attained by combining independent reviews, inter-coder comparisons of data categorization, coding clarification, and refinement with reliability checks on all sources. To derive general areas of convergence, the primary author of this chapter used the convergent responses from the review and coding process in concert with a second examination of each source.

Other chapters in this research synthesis have included separate sections on findings and implications for skilled and diverse learners. This pattern was difficult to follow with the research on vocabulary acquisition. Our understanding of the outcomes of vocabulary acquisition clearly surpasses our understanding of the process of vocabulary acquisition. However, the early indication is that the acquisition process is similar for all students regardless of vocabulary knowledge. Consequently, it may be more useful to discuss differences in word knowledge as differences on a continuum rather than as different processes that distinguish students with poor from students with rich vocabularies. In addition, studies that theorize about the process of vocabulary acquisition compare and contrast students with poor versus rich vocabularies in the same sections. Therefore, we will follow this strategy as much as possible in this synthesis.

Areas of Convergence

In examining the research evidence on vocabulary acquisition, five themes emerged and converged. These themes addressed (a) vocabulary size differences between students, (b) accounting for those differences theoretically, (c) successful methods to improve the vocabularies of students with diverse learning needs, and (d) the relation between vocabulary knowledge and reading achievement.

The Vocabulary Gap Between Groups of Students

The first area of convergence is that vocabulary differences between students are extensive. In this section, we present evidence that the difference in the number of words known by students with poor vocabularies versus students with rich vocabularies is extensive, grows over time, and becomes apparent early.

Vocabulary Size

In their review of vocabulary acquisition, Beck and McKeown (1991) noted that estimating vocabulary size was probably the oldest type of vocabulary research. Thus, during the 20th century, scores of studies have focused exclusively on estimating vocabulary size. Given the complexity of defining word knowledge (Baumann & Kameenui, 1991), it is not surprising that such estimates have varied considerably. For

example, Graves (1986) reported that studies of vocabulary size conducted prior to 1960 resulted in estimates ranging from 2,500 to 26,000 words for typical first-grade students, and from about 19,000 to 200,000 words for university graduate students. These discrepancies were due to lack of specificity regarding (a) differences between words and word families (e.g., is a student who knows the meaning of *run* , *ran* , and *running* credited with knowing one, two, or three words?); (b) definitions of word knowledge (e.g., recognizing the meaning of a word in a multiple-choice question versus producing a definition for the word); and (c) the source used to represent English vocabulary (e.g., dictionaries versus word frequency lists) (Beck & McKeown, 1991).

As researchers began to specify more precisely the parameters of vocabulary knowledge, more accurate and consistent estimates of vocabulary size were generated. For example, Nagy and Anderson (1984) attempted to determine the number of printed words used in English materials in grades 3 through 9 by examining the textbooks, workbooks, novels, magazines, and encyclopedias used in the classroom. Their estimate of 88,533 word families is now widely used as the domain of words that students in grades 3 through 9 can be expected to know.

Beck and McKeown (1991) provided another estimate of the number of words students know by examining recent studies that used more defined criteria following the tradition established by Nagy and Anderson (1984). Through more precise measures, for example, estimates of the vocabulary size for 5- to 6-year-olds dropped from a range of between 2,500 to 26,000 words to between 2,500 to 5,000 words.

In summary, estimates of vocabulary size have become more consistent during the last 10 years. Methodological procedures that have helped reduce past variances include (a) defining more precisely the domain of words being drawn upon to assess knowledge and (b) considering the difference between words and word families when calculating estimates.

Vocabulary Growth

Closely related to vocabulary size is vocabulary growth, or the number of *new* words students learn each year. Not surprisingly, the methodological problems that have plagued estimates of vocabulary size have also plagued estimates of growth. Thus, estimates of vocabulary growth have varied widely. For instance, early research on vocabulary growth resulted in estimates that students learned as few as 1,000 words to as many as 7,300 new words per year (Beck & McKeown, 1991). As definitions of vocabulary knowledge have become more refined, estimates of growth have become more consistent. For example, three widely cited reviews of vocabulary research suggest that the number of new words students learn, especially in the primary grades, is about 3,000 new words per year (Baumann & Kameenui, 1991; Beck and McKeown, 1991; Graves, 1986).

Students who learn the meaning of 3,000 words per year must learn approximately 8 words per day. This incredible growth may be due in part to neurological makeup, in

which children act as "'spontaneous apprentices' in the business of language, acquiring new words at such a phenomenal rate" (Miller, cited in Liberman & Liberman, 1990, p. 58). In addition, such high growth rates can be accomplished only if flexible definitions of word knowledge and learning are used. In discussing vocabulary knowledge, Carey (1978) distinguished between "fast mapping" and "extended mapping." In fast mapping, an individual is able to learn a very cursory meaning of a word quickly, sometimes after just one exposure. It is not until extended mapping occurs, however, that an individual gains full understanding of a word's meaning. To attain extended mapping sometimes takes years and multiple exposures to a word. Carey hypothesized that school-aged children may be working on as many as 1,600 word mappings simultaneously. That is, at any point in time as many as 1,600 words are at various stages of mapping. So, if a student learns the meaning of eight new vocabulary words per day, the majority of those words are learned at only a very basic level of understanding.

Vocabulary Differences Between Students

Even as methodological improvements in vocabulary research have occurred, one unequivocal finding has remained: Students with poor vocabularies know alarmingly fewer words than students with rich vocabularies. For example, Beck and McKeown (1991) discussed a study conducted by Smith in 1941, who reported that high-achieving high school seniors knew four times as many words as their low-achieving peers. Smith also reported that high-achieving third graders had vocabularies that were about equal to those of low-achieving twelfth graders.

In 1982, Graves, Brunetti, and Slater (cited in Graves, 1986) reported a study on differences in the reading vocabularies of middle-class and disadvantaged first graders. In a domain of 5,044 words, disadvantaged first graders knew approximately 1,800 words whereas the middle-class students knew approximately 2,700 words. Using a larger domain of words (19,050), Graves and Slater (cited in Graves, 1986) reported that disadvantaged first graders knew about 2,900 words and middle-class first graders approximately 5,800 words.

One of the most alarming patterns in terms of vocabulary-growth differences between students is that important differences are apparent regardless of how early vocabulary is measured, sometimes as early as when students begin school. Because reading-achievement differences between students also develop as early as first grade (Biemiller, 1977-1978; Juel, 1988), the vocabulary gap widens rapidly. As Beck and McKeown (1991) pointed out, "Even if some students are learning as many as seven new words a day, many others may be learning only one or two" (p. 795).

Recent studies have extended our understanding of vocabulary differences between students. In an important study, White et al. (1990) investigated reading vocabulary size and growth differences between students in grades 1 through 4 in two low socioeconomic status (SES) schools and one middle SES school. Reading vocabulary was defined as the number of printed words that were both decoded and understood. White et al. (1990) found that even in grade 1, there were important differences in the size of the reading

vocabularies of students in the middle SES school (about 4,800 words out of 19,050) compared to students in the two low SES schools (about 3,500 and 2,500 words, respectively). Also, the differences between the number of words known by students at each grade level indicated that vocabulary increases may exceed the 3,000 words per year commonly referenced (e.g., Baumann & Kameenui, 1991; Beck & McKeown, 1991; Graves, 1986). A prevailing finding was that vocabulary growth appeared to differ on the basis of SES. The vocabulary size of the students in the middle SES school increased by about 5,200 words per year while that of the students in the two low SES schools increased by about 3,500 words per year.

Although White et al. (1990) investigated reading vocabulary (i.e., words students could decode and understand), the overall vocabulary differences between students in three schools were not attributable exclusively to decoding skills. For example, word meanings of at least 96% of the *frequently used* words were known by students in all three schools, but only 85% and 82% of the *moderately used* words decoded by students in the two low SES schools were known, compared to 91% for students in the middle SES school. For *infrequently used* words, students in the two low SES schools knew the meanings of 61% and 64% of the words they decoded, whereas students in the middle SES school knew the meaning of 79% of the words they decoded.

The White et al. (1990) findings illustrate how the vocabulary problems of students who begin school with poor vocabularies worsen over time. At grade 1, the vocabulary difference between students in the middle SES school and students in the two low SES schools were about 1,300 and 2,300 words, respectively. At grade 3, vocabulary differences of approximately 5,000 words were found between students in the middle SES school and students in the two low SES schools.

Simmons and Kameenui (1990) attempted to identify important developmental changes in the relation between reading comprehension and vocabulary knowledge. They found that 10- and 12-year-old students with learning disabilities had less extensive vocabularies than matched-aged peers without disabilities. Their most interesting finding was that for 10-year-olds, differences in vocabulary knowledge between students with and without learning disabilities prevailed even after statistical adjustments were made for differences in reading achievement. For the group of 12-year-olds, however, the effect of learner classification was no longer significant following adjustments for level of reading comprehension. Simmons and Kameenui (1990) attributed this finding to the increased interdependence between reading achievement and vocabulary knowledge as students advance in grade. In other words, vocabulary knowledge can be more easily identified as an isolated skill early in the primary grades versus later. This finding has implications not only for the timing of vocabulary interventions, but also for how the general focus of interventions might change depending on the students' age and skill.

In summary, estimates of vocabulary size have become more consistent in recent years. In general, students learn an impressive number of words per year, perhaps 3,000 or more. However, vocabulary growth varies tremendously between students, and many diverse learners acquire vocabulary knowledge at much lower rates than other students.

One of the most alarming findings is that vocabulary differences between students appear early and the vocabulary gap grows increasingly large over time.

Individual Differences in Vocabulary Development

The second area of convergence in the vocabulary literature is that researchers have attempted to identify critical factors that contribute to individual differences in vocabulary development. Although investigators have pursued very different lines of inquiry, they are united by a search for student characteristics that impede adequate growth. It is unlikely that a search for a specific cause of poor vocabulary development will prove fruitful. Instead, causal explanations are likely to be a complex combination of multiple factors. The purpose of this section is to describe recent research investigating individual differences in vocabulary development, which can be grouped into three general categories: generalized linguistic deficiencies, memory deficits, and poor word learning strategies.

Generalized Linguistic Differences

Stahl and Erickson (1986) argued that the vocabulary problems of some students are part of a well-established empirical trail of "language performance differences between reading disabled and normally achieving children at nearly all levels of linguistic performance and school ages" (p. 285). They compared four models to account for these linguistic differences: a general language deficit model, a speed of verbal information processing model, a word decoding model, and a rule abstraction model (i.e., difficulties inducing rules that govern language use).

To test these models, Stahl and Erickson (1986) had third-grade students with and without disabilities and first-grade students without disabilities perform numerous tasks designed to measure language performance at syntactic, semantic, orthographic, and discourse levels. Their findings indicated that third-grade students without disabilities consistently performed better than third-grade students with disabilities on multiple measures of language proficiency. However, comparisons between third-grade students with disabilities and first-grade students without disabilities revealed no significant differences. Results of regression analyses indicated that the rule abstraction model accounted for the measures of language performance better than the other two models. The implications suggest that some students' poor vocabulary development is the result of faulty or incomplete use of rule-governed structures of language. Stahl and Erickson concluded that for children who are "deficient in the ability to abstract or induce rules, the instruction should be explicit, limiting the requirement that the child figure out rules by him or herself" (p. 289). Thus, rather than having students try to use context clues to derive the meaning of important, unknown words they encounter in written text, a better strategy might be to provide students with a short definition of difficult words prior to reading the text, upon which they can build deeper contextualized understanding of the words during reading.

A study by Boucher (1986), however, contradicted the notion that students with disabilities suffer in all areas of linguistic performance. Boucher (1986) found great similarities in the meaning of the words used in natural speech by groups of sixth graders with and without disabilities. Both of these student groups also showed the same degree of consistency in word meaning across situations, and the same general lack of language adaptation in response to changes in the age of the listener.

These results suggest that the same words used by students with poor vocabularies and students with rich vocabularies are used with the same intended meaning. The problem for students with poor vocabularies may be that they do not acquire the meaning of new words as rapidly as students with rich vocabularies. The results of Boucher's (1986) study imply that students with poor vocabularies use the words they are taught as appropriately as students with rich vocabularies. Therefore, it appears that key to increasing vocabulary development is ensuring that students with poor vocabularies not only learn the meaning of words, but have the opportunity to use them frequently.

It may be that receptive language tasks more clearly illustrate differences between students with and without disabilities than expressive language tasks. Highnam and Morris (1987) found that students with disabilities performed significantly poorer that students without disabilities on a series of semantic interpretation tasks in which they judged the appropriateness of responses to simple "wh" questions. For example, to the question "Whose coat is that,?" an appropriate response would be "That is John's coat," and an inappropriate response would be "That is a red coat." This finding supports Stahl and Erickson's (1986) hypothesis that students with disabilities have difficulty with rule-governed structures of language.

Memory Deficits

Recent studies have investigated whether memory deficits account for individual differences in vocabulary development. In one of the most comprehensive studies in this area, Swanson (1986) argued that semantic memory deficiencies may underlie the difficulties some students experience when learning the meaning of words. Swanson tested three assumptions: (a) students' paucity of word knowledge is the result of weak associative connections between words, including connections at semantic, phonemic, and orthographic levels; (b) students' deficient organization of information in semantic memory; and; (c) students' inefficient use of procedures to activate semantic, phonemic, and orthographic features of words.

To test these assumptions, Swanson (1986) had groups of students with and without learning disabilities listen to lists of word pairs that were related semantically (e.g., red, black; table, chair); phonemically (e.g., sit, pit); and structurally (e.g., sun, small [words that began with the same letter]). Prior to hearing the words, students were given either orienting instructions to listen for words from one of the three categories (e.g., "Listen for words that rhyme with 'sit'") or no specific instructions for remembering the words. Consistent with many other studies investigating the recall of linguistic items, Swanson (1986) found that students with learning disabilities recalled fewer words than students

without disabilities. In addition, both groups of students recalled more words when orienting instructions were given for one of the word categories.

Among Swanson's (1986) most important findings was that students with disabilities clustered words by categorical membership (i.e., semantically, phonemically, and structurally) less well than students without disabilities. Also, students with disabilities did less well than students without disabilities in activating word features from semantic memory to match the demands of a task. Specifically, students without disabilities recalled a higher percentage of correct words when they were given orienting instructions to remember specific categories of words. This finding was true for all three orienting conditions. The author interpreted this finding as implying that students with disabilities manifest qualitatively different selective attention patterns in recalling word features compared to students without disabilities.

Swanson (1986) concluded that students with disabilities are more diffuse in their attention to target word features than other students. In addition, he stated that these students "fail to activate a critical number of word features [e.g., semantic phonemic, orthographic] in semantic memory and, therefore, may resort to an alternative means of processing information" (p. 483). Importantly, Swanson (1986) noted that the semantic organizational difficulties of students with disabilities are "due to inadequately built-up word knowledge" (p. 485). Students with disabilities do not have an "adequately developed hierarchical class of word knowledge, but instead have something like a small collection of word features linked in some way" (p. 485). In contrast, students without disabilities possess a high level of "knowledge or accumulation of facts about words which become increasingly accessible by means of well-trodden information processing routes" (p. 485).

In a similar study, Lorsbach and Gray (1985) investigated developmental differences in processing the semantic features of words. Showing 70 slides that paired a verbally presented word label with a visual referent of the word, they instructed groups of second- and sixth-grade students with and without learning disabilities to remember as many of the paired items as possible. On a subsequent recognition test in which paired items were again presented, students were to identify which of the items were the same as those presented in the initial trial and which were different. Items that were not exact replications were related to the original items in one of three ways: Acoustic distractors were items with labels that were homophonous (i.e., same sounding) with one of the target items; visual distractors consisted of a line drawing identical to that used for one of the targets but with a new label that gave it a completely different referent; semantic distractors were composed of a label synonymous with that of a target, but presented with a new line drawing that was clearly different from the original.

For both groups of second-grade students, and for sixth-grade students with learning disabilities, visual distractors produced significantly greater numbers of false recognitions than acoustic or semantic distractors. This indicates that for these students visual attributes were dominant, whereas acoustic and semantic features assumed a less prominent role in memory recognition. Sixth-grade students without learning disabilities,

however, committed more false recognitions faced with semantic distractors than with acoustic or visual distractors. In other words, the older students without disabilities seemed to process the semantic meaning of the target items more thoroughly than their visual features. Lorsbach and Gray (1985) attributed their findings to the possibility that students with learning disabilities "do not spontaneously incorporate semantically related information in their rehearsal activities" (p. 226).

Walker and Poteet (1989) investigated whether depth of word processing and the match between learning and assessment conditions interacted with student vocabulary skills in later recall tasks. They tested fourth and fifth graders with and without learning disabilities on their ability to recall words presented in one of two conditions. In a shallow-processing condition, stimulus word pairs either rhymed or did not rhyme; in a deeper-processing condition, the stimulus word was embedded in a sentence that either did or did not make sense semantically. On the recall test, retrieval cues either matched the processing condition in the initial learning situation (e.g., initial learning: *fan/man* ; retrieval cue: *fan/ ___*) or were different (e.g., initial learning: *fan/man* ; retrieval cue: *On a hot day the ___ feels good*).

Overall, students without learning disabilities recalled more target words than students with learning disabilities. With both groups, more target words were recalled when the deeper-level cues were used (i.e., target word embedded in a sentence versus rhyming pair), especially when the target word made sense semantically. Finally, all groups recalled more words when the type of retrieval cue (i.e., rhyme or sentence) matched the learning cue. The authors concluded that word learning can be enhanced by "adding as much semantic context to new information as possible" (i.e., deeper-level processing) and suggested that "new information should be tied to previous learning to assist students in creating naturally occurring semantic relationships that will aid in later recall" (p. 31).

Differences in Strategies for Learning Word Meanings

Other researchers have investigated whether students with poor vocabularies use different strategies to learn the meaning of words than students with rich vocabularies. Griswold, Gelzheiser, and Shepherd (1987) tested groups of eighth graders with and without learning disabilities on a sentence completion task after they had studied a list of words. Although students with learning disabilities learned a smaller percentage of unknown words than students without disabilities (36.7 versus 67.4%), the two groups did not differ in the strategies used to learn the words, or in the amount of time spent studying the words.

Griswold et al. (1987) also found that strategy use did not account for the percentage of unknown words that students learned. The vocabulary learning score was accounted for primarily by the reading and vocabulary skills students had *prior to the study* , as measured by performance on standardized reading vocabulary and comprehension tests. Thus, students who knew more word meanings prior to studying unknown words learned the meanings of more new words after studying. The authors suggested that "prior knowledge contributes more to vocabulary learning than memorization strategies as they

are typically defined" (p. 625). The results of this study have implications for the timing of vocabulary interventions, and the importance of explicitly highlighting the semantic associations between words as one way to help students build background knowledge.

Another explanation of individual differences in vocabulary development may be that students with poor vocabularies have ineffective strategies for retaining the meaning of words they have learned. Fawcett and Nicolson (1991) taught 24 difficult words to a group of adolescents with reading disabilities and poor vocabularies and a group of adolescents with reading disabilities and rich vocabularies. Once again, students with rich vocabularies learned more word meanings than students with poor vocabularies. The authors attributed this finding to semantic richness--that is, the density of meaning and linkages among words. Fawcett and Nicolson's (1991) main finding was that the adolescents with poor vocabularies appeared to forget more over a 6-month posttraining period. Although they offered no explanation for this finding, the authors recommended that vocabulary development programs for students with poor vocabularies seriously address increasing the conceptual linkages among vocabulary items. In addition, for long-term retention to occur, it may be necessary for students to be taught strategies for using the words they learn. This effect can be understood in terms of Carey's (1978) notion of extended mapping. That is, the more frequently students use words they have learned, the faster the words will become part of their active and usable vocabulary.

Reminiscent of Carey's (1978) notion of "fast mapping" and "extended mapping," Van Daalen-Kapteijns and Elshout-Mohr (cited by Beck & McKeown, 1991) hypothesized that acquiring the meaning of words begins with a rough formulation of word meaning followed by empty slots reserved for additional information. These researchers found that college students did form initial rough notions of word meanings and that the integration of additional information differed between students with poor and rich vocabularies. Essentially, Van Daalen-Kapteijns and Elshout-Mohr noted that students with poor vocabularies had difficulty adjusting their model of word meaning when they acquired new information about the meaning of a word. For example, students who initially learn that *set* means to "put in a specified position; place: *set a book on a table* " might have difficulty adjusting their model of the meaning of *set* to accommodate other meanings such as "to prescribe or establish: *set a precedent* " (examples from the *American Heritage Dictionary* , 1992). This finding is consistent with current learning disability theories, in which students with disabilities are thought to show less flexible use of learning strategies in response to changes in task demands than students without disabilities.

In summary, findings regarding the causes of individual differences in vocabulary acquisition are far from conclusive. In general, more effort has been spent on identifying within-child factors that contribute to insufficient growth than environmental factors. Within-child factors have included biological factors such as language and memory impairments, and potential instructional factors such as strategy differences.

Different Instructional Procedures for Different Goals

In accounting for individual differences in vocabulary knowledge it also is important to consider how complete an individual's understanding of a word's meaning is (Shore & Durso, 1990). Depth of understanding varies considerably from person to person. For example, a person's understanding of the word "bachelor" may occur at one of many levels. At the most basic level, bachelor may be understood strictly in its dictionary sense as "an unmarried man" (*American Heritage Dictionary* , 1992). At a much deeper level, the word "bachelor" may constitute information about age, gender, independence, functional living, organizational tendencies, and a host of other metaphoric and literal interpretations (Anderson & Nagy, 1991). The third area of convergence, therefore, is that instructional procedures to teach word knowledge must match the goals for depth of word knowledge. To understand this issue, it is important to first address the strongest criticism leveled against a direct instructional approach to facilitate student vocabulary development.

An Argument Against Direct Instructional Approaches of Word Meanings

Anderson and Nagy's (1991) chapter, "Word Meanings," presents a comprehensive treatment of depth of word knowledge and a provocative analysis of vocabulary development with clear implications for decreasing the absolute gap between students with poor and rich vocabularies. Anderson and Nagy's criticism of direct instructional approaches to vocabulary development begins with an analysis of what they refer to as the *standard theory* of word knowledge, according to which word meanings "can be characterized in terms of *criterial features* --that is, necessary and sufficient conditions for inclusion in the [definition] of a word" (p. 693). Anderson and Nagy suggested that the standard theory grew out of efforts to align a theory of vocabulary acquisition with the general scientific principle of parsimony: in other words, to equate word meaning with the "necessary and sufficient conditions" for knowledge. However, they suggested that "there is no convincing, a priori reason to assume that, in representing word meanings, the human mind avoids redundancy and strives for parsimony of representation" (p. 695). In essence, Anderson and Nagy believe that the meaning of words can be fully appreciated and understood only to the extent that they are analyzed in the context of connected oral speech or written text. Furthermore, the variety of contexts in which words can appropriately be used is so extensive, and the crucial nuances in meaning so constrained by context, that teaching word meanings in an abstract and decontextualized manner is essentially futile and potentially misleading.

Words are such "slippery customers" argued Anderson and Nagy (1991), that even when the standard theory attempts to provide for the contextual understanding of word meanings, it would be a monumental task to include a full range of contexts to define adequately the way words are used. For example, Anderson and Nagy (1991) described the countless problems that arise when attempting to arrive at a standard meaning of the verb *give* . According to Webster's *New Third International Dictionary* (1964), the first standard meaning of *give* is "to confer ownership of something without receiving a return." As Anderson and Nagy (1991) pointed out, this definition works fine in the context of "John gave Mary a present," but in the context of "John gave Mary a kiss," or

"Mary gave an excellent performance," the standard meaning of "conferred ownership" is crude at best.

When the standard meaning of *give* is supplemented by attempts to provide adequate contextual examples, not only does its meaning begin to lose the important element of parsimony (the *Third International Dictionary* contains 56 related contexts for *give* subsumed under 14 major groupings), but it still only partially accounts for the range of adequate contextual examples. For instance, some of the contextual entries for *give* include: (a) administer a medicine (e.g., *give* a shot of penicillin); (b) perform the action necessary or appropriate for a public performance (e.g., *give* a concert); (c) yield or furnish as a product, consequence, or effect (e.g., the candle *gave* its final flicker); (d) deliver or deal by some bodily action (e.g., *give* him a shove); and (e) deliver verbally (e.g., *give* a valid argument) (examples from Anderson & Nagy, 1991). Because these uses of *give* are related, support for the standard theory would be provided if it were possible to substitute the same synonym in each expression and preserve its meaning. This clearly is not the case, however, as Anderson and Nagy (1991) stated, "you can say *set forth* a valid argument, but you cannot, in any normal situation say *set forth* a warm greeting; you can say *grant* him permission, but you cannot say *grant* him a shove" (p. 698).

In an earlier paper, Nagy and Anderson (1984) argued that:

any program of direct vocabulary instruction ought to be conceived in full recognition that it can cover only a small fraction of the words that children need to know. Trying to expand children's vocabularies by teaching them words one by one, ten by ten, or even hundred by hundred would appear to be an exercise in futility. *Vocabulary instruction ought, instead to teach skills and strategies that would help children become independent word learners* [italics added]. The challenge to those who would advocate spending valuable instructional time with individual words is to demonstrate that such instruction will give the child an advantage in dealing with the ocean of words not instructed. (p. 328)

Nagy and Anderson's (1984) argument concerning the futility of implementing *only* a system of direct instruction to significantly increase the word knowledge of students with poor vocabularies is most likely correct, but the argument needs clarification. *Any* one-dimensional approach will be inadequate for seriously reducing the vocabulary gap between students with poor and rich vocabularies. Thus, Anderson and Nagy (1991) correctly suggested that teaching students that words mean precisely what is specified in standard definitions is a poor technique. However, it also seems unwise to avoid helping students establish, as quickly as is possible and reasonable, a foundation of vocabulary knowledge upon which they can build intricate structures of contextualized understanding (Paul & O'Rourke, 1988).

Researchers who advocate a more explicit approach to teaching word meanings recognize the limitations of teaching words in isolation as this quote from Kameenui et al. (1987) illustrates:

Vocabulary instruction must move beyond the teaching of words directly as a primary activity. Because students derive the meanings of many words incidentally, without instruction, another possible role of instruction is to enhance the strategies readers use when they do in fact learn words incidentally. Directly teaching such strategies holds the promise of helping students become better independent word learners. (p. 140)

Anderson and Nagy (1991) suggested that the primary instructional procedure for facilitating strong vocabulary development is to ensure that students develop independent strategies for learning the meaning of words as they occur in context. Although student independence in learning word meanings from context should be the ultimate goal of a comprehensive vocabulary development program, there are two problems with relying too heavily on this approach.

First, the students with the greatest vocabulary needs are the same students whom Stanovich (1986) described as actively selecting, shaping, and evoking environments that are not conducive to rapid growth in reading or vocabulary. In essence, students who are not successful in developing early reading skills tend to become frustrated by reading activities, and thus do not engage in the volume of reading necessary to significantly influence their vocabulary development. Although it may be difficult for advocates of direct vocabulary instruction to demonstrate that instruction with individual words gives the child an advantage in dealing with the "ocean of words not instructed" (Anderson and Nagy, 1991, p. 328), it is equally difficult to demonstrate how systematic increases in the amount of reading by poor readers can approximate (even surpass if the vocabulary gap is to be reduced) the amount of reading by good readers.

The second problem with overrelying on independent word learning strategies is that it is unclear how this would address the needs of students in kindergarten and first grade (i.e., before most students are reading). Already at this early age, many students have serious vocabulary limitations compared to their peers (White et al., 1990), but they do not have adequate reading skills to engage in the amount of reading necessary to reduce the gap. Therefore, reconciling the differences between advocates of direct vocabulary instruction in word meanings and those who advocate for the development of independent word learning strategies can be done most easily through flexible and integrated approaches to vocabulary development.

Depth of Word Knowledge

Recent secondary sources in vocabulary research (e.g., Baumann & Kameenui, 1991; Beck & McKeown, 1991; Graves, 1986) discussed the importance of considering levels of word knowledge in determining vocabulary development. As Beck and McKeown (1991) stated, "knowing a word is not an all-or-nothing proposition; it is not the case that one either knows or does not know a word. Rather, knowledge of a word should be viewed in terms of the extent or degree of knowledge that people can possess" (p. 791). A comprehensive vocabulary development program that addresses levels of word knowledge in its instructional and assessment strategies has the potential to emphasize a range of approaches from independent word learning strategies to teacher-directed

strategies that focus on the meanings of individual words. For example, a comprehensive instructional sequence might entail explicitly teaching the meaning of words for which students have no knowledge (e.g., *bachelor* --unmarried man). By arranging specific learning opportunities, the student might develop a deeper understanding of the word *bachelor* through independent strategies. The primary strategy might involve multiple exposures to the word *bachelor* in connected written text (McKeown & Beck, 1988).

Thus, considering levels of word knowledge may help determine the type of strategy to be used to facilitate improvement in vocabulary knowledge. Baumann and Kameenui (1991) discussed three levels of word knowledge that can be used to consider depth of understanding and related instructional procedures: *association* , *comprehension* , and *generation* .

A student with *associative* knowledge is able to link a new word with a specific definition or a single context. To possess *comprehension* knowledge, a child must either demonstrate a broad understanding of a word in a sentence or be able to use definitional information to find a antonym, classify words into categories, and so forth. Finally, *generative* knowledge is characterized by the ability to produce a novel response to a word, such as an original sentence, or a restatement of the definition in the child's own words.

Thus, whether a student needs to have associative, comprehension, or generative knowledge of a word's meaning has ramifications for the type of instructional procedures that should be used (McKeown & Beck, 1988). For example, very different instructional strategies might be used with a student who needs to have a very general sense of a word's meaning to understand part of a story (e.g., the word *Occurrence* in *The Occurrence at Owl Creek Bridge* can be understand as *What Happened*) versus a student who needs to know the meaning of a word in sufficient depth to use the word in discourse (e.g., a person would have to understand the word *Powers* in *The Rise and Fall of the Great Powers* at a deep level to understand the book).

Multiple Methods of Enhancing Individual Word Knowledge

The fourth area of convergence in vocabulary research is that many different instructional methods have yielded positive results in increasing vocabulary knowledge. The majority of vocabulary intervention research has examined the effectiveness of increasing students' knowledge of individual, specific words.

Many methods to increase vocabulary knowledge have resulted in more words learned than otherwise occurred during normal incidental learning opportunities. However, Beck and McKeown (1991) concluded that a single best method of vocabulary instruction has not been identified. Recent studies, combined with the information in many secondary sources, provide a clear picture of the strengths and weaknesses of efforts to increase understanding of individual words.

In considering vocabulary growth, we need to distinguish between *intentional* and *incidental* learning. The majority of word meanings are learned through incidental word learning opportunities (Baumann & Kameenui, 1991). That is, through normal everyday experiences with oral and written language, students learn most of the approximately seven words they acquire each day. In some cases, students learn word meanings intentionally, however. For example, the classroom teacher may request that students be able to generate original sentences for 10 new vocabulary words per week. Such intentional word learning opportunities can be either teacher- or student-directed. Intentional vocabulary learning interventions are labor-intensive, however, because they require that direct efforts be expended on word learning activities. Techniques that utilize high amounts of teacher time are particularly labor-intensive.

Recent Studies on Teaching Specific Words

Baumann and Kameenui (1991) noted that even studies employing definition or synonym instruction, which have come under increasingly strong criticism, report that the number of words learned exceeds the number acquired during incidental learning opportunities. Recent studies have examined the benefit of using alternative vocabulary-learning techniques, such as semantic mapping/features analysis, and keyword and computer-assisted methods, versus more traditional techniques.

Semantic mapping/features analysis . Bos and Anders (1990) compared the effects of three knowledge-based interactive vocabulary instructional techniques with a traditional definition approach to vocabulary instruction. Subjects were 61 junior high students with LD who were learning from science text. In knowledge-based instruction, students were assigned to one of three groups. Students in the semantic mapping group constructed a hierarchical relationship map from a vocabulary list. Students in the semantic-feature analysis group predicted the relationships among concepts using a relationship matrix. Students in the semantic/syntactic feature analysis group predicted the relationships among concepts and the answers for cloze-type sentences using a relationship matrix as a guide. Finally, students in the (access/instrumental [definition] instruction group) were directly taught the definitions of the vocabulary terms, emphasizing oral recitation, correct and automatic pronunciation of each vocabulary word or phrase, and memorization of concise context-related definitions.

Students read a passage from their science text and then met as a group to discuss the text in a postreading activity. Then, they were instructed to write all they could recall about the topic. Their performance was evaluated on the basis of vocabulary learning, reading comprehension, and the quality of written recalls. Bos and Anders (1990) found that on the reading test overall (vocabulary and comprehension items), and specifically on the reading comprehension items, students in the three interactive interventions scored higher than students engaged in definition learning.

In addition to vocabulary growth, the use of semantic maps may result in consistent improvements in reading comprehension. Sinatra, Berg, and Dunn (1985) found that the use of two types of semantic maps, one with class, property, and example connections,

and one modeled after typical story grammar elements, resulted in improved reading comprehension scores for three students with LD on 11 of 15 comparisons. Despite the small sample size, the authors suggested their findings supported the theory that students with LD have difficulty organizing and recalling verbal information.

In an investigation with a similar focus to the study by Bos and Anders (1990), Fawcett and Nicolson (1991) taught five students with reading disabilities and rich vocabularies and eight students with reading disabilities and poor vocabularies 24 vocabulary words and 24 matched untrained words. The students, ages 11 to 14, were trained for an average of either 10 minutes per word or 3.3 minutes per word in an (a) enriched training condition (i.e., generating sentences and contexts, cross-linking words, and identifying affective reactions, stressing semantic links with related concepts); or a (b) traditional training condition (i.e., worksheets, crosswords, word bingo, and missing letters in order to link words with definitions).

Students were tested on word knowledge using a multiple-choice format and lexical decision speed and accuracy (i.e., deciding if an item was a word or nonword as quickly as possible). All students scored higher on word knowledge at posttest than pretest. Neither the enriched training nor greater amount of training (10 minutes per word vs. 3.3 minutes per word) led to significantly better word knowledge. This finding indicates that if the goal is word knowledge at a rudimentary level (i.e., associative level; Baumann & Kameenui, 1991), then modest amounts of instruction may suffice. Some evidence in this study suggests that amount of training but not type of training may have influenced another level of word understanding, speed of lexical access. Thus, students trained on words for 10 minutes were able to recognize items as words or nonwords faster than students trained for 3.3 minutes.

Keyword method . The keyword method has received considerable support as a technique for teaching word meanings to students (Baumann & Kameenui, 1991). In the keyword method, the student is taught to construct a visual image that connects the target word and a familiar, concrete word (similar auditorially) that shares some common feature. For example, in the word *carlin* , which means *old woman* , the keyword *car* might be used to have the student generate the image of an old woman driving a car. When asked to recall the meaning of *carlin* , the student retrieves *car* because of its acoustic similarity to *carlin* , and then recalls the visual image and the meaning of carlin (example from Pressley, Levin, & McDaniel, 1987, cited in Baumann & Kameenui, 1991).

Critics have argued that the keyword method works better for concrete words (e.g., carlin) than abstract words (e.g., festive). To examine this contention, Mastropieri, Scruggs, and Fulk (1990) compared the keyword method to a more traditional rehearsal method. They taught 25 students with LD eight abstract and eight concrete words using either a keyword method or a rehearsal method. In the rehearsal method, students were instructed on word meanings using experimenter-led drill and practice, rapid-paced questioning, and corrective feedback. The keyword method was more successful than the rehearsal method on (a) a production test in which students provided an oral definition of the word and (b) a generalization measure in which students provided the appropriate

word given a novel instance of the word. In addition, Mastropieri et al. (1990) found that the keyword method was just as successful for teaching the meanings of abstract as concrete word meanings (4.96 vs. 5.71 words).

Condus, Marshall, and Miller (1986) examined the effectiveness of four vocabulary intervention techniques with 64 students with LD. The instructional interventions were the keyword method, picture context, and sentence-experience context. In addition, students in the control group could choose any method they wanted to learn the vocabulary word meanings. Students were taught 50 words in 10- to 20-minute training periods conducted three times per week over five weeks. Vocabulary performance was measured with a multiple-choice test. Immediately following the intervention, students in the keyword group and in the two context groups outperformed control students on the vocabulary test. Students in the keyword group outperformed students in all the other groups. At an 8-week followup, the keyword group mean was nearly twice the mean of the lowest experimental group (sentence-experience) (28 words vs. 15 words) and more than three times greater than the control group mean (9 words correct).

Computer-assisted methods . Two recent studies have examined the effectiveness of computer-assisted interventions for increasing knowledge of individual words. Three features in particular, seem to make computer-assisted interventions attractive. First, such interventions require less direct teacher time than teacher-led instruction. Second, they have the potential to individualize instruction and facilitate the alignment of instructional techniques and vocabulary goals. Third, they have the potential to systematically imbed important instructional design features within the intervention framework, including systematic review, instructional scaffolding, and integration across academic areas.

Johnson, Gersten, and Carnine (1987) used two computer-assisted instructional vocabulary programs to teach the meaning of 50 words to 25 high school students with LD. Students were matched on vocabulary pretest scores and randomly assigned to one of two computer-assisted instructional groups. The differences between the groups were (a) the size of the teaching sets and (b) the procedures for cumulative review. One program provided teaching and practice exercises on small sets of words (i.e., 10) and cumulative review exercises on all words learned in the program, whereas the other presented exercises on two sets of 25 words and no cumulative review. Students received computer-assisted vocabulary instruction for a maximum of eleven 20-minute sessions.

The major finding was that significantly more students in the small teaching set reached mastery within 11 sessions than students in the large teaching set group. Learning was measured using a criterion-referenced test. Students in both groups learned approximately the same number of words (17.3 vs. 18.95) and retained the information over time, as measured by the maintenance test (15.8 vs. 17.25). Students in the small teaching set with cumulative review seemed to learn the material more efficiently.

A second study on computer-assisted instruction was conducted by Reinking and Rickman (1990). Computer-mediated texts provided students immediate access to the definitions of difficult words in a passage on a computer screen. That is, students either

selected to view the definitions of words at their discretion, or the definitions of the target words were automatically presented. In two non-computer-assisted conditions, students could look words up at their discretion in a dictionary or a glossary. Results showed that students in the two computer-assisted groups scored significantly higher on the multiple-choice vocabulary test and the passage comprehension test than students in the dictionary or glossary groups. The means between the groups on the multiple-choice vocabulary test, however, indicated that the effects were not particularly strong and may have been attenuated by a ceiling effect. Mean scores for students in the dictionary and glossary groups (26.4 and 26.5 correct, respectively, out of 32) were only two or three items lower than students in the self-select and computer-select groups (28.7 and 29.4, respectively). In addition, test performance seemed to be only marginally affected by the number of definitions provided to students. Students in the glossary group, for example, looked up an average of 2.1 words, whereas students in the self-select computer group looked up an average of 9.6 words. Thus, students either had some understanding of the majority of words considered difficult prior to the study, or they learned enough about the meaning of the words during passage reading to answer the items correctly on the vocabulary test.

In summary, vocabulary interventions typically include procedures to enhance student understanding of individual words. In general, innovative vocabulary interventions are superior to traditional instructional procedures that focus on transmitting a single definition of a target word. These more effective procedures include semantic/syntactic features analysis, the keyword method, and computer-assisted methods.

Reading Achievement and Vocabulary Acquisition

The fifth and final area of convergence in research on vocabulary development is that students need to develop strong beginning reading skills to be able to engage successfully in the volume of reading necessary for them to learn large numbers of word meanings through reading connected text (Anderson & Nagy, 1991). The only realistic chance students with poor vocabularies have to catch up to their peers with rich vocabularies requires that they engage in extraordinary amounts of independent reading. Furthermore, research finding are increasingly clear that opportunities for developing adequate reading skills are limited. In fact, the status quo in beginning reading instruction may be entirely insufficient to meet the reading and vocabulary needs of many diverse learners (Adams, 1990; Liberman & Liberman, 1990). For example, according to Juel's (1988) longitudinal study, there was an 88% chance that a poor reader at the end of first grade would remain a poor reader at the end of fourth grade. Stanovich (1986) explained how the development of strong beginning reading skills facilitated vocabulary growth, which in turn facilitated the further increases in reading. This reciprocal, causal relation between reading and vocabulary seems to continue unabated throughout development.

The amount of independent reading that diverse learners need to engage in to reduce the vocabulary gap that separates them from normal achieving peers is extensive. Researchers generally agree that students do learn word meanings in the course of reading connected text, but the process appears to be very time consuming (Baumann & Kameenui, 1991 Beck & McKeown, 1991). That is, students have to engage in

considerable amounts of reading to be exposed to unknown words a sufficient number of times for them to be learned.

Beck and McKeown (1991) asserted that "research spanning several decades has failed to uncover strong evidence that word meanings are routinely acquired from context" (p. 799). Their conclusion was that some learning from context does occur, but that the effect is not very powerful. A number of other studies have examined the effects of learning words through normal reading activities (incidental learning). For example, Jenkins, Stein, and Wysocki (cited in Beck & McKeown, 1991) studied the effects of learning words in context with fifth-grade students. The contexts were created so that a word's meaning was either strongly implied or a synonym was provided. Jenkins et al. found that students learned the meaning of words that had been encountered six or ten times, unless exposure to meaning occurred prior to passage reading, in which case two encounters were sufficient to produce positive effects. Nagy, Herman, and Anderson (cited in Beck & McKeown, 1991) calculated that the probability of learning a word from a single contextual encounter was between .05 and .11, depending on the learning criterion used.

Even though independent reading may not be an efficient way to learn word meanings, the procedure does not have to be efficient to be effective, and thus, to ultimately result in powerful overall effects (Anderson & Nagy, 1991). Given that students in the primary and middle grades read anywhere from 100,000 to over 10,000,000 words of connected text per year (Nagy & Anderson, 1984), it is unnecessary for students to be efficient in deriving the meaning of words from text for the procedure to result in considerable vocabulary learning.

Relatedly, the connection between reading comprehension and vocabulary knowledge is strong and unequivocal (Baumann & Kameenui, 1991; Paul & O'Rourke, 1988; Stanovich, 1986), although the precise nature of the causal relation between the two constructs is still under investigation. As Stanovich (1986) stated:

The correlation between reading ability and vocabulary knowledge is sizable throughout development. Although, as in most areas of reading research, correlational evidence is much more plentiful that experimental evidence, there is a growing body of data indicating that variation in vocabulary knowledge is a causal determinant of differences in reading comprehension ability. It seems probable that like phonological awareness, vocabulary knowledge is involved in a reciprocal relationship with reading ability, but that--unlike the case of phonological awareness--the relationship is one that continues throughout reading development and remains in force for even the most fluent adult readers. (p. 379)

Arguing that reading instruction should be an integral component of a comprehensive vocabulary building program we return to Becker's (1977) observation that vocabulary knowledge was the primary factor limiting the reading and academic success beyond grade 3 of students from impoverished backgrounds. We can use a similar rationale to argue that if the spiraling negative effects of reading problems are to be avoided,

comprehensive vocabulary development programs should be implemented with students prior to grade 3.

Summary

Vocabulary acquisition is crucial to academic development. Not only do students need a rich body of word knowledge to succeed in basic skill areas, they also need a specialized vocabulary to learn content area material. A foundation of vocabulary knowledge must be in place early if children are going to perform successfully in school. The following points capsulize our findings of recent research on vocabulary acquisition.

Students learn an amazing number of words during their early school years, as many as approximately 3,000 per year on the average, or 8 words per day. However, the number of words students learn varies greatly. As some students are learning eight or more words per day, other students are learning only one or two.

Even as early as kindergarten, sizable differences are found between students in the number of words known. This vocabulary gap tends to increase significantly throughout school. Thus, early differences in vocabulary knowledge have strong implications for students' long-term educational success.

Multiple factors may contribute to differential rates of vocabulary growth. Biological factors that may partially account for differential rates of vocabulary growth include general language deficits and memory problems. Also, a strong relation has been found between environmental indicators such as socioeconomic status and vocabulary knowledge, indicating that home factors may contribute substantially to students' vocabulary knowledge.

Nearly all strategies of increasing vocabulary knowledge result in greater learning than occurs during typical opportunities. These methods have included semantic mapping and semantic features analysis procedures, the keyword method, and computer-assisted instruction.

Words can be known at different levels of understanding. Therefore, choice of vocabulary intervention procedure should be based on the procedure's efficiency with respect to teacher and student time, and its usefulness in helping students learn the meaning of other words independently.

Directly teaching word meanings does not adequately reduce the gap between students with poor versus rich vocabularies because of the size of the gap. It is crucial, therefore, that students also learn strategies for learning word meanings independently.

The relation between reading comprehension and vocabulary knowledge is strong and unequivocal. Although the precise causal direction of the relation is not understood clearly, there is evidence that the relation is largely reciprocal.

The development of strong reading skills is the most effective independent word learning strategy available. However, those students who are in the greatest need of vocabulary acquisition interventions tend to be the same students who read poorly and fail to engage in the amount of reading necessary to learn large numbers of words.

The meaning of words is learned during independent reading activities, but the effects do not appear to be very powerful. Words need to be encountered in text multiple times before their meaning becomes part of a student's vocabulary. However, although independent reading is not an efficient way to learn word meanings, the tremendous number of words typical students in the primary and middle grades encounter in written text nevertheless result in considerable vocabulary learning.

Improvements in beginning reading instruction are crucial if students are to develop the skills necessary to engage in significant amounts of independent reading and hence acquire a sufficiently large vocabulary.

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Table 1
Description of Vocabulary Studies
Primary Studies

Author	**Vocabulary Dimension**	**Participants**	**Purpose**
Bos & Anders (1990)	Increasing student knowledge of individual words and reading comprehension skills.	Junior high students with learning disabilities. N=61.	To compare effectiveness of three knowledge-based interactive vocabulary strategies
Boucher (1986)	Semantics and Pragmatics--being competent in interpersonal communication.	5th- and 6th-grade students with and without learning disabilities. N=10.	To determine if there are differences in the verbal language of students with and without learning disabilities and identify any changes between these groups on the basis of listener age.
Condus, Marshall, & Miller (1986)	Increasing student knowledge of individual words.	12-year-old students with learning disabilities. N=64.	To investigate the effectiveness of an imposed keyword mnemonic strategy and two other instructional procedures on vocabulary acquisition and maintenance.
Fawcett & Nicolson	Using parents to enhance student	Adolescents with dyslexia, ages 11 to	To investigate whether children with dyslexia show

(1991)	knowledge of individual words.	14. N=13.	similar training effects to those reported in other studies
Griswold, Gelzheiser, & Shepherd (1987)	The strategies students use to learn word meanings.	8th-grade students with and without learning disabilities. N=76.	To investigate whether the failure to spontaneously produce appropriate strategies for memorizing word definitions accounts for vocabulary differences between students.
Highnam & Morris (1987)	Appropriateness of linguistic stress and semantic interpretation in discourse.	9-year-old students with and without learning disabilities. N=20.	To examine differences between students in the ability to recognize the appropriate use of linguistic stress and semantic interpretation in discourse.
Johnson, Gersten, & Carnine (1987)	Increasing student knowledge of individual words.	Students with learning disabilities in grades 9 through 12. N=25.	To compare the effects of two methods of computer-assisted vocabulary instruction on the acquisition and maintenance of word meaning.
Lorsbach & Gray (1985)	The process by which stimulus attributes are selected for storage in long-term memory.	Students with and without learning disabilities in grades 2 and 6. N=72	To compare the encoding preferences of students with and without learning disabilities.
Mastropieri, Scruggs, & Fulk (1990)	Increasing student knowledge of individual words.	Students in grades 6 through 8 with learning disabilities. N=25	To investigate if students with learning disabilities learn the meanings of concrete and abstract words equally well using the keyword method; and whether they adapt their acquired vocabulary to semantically novel instances.
Reinking & Rickman (1990)	Computer-assisted strategies to increase student knowledge of individual words.	Normally achieving students in grade 6. N=60	To determine if intermediate-grade readers' vocabulary learning and comprehension would be affected by two types of

			computer-assisted strategies.
Shore & Durso (1990)	Partial knowledge in vocabulary acquisition.	Volunteers from psychology introduction class. N=132.	To assess levels of word knowledge by filtering words through a series of questions that required increasingly less understanding of the target word.
Simmons & Kameenui (1990)	The effects of task form on vocabulary knowledge	10- and 12-year-old students with and without learning disabilities. N=48.	To examine the effect of task demands on vocabulary learning with different students.
Sinatra, Berg, & Dunn (1985)	Recall and organization of information within written texts	Primary and elementary students with learning disabilities. N=3.	To show how the semantic mapping approach can improve the reading comprehension of students with learning disabilities.
Stahl & Erickson (1986)	Causes of language problems in students with disabilities.	Students in grades 1 and 3 with and without learning disabilities. N=38.	To compare the performance of students on a variety of language and reading tasks to explicate the causes of language problems in students with disabilities.
Swanson (1986)	Semantic memory.	Students with and without disabilities. N=52.	To determine if semantic memory deficiencies underlie the encoding processes of students with learning disabilities.
Walker & Poteet (1989)	Memory performance--deep encoding and efficient recall.	Students in grades 4 and 5 with and without learning disabilities. N=60.	To investigate differences between students on their performance on a cued recall memory test, and to examine the interaction between processing level and retrieval cues.
White, Graves, & Slater (1990)	Reading vocabulary and socioeconomic status.	Students in grades 1 to 4 in three schools with different cultures and socioeconomic status levels. N= 47 to 91 in each grade at each school.	To estimate the vocabulary size and growth of students in grades 1 through 4.

Secondary Studies

Author	Vocabulary Dimension	Participants	Purpose
Anderson & Nagy (1991)	Theoretical models of word knowledge.	All age groups. Primary focus on normal achievers.	To discuss the nature of people's knowledge about word meaning and how word meaning is acquired and used in reading comprehension.
Baumann & Kameenui (1991)	Vocabulary instruction.	Studies involved varying populations including normal to high achieving, disadvantaged, and students with learning disabilities. Students ranged in grade from 3rd through college level (a few studies included kindergarten and first-graders).	To discuss (a) the theoretical and pedagogical issues that haunt research on vocabulary instruction, (b) ways by which we can best teach vocabulary, and (c) what we know and do not know about teaching vocabulary.
Beck & McKeown (1991)	Vocabulary acquisition.	Studies reflect varied populations.	To discuss (a) what the role of instruction is in vocabulary acquisition, (b) what it means to know the meaning of a word, (c) what we know about vocabulary size and growth, and (d) how word knowledge is measured.
Kameenui, Dixon, & Carnine (1987)	Vocabulary instruction.	Primary focus on students who have at least minimal levels of reading skill.	To discuss the link between vocabulary learning and reading comprehension within the context of reading instruction, and to propose a comprehensive instructional program for increasing vocabulary development and reading comprehension.
Graves (1986)	Vocabulary learning and instruction.	School-age students.	To explore vocabulary size, depth of word knowledge, and how to assess word knowledge. The study also

			discusses the effects of vocabulary on reading comprehension, teaching individual words, and the instruction that currently takes place in schools.
McKeown & Beck (1988)	Matching vocabulary goals to vocabulary instruction.	School-age students.	To (a) discuss the design features of effective vocabulary instruction, (b) explore issues that affect vocabulary instruction design, and (c) promote an instructional model for vocabulary acquisition.
Paul & O'Rourke (1988)	Relationship between multimeaning words and reading comprehension.	Primary focus on low-performing students.	To (a) present general findings regarding prevalence of polysemic words in reading materials, (b) discuss the relationship between vocabulary instruction and reading comprehension, and (c) give examples of teacher-directed, theory-based instructional techniques.