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Abstract

Research on the acquisition of word identification and vocabulary understanding is reviewed in this report. One of the major themes is that children's understanding of words is best understood from the perspective of developing sensitivities to the English language. A second major theme is that acquisition of word identification skills and vocabulary knowledge centers on discovery of the regularity of the language.

The authors present a synthesis of information from both qualitative and quantitative studies. The literature on word identification and vocabulary development stems from different theoretical and methodological orientations and so the studies need to be considered illustrative. Nevertheless, it appears that the patterns of findings support several important instructional implications. Instructional activities ought to take place in informal as well as formal settings, provide a broad rather than narrow focus, and engage children in a variety of activities. Instruction must also be carefully tuned to draw from and extend children's existing knowledge.

CHILDREN'S DEVELOPING KNOWLEDGE OF WORDS

Over time, research on the acquisition of knowledge about words, their meanings, and the word-reading process has led to changes in views of reading and its development. In this report we review research on two aspects of beginning reading: word identification and vocabulary knowledge. Word identification and vocabulary knowledge are critical in the sense that reading for meaning cannot take place in their absence. We do not intend this to mean that other aspects of reading such as knowledge of the functions of literacy (Heath, 1983) or concepts about print (Clay, 1979, 1985), or story forms (Applebee, 1980) are unimportant. It would be inaccurate to speak of word identification and vocabulary knowledge as the only skills basic to reading.

In fact, one of the major themes in this report is that children's understanding of words is best understood from the perspective of developing sensitivities to the English language. In the case of word identification, for example, experiences in writing, spelling, and reading words make a significant contribution. Vocabulary knowledge takes place through word play and talk about language as well as through wide-ranging opportunities to express, hear, and read new words in meaningful contexts.

A second major theme in the report is that acquisition of word identification skills and vocabulary knowledge centers on discovery of the regularity of the language. Of course, the English language is quite complex, so the process of discovery is not simple. In some cases words may be identified or their meanings interpreted through the application of rather simple understandings. In other cases, though, more complicated understandings must be invoked.

The first section of this report deals with word identification and the second with vocabulary knowledge. We decided not to address the two topics in a strictly parallel manner. Research conducted with adults receives much less attention in the section on word identification than in the section on vocabulary. The reason for this difference is that children's learning of word identification involves striking developmental changes. Children typically shift from identifying words one by one, in piecemeal fashion, to identifying words using a variety of approaches based on extensive knowledge of context, letter sounds, and syllable patterns. A similar shift in approaches does not seem to occur with acquisition of vocabulary knowledge. Thus, research conducted with adults may be less informative in the case of word identification than in the case of vocabulary knowledge, especially when it comes to instructional implications.

The research we review presents a synthesis of information from both qualitative and quantitative studies. The literature on word identification and vocabulary development is vast, so the studies we cite should be considered illustrative. These studies stem from different theoretical, as well as methodological, orientations. Nevertheless, it appears that the patterns of findings in both bodies of research are gradually converging and tend to provide support for many of the same conclusions. It is these patterns that we have tried to convey.

Word Identification

The typical four-year-old relies on idiosyncratic cues to identify words. For example, a child might recognize the word *monkey* because there is a tail on the *y* (Gates & Bocker, 1923), or *look* because it seems to have two eyes in the middle. In a word learning study, Gough and Juel (in press) even found that young children were more likely to notice and rely on a thumb print on a word card than on the letter information. These examples make the point that children do not intuitively make use of letter-sound information to recognize words. By the end of the elementary school years, however, children can usually read and understand words using a vast array of information about letter-sound patterns, clusters of letters, and syllables. Children can then identify words quickly and with little effort. They are better able to place word identification in the background and focus on comprehension. Children

with inadequate word identification skills, however, continue to rely principally on context cues and are almost invariably poor readers (Simon & Leu, 1987; Stanovich, in press).

Clearly, proficiency in word identification is central to the reading act. How might proficient word identification be characterized? What course do children generally follow in developing the ability to identify words? What types of classroom experiences appear most valuable for strengthening children's ability to identify words? These questions are addressed below.

Proficient Word Identification

Skilled readers have the ability to identify words fluently and effortlessly. According to McConkie and Zola (1987) reading is carried out

> by making a series of eye fixations, each of which exposes the processing system to a large and complex stimulus array... During reading these displaced views of the text occur four times per second, on the average. Thus, about every quarter of a second the reader selects from the stimulus array the information that is needed to further an understanding of the text. (p. 385)

The processes of identifying words becomes subservient to text meaning and overall understanding.

There appear to be two mechanisms for the word identification process (Rayner & Pollatsek, 1989). One mechanism, a direct route, involves rapid or automatic recognition of words and their pronunciation and meaning. Most common words, words that appear frequently in texts such as pronouns, articles, and frequently read nouns and verbs, are recognized rapidly by skilled readers. Less common words and words never before seen cannot be recognized by this process. The other mechanism seems to operate through an ongoing construction process of plausible pronunciations. Words are recognized through a process of similarity or analogy to known words and by knowing spelling pattern rules. Skilled readers might pronounce, "barbet," for example, through analogy to other known words, such as *barber* or *sherbet*. They would not think that it is pronounced like "ba-rbet" because they know that *rbet* is not a legal syllable in English. Skilled readers usually can make appropriate generalizations to new words based on this sort of extensive knowledge of words and word patterns.

In summary, we can say that there are two systems for identifying words. One is a direct, lexical mechanism in which the pronunciation is "looked up" after the eye fixates on the word. The other is a slower, pattern-based mechanism whereby the pronunciation of a word is generated by a complex analysis of analogous words. This works in coordination with spelling or pronunciation rules. The direct route results in rapid recognition of very frequently occurring words, regardless of their letter-sound regularity. The analytic system results in recognition of most other words based on knowledge of similarly formed words and rules for analyzing words into letter-sounds, syllables, and roots and affixes.

This picture of skilled reading indicates that children need to be able to identify common words effortlessly and to figure out less-common words through knowledge of word structures. How do most children arrive at this point? The beginnings of word identification can be traced back to children's early experiences with literacy. If we follow the development from that period through the primary grades, we can see how word identification develops systematically and how it can be related to instruction.

Development of Word Identification Skills

Becoming literate builds upon the production and understanding of speech, but also goes far beyond. Literacy requires an awareness that the words in books, on signs, and in other places are intended to convey a message that may be interesting, amusing, or important (Mason & Au, 1990). Literacy also involves an ability to separate oneself from meaning, that is, to take a distant or analytic position, to judge as well as to understand text information and to think of language as a tool (Egan, 1987; Olson, 1984).

Children first become aware that language can be observed and analyzed into words and letters by seeing its written form in familiar contexts. For example, while looking at an alphabet book with a parent, the young child may see the word *apple* accompanied by the letter *A* and a picture of an apple. At breakfast there may be Special K cereal with an oversized *K* on the box. On outings, the child visits a McDonald's restaurant and sees the sign with the golden arches. These early experiences with environmental print may play a role in children's early understanding of words by helping children view printed words as meaningful representations of objects, unchanging in their context (Mason, 1980).

A further contribution of these experiences to later word identification, however, has not been clearly established. Ehri (1983), for example, found that children noticed nothing different about the *PEPSI* logo when the letters were changed to read *XEPSI*. Nonetheless, although children are not processing all letter information, their responses suggest that they are gaining an understanding of the function of familiar environmental print. Mason and Stewart (1989) found in testing preschool children's understanding of print that they were likely to give the response "stop sign" when asked to read *STOP* when it was printed on the familiar octagon-shaped sign. This erroneous response was only a temporary stage in their reading development.

It may be, then, that environmental print serves in a preliminary way to make children aware of some words and helps to illustrate some of the purposes served by print. Having a sense of these purposes would also make the print more meaningful, and thus more memorable (Doake, 1985), and it could help motivate children to begin attending more closely to print.

Another indication that word identification has its roots in children's general understandings of print is provided by the work of Peterman and Mason (1984). They showed kindergarten children labeled pictures. They found that some children could point to the print when asked where there is something to read, but then would ignore the print when asked to read what it says. That is, children knew that reading involved print, but had the idea that they could read without using the letter information. Children further along realized that they should attend both to pictures and print when trying to identify the labeled pictures or when trying to recall a page of text that had been read to them. Even then, however, where a word ends or where to begin and stop reading was still uncertain for some children. For example, when shown the phrase "wood blocks" and asked how many words there were, some children did not distinguish letters from words and counted the letters instead.

As children have more opportunities to watch others read and to try to read by themselves, they come to the realization that printed words can be differentiated on a page. They might try to remember words by the initial letter, especially if a word begins with the same letter as their name. They might overuse letter names when they write, spelling *are* as *R*, and *you* as *U*, indicating that they cannot yet break words into letter sounds.

As part of becoming literate in English, though, children must come to realize that words can be further analyzed and that there are predictable patterns of letters and sounds. That is, they must gain an understanding of the regularity of spelling-to-sound correspondence. As with learning about the visual properties of print, initial learning about the relationships between letters and sounds often begins

through home literacy activities. Various experiences appear to support the development of these concepts: hearing nursery rhymes, stories, and interesting words; discussing words with parents; using invented spelling and writing; and having words pointed out in context (Bissex, 1980; Taylor, 1983). Maclean, Bryant, and Bradley (1987) determined that knowledge of nursery rhymes at age 3 was strongly related to early reading performance.

Before making much use of spelling-to-sound regularities in English words, children tend to use other types of information. Context cues provided by pictures and sentences make it easier for beginning readers to identify words. When these cues are unavailable, beginners generally experience much more difficulty. Less advanced first graders, for example, find words easier to identify if they are presented in the sentences in which they were learned rather than in other sentences or lists (Francis, 1977). Beginning readers are likely to make oral reading errors that are consistent with sentence context but not with spelling-to-sound information (Stanovich, Cunningham, & Feeman, 1984; Underwood, 1985). According to a compensatory model of reading performance, beginners are compensating for their limitations in using spelling-to-sound correspondence by relying heavily on context cues.

Considerable research has verified that an ability to break the sounds of words into phonemes, which is referred to as *phonemic awareness*, is the initial step in lessening the importance of context. Phonemes are the sounds of letters and letter groups in words (e.g., *m-ea-t, g-r-i-pe, sh-e-ll-s*). Early on, children are not aware of phonemes. Rather, they seem first to recognize the syllable as a unit, and then notice that a syllable has two major subunits, called the onset and the rime (Treiman, 1986). The onset is the initial portion of the syllable (e.g., *m* in *meat*, *gr* in *gripe*, or *sh* in *shells*). The rime includes the vowel and ending consonants (e.g., *eat* in *meat*, *ipe* in *gripe*, *ells* in *shells*). Treiman found that young children could analyze spoken syllables into onsets and rimes before they could identify phonemes. This suggests that children can be helped to hear syllables in words, then onset/rimes, and then individual phonemes. Instructionally, it suggests that breaking spoken words into syllables by clapping could be a useful beginning step. Initial sounds of words could be introduced through ABC books, where the first letter in a word is highlighted, and ending sounds of words could be presented through rhymes.

After children can distinguish onset/rime units in words, they will be able to separate other phonemes in words and to manipulate phonemes. Bissex (1980), for example, reported her son's discovery that he could remove the *l* from *please* and have the word *peas*. With these and related discoveries, children begin to realize the regularities of spelling-to-sound patterns. They begin to figure out words they have never seen in print before based on their knowledge of letter patterns and knowing the words orally. This knowledge can be tested with various word and letter-sound analysis tasks, which Stanovich, Cunningham, and Cramer (1984), and Yopp (1988) showed are all highly intercorrelated.

More generally, word and letter-sound analysis ability is significantly correlated with later reading achievement (e.g., Calfee, Lindamood, & Lindamood, 1973; Lundberg, in press; Share, Jorm, Maclean, & Matthews, 1984). An ability to analyze words into letter sounds appears to allow children to discover and exploit the alphabetic principle of spelling-to-sound regularities. Understanding this aspect of written language structure provides "a basis for constructing a large and expandable set of words--all the words that ever were, are, and will be--out of two or three dozen signal elements [phonemes]" (Liberman & Shankweiler, 1985, p, 9).

Can children be taught an awareness of phonemes in words? Apparently, yes. Two studies have shown that phonemic awareness training in kindergarten benefits children's later reading. Bradley and Bryant (1983) worked with children who had obtained low scores on a test of phonemic awareness. One treatment group was given 40 individual tutoring sessions on letter naming; identifying the beginning, middle, and final sounds in words; and seeing the words in print. Children in the comparison and control groups did not fare as well as the treatment group in later school years in reading. Lundberg, Frost, and Petersen (1988) found that children's reading and spelling benefitted from metalinguistic

training given in daily, whole-class lessons during the kindergarten year. Teachers provided the following types of activities in approximately this sequence: listening to nonverbal and verbal sounds; nursery rhymes and stories and games for rhyming production; segmentation of sentences into words; segmentation of words into syllables (clapping, marching, dancing, walking followed by use of plastic markers and games using puppets); segmentation of initial letters of words from remainder; and segmentation of two-letter words into phonemes.

Word Reading and Spelling Development in the Primary Grades

Ehri (1986) and Ehri and Wilce (1987) proposed that knowledge of how to match letters to sounds progresses in a developmental fashion. At first children use knowledge of letter names to spell parts of words, usually the initial or initial and final parts. Thus, they might spell *cat* as *K* or *KT*. After this semiphonetic stage, children master vowel spellings and phonemic segmentation, enabling them to place all the letter sounds in the words, though not necessarily correctly. During this time *cat* might be spelled correctly or phonetically (*kat*). Finally, sometime during the first grade of reading instruction, children move into the morphemic stage, "when the principle of one-letter-for-every-sound loses its grip and spellers begin to utilize word-based spelling regularities to generate spellings" (Ehri & Wilce, 1987, p. 62). At this point children are learning about conventional spellings through the texts they are reading.

When children first turn to the use of spelling-to-sound information, the presence of the more consistent or regular spelling-to-sound patterns (as in words such as *pat, paid, pave*) becomes important. For a short time, children might even have more difficulty identifying words that form inconsistent patterns or are exceptions to regular patterns (e.g., *put, said, have*). Gradually though, they recognize exceptions as unique words. Most of these words would be recognized directly. Recognition of less common words builds on an understanding of regular word patterns and leads to recognition through the other word identification mechanism (Tunmer, Herriman, & Nesdale, 1988).

This means that knowledge of spelling-to-sound correspondence not only enables readers to recognize words they know, but also to identify words never encountered previously. Glushko (1981) showed that adults use their knowledge of common, regular words to identify unknown words by using familiar, analogous words. Goswami (in press) found that even beginning readers figure out new words by analogy, that is, by thinking of similar (rhyming or alliterative) words. For example, a child may recognize a new word, *peak*, by recalling the pronunciation of the analogous word, *beak*. Goswami found that children who had acquired letter-sound knowledge used decoding by analogy both when reading words in lists and when the new words were in connected texts. In a second study she found that children who were taught words with regular patterns (e.g., *beak*) made more analogies than children who were taught words inconsistent in pattern (e.g., *break*). Goswami pointed out that these results are congruent with Treiman's (1986) view that "phonemic awareness progresses from an analysis of syllable into onsets and rimes, and only subsequently to the ability to analyze onsets and rimes into phonemes" (p. 41). Similarly, in an unpublished study, Mason found that a number of second-grade children figured out how to pronounce pseudowords by analogy, for example, explaining that they could pronounce *moke* by taking the *s* off from *smoke*.

Knowledge that letters form predictable sequences is also important, beginning at about second grade (Adams, 1990). Children find it easier to identify words containing commonly occurring letter sequences. For example, words such as *ten* and *the* will be easier to identify than *tsar* or *two* because *t* as the first letter of a word is more likely to be followed by *e* or *h* than *s* or *w*. Children gradually become knowledgeable about the predictability of letter sequences and at about fourth grade, they can use this knowledge to recognize syllable patterns and boundaries in multisyllable words. They can determine where breaks between syllables are likely to occur and how the syllables might be pronounced (e.g., *mon-key* rather than *mo-nkey* because *nkey* is not a legitimate syllable; *fa-ther* rather than *fat-her* because *th* is a letter sequence that usually appears in the same syllable).

In brief, by the end of first grade, many children are reading easy texts fluently, and some have even gained the ability to identify common syllable patterns. At this point, most children are well on their way to becoming effective word readers, able to make good use of common and less common patterns in written English. By the end of third or fourth grade, only uncommon multisyllable words are difficult for most children to recognize.

Connecting Word Recognition Development to Other Aspects of Literacy

Recent developmental models of reading connect early with more skilled reading and introduce an interplay between word identification and text comprehension. Lundberg (in press), for example, proposes that reading emerges from two related but separate roots. One, word recognition, is related to phonology, and the other is related to comprehension. When learning to read, children use internal representations of words from their own language to begin the analysis of written words. Children begin reading using highly contextualized skills and then move on to relatively decontextualized skills. Book reading, listening to stories at an early age, and learning to read easy stories appear to contribute to effective reading development.

Brugelmann (1986) suggests that both writing and spelling are coordinated with reading because all three aspects of literacy require similar knowledge about the written language. Children's writing moves from aimless traces, beginning with toddlers who might experiment by touching pencil to paper, and then to directed scribbling, such as zig-zags across the page. Next, children imitate letter shapes, constructing letter-like scribbles, then single letters, and then multiple letters. Finally recognizing that the letters can form words and phrases, they construct letters that are connected. Just as writing develops from scribbles, so spelling develops from drawings that are intended to represent words, and then letters are added arbitrarily to the drawings. Next, letters that represent particular words are used, such as *R* for the word *are*. A sound-oriented shorthand, an invented spelling, is then developed to represent the sounds the child hears in words. A child might spell *kite* as *kt*. Children eventually replace these with specific learned spellings, filling in the vowels and applying learned orthographic patterns. Earliest aspects of reading are listening to stories and telling stories. Then, mock or pretend-reading, imitations of being read to, occur. Lartz and Mason (1988), for example, showed how a four-year-old child could say a substantial part of a story from remembering what was read to her and with the aid of the illustrations on successive pages. For all three aspects of literacy, context is utilized, and then gradually superseded by attention to letter-sound information and more complex patterns of English.

Brugelmann's proposal reminds us that word identification is only one part of literacy activity: knowledge about how to recognize words is initiated with rough attempts to carry out the whole act, whether reading, writing, or spelling, and continues to become more accurate and realistic.

Instructional Implications

Children face a major cognitive challenge to understand the regularity of written English for identifying, writing, and spelling words effortlessly. Word recognition research points to the complexity of the learning children must do to become proficient word identifiers. They must develop phonemic awareness, come to an understanding of spelling-to-sound correspondence, and then progress to applying knowledge of letter patterns and syllables.

It is not surprising, then, that research supports the importance of systematic instruction in spelling-to-sound correspondences, commonly called phonics instruction, during the early grades (Anderson, Hiebert, Scott, & Wilkinson, 1985). Early studies tended to pit approaches incorporating systematic phonics instruction against approaches that emphasized text reading and relied on children's learning of words as wholes. We believe this tendency had the inadvertent effect of creating a false dichotomy. It seemed to lead some educators to infer that reading programs including systematic instruction in

spelling-to-sound regularities should minimize comprehension, book reading, and writing. At times, this led to the implementation of beginning reading programs in which book reading played little or no role, and children received lesson after lesson on letter-sound relationships (Durkin, 1983; Mason, 1984). Other educators, in turn, rejected what they viewed as an overemphasis on phonics instruction and tried to promote programs that emphasized book reading, writing, and the development of positive attitudes toward literacy (Allen, 1989).

In our view, an integrated reading and writing program and systematic instruction in spelling-to-sound regularities need not be diametrically opposed because word recognition and comprehension have common roots in story book reading, vocabulary, and listening activities, (Mason, in press). Moreover, because reading and spelling can support the development of the other skills (Clarke, 1988; Dobson, 1989), they will foster word recognition if taught together. Let us be more specific about how systematic instruction in spelling-to-sound regularities and holistic approaches could work in concert.

Research on children's reading development suggests that essential concepts about word identification usually are acquired informally at home in the context of meaningful reading and writing activities. School programs for introducing written words would be more supportive if children could experience reading and writing informally. A number of new kindergarten programs are moving in this direction. There are successful ways to provide instruction as well as child-directed activity (Allen & Mason, 1989; Mason & Au, 1990). In these programs, literacy goals are accomplished through activities that are staged by teachers. Formal teacher-directed activities might include activities in which children talk about and learn to recite or read books that are read to them, hearing and playing letter- and word-sound games, writing and analyzing words in a message that the teacher has written, writing or drawing by children, and reading to children. Child-directed activities might include reading and writing, story listening centers that are changed weekly to include inviting new materials, and dramatic and block play centers in which reading and writing material are available and become part of the situations that children create.

If children can begin reading by using a variety of context-supported materials, they will be less likely to lose the sense of text meaning and will know to rely on pictures as well as letter and sentence information to begin reading (Clay, 1985). As letter and sound cues in words become more apparent, children will use their knowledge of context in conjunction with spelling patterns to become more proficient readers.

An integrated reading and writing instructional program should extend into the primary grades as well, and there still ought to be both systematic and informal opportunities for children to learn about word identification. Phonics instruction alone is not sufficient for building proficient word identification ability, a conclusion that is also supported by phonics advocates. Phonics instruction supports only one strategy for word identification, namely, analysis of words into their constituent phonemes. To avoid giving the impression that phonetic analysis is the only way to identify words, teachers should encourage children to decode words by analogy. Moreover, since early growth in word reading is linked with opportunities to read connected text (Anderson et al., 1985), teachers should provide opportunities for children to listen to stories and to read and write on their own.

Creative writing is an example of an informal activity that will support the development of other word identification strategies. In a study comparing first graders who used conventional spelling with those who invented their own spellings of words, Clarke (1988) found that allowing children to invent word spellings in their creative writing assignments led to longer pieces, knowledge of more written words, and superior spelling and phonetic analysis skills.

Lesgold, Resnick, and Hammond (1985) point to another advantage of context-supported instruction. Children's learning is supported when easy reading materials are presented in a meaningful context.

Drawing an analogy to skiing, the authors note that when skiing was taught using a skills approach, each aspect

> was separately learned and practiced. Learning was slow. Then, skis started to be made in a graded series of lengths. Short skis allowed novices to engage in the integrated activity of skiing from the start, without significant risk. Learning became much more rapid. (p. 110)

The idea is that reading development may proceed more rapidly if children have the opportunity to engage in all aspects of the process at once. This is in contrast to always having their attention narrowly focused on just one aspect of reading, without regard for the whole process.

It is hard to learn to identify words in our language. As a result, developmental change in word identification involves an understanding of many subtle concepts. What must be learned cannot be completely taught or satisfactorily supervised by teachers. Thus, we recommend that teachers keep children's meaningful text reading as the primary goal along with more inductive word identification approaches. If teachers coach children to use word identification strategies in meaningful contexts and encourage them to use more than one strategy, children will learn how to navigate independently and find their own way through the thicket of letters and sounds, word patterns and irregularities, phrases and text context. As Clay (1985) directs, children need to learn how to monitor their own reading; to use strategies involving letter information, word patterns, and text interpretation; and to cross-check for meaningful renditions of the text. Practicing with complete texts--stories, expository texts, and children's own writings--is probably the best approach.

These conclusions point to the need for significant changes in typical kindergarten and primary-grade reading lessons. Among the changes are the following:

- A shift from assuming that learning to read and write is initiated in first grade to the notion that literacy can and often does begin to develop earlier and can be fostered with context-supported reading and writing activities in kindergarten.

- A shift from teaching word recognition as isolated words and skills to teaching them in the context of a wide range of meaningful reading and writing activities.

- A realization that word identification skills are acquired over several years, and so new literacy concepts should be built upon those already learned and understood.

- An understanding that children need a range of word-reading experiences in order to acquire word identification processing mechanisms that lead to accurate, rapid access of common words and analyses of letters and word patterns in other words.

Word Identification Summary

The instructional changes we advocate are in keeping with the two major themes of this report, one being that children learn to identify words more effectively if they are presented within a larger, more meaningful context, whether it be a story, sentence, picture book, phrase, or advertisement. Extensive opportunity to read and listen to texts of all sorts is recommended. If words are learned in context, children will be able to keep the goal of understanding in mind as they see, learn about, and figure out

new words. Teachers will then find it easier to model the act of reading for children, which in turn will aid children to better understand both the processing steps of word identification and the purposes for reading and learning words.

The second theme in this report is that the very complexity of written English requires children to develop a number of different strategies for learning to identify words. Children need to supplement the instruction they receive in school with their own discoveries about language patterns. To that end, we recommend systematic instruction that encourages phonemic awareness and then leads children to knowledge of spelling-to-sound correspondences. We also recommend that the teacher establish opportunities in the classroom for children to read and write informally. Children can learn to read and write accurately and fluently if they are allowed opportunities for invented spelling, approximations to conventional text reading and story rereadings.

Vocabulary Knowledge

Word knowledge is, of course, not limited to word identification. As word forms are identified, they are immediately connected to their meanings, whether by direct, lexical access, or by the slower, word analysis mechanism. Thus, recognition and knowledge of word meanings leads to text comprehension. Moreover, skilled readers possess an extensive vocabulary. For example, an average high school senior understands an amazing number of words, about 27,000 (Nagy, Herman, & Anderson, 1985). Top students and many adults know literally thousands more.

How might extensive, well-developed vocabulary knowledge be characterized? What systems and processes might be involved? How might teachers best utilize what is currently known about vocabulary knowledge to expand and sharpen their students' developing vocabulary knowledge? The next section addresses these questions.

Extensive, Well-developed Vocabulary Knowledge

Adults and older students who have extensive vocabularies possess not only systematic knowledge of English pronunciations but also a vast array of concepts about meaning-related connections among words. They understand how the English language works, and they use vocabulary skills appropriately in any number of situations. They use these systems interactively as they construct and convey meaning while reading, speaking, writing, and listening.

Systems of words. Words are labels for concepts, and recognizing words in ordinary use brings to mind a contextually appropriate meaning rather than a well-articulated definition (Anderson & Freebody, 1981; Clark, 1983; Johnson-Laird, 1987; Miller, 1986). When words are well understood, in fact, the richness of understanding far exceeds any definition you might read or write down.

For example, the word *restaurant* immediately brings to mind "a place where you go to buy food and eat." A bit more thought brings to mind types of restaurants (e.g., elegant, fast food, the one your aunt took you to), available services (e.g., head waiters, busboys), kinds of furnishings (e.g., counters, chopsticks, the decor of your favorite one), ways of paying, appropriate manners for a given establishment, acceptable clothing to wear while there, actions likely to occur (e.g., ordering, spilling, sizzling), feelings (hunger, impatience, satisfaction), and so on.

Thus, a whole network of concepts is activated; in the above case, a network of knowledge about restaurants. Cognitive psychologists term such networks *schemata* (e.g., Anderson, 1984a); psycholinguists describe such organization as *semantic fields* (e.g., Kuczaj, 1982). People with comprehensive vocabulary knowledge know many of these topically related systems and draw upon their

understanding of them to construct meaning while reading or listening (Anderson & Pearson, 1984; Bransford & Nitsch, 1978).

In addition to understanding words as topical networks, people have extensive knowledge of how whole families of English words are related *morphologically* (that is, by their root meanings and affixes). For example, you understand the concept of the root word, *act*, and how its meaning is the basic ingredient woven through *react, activation, actor, inactivity*, and so on. You also understand that groups of words are related by function. For instance, you can grasp how the basic function of seeing is a bit different when one is *glancing, staring, looking, leering*, or *glimpsing*.

Although an exact understanding of what it means to know a word is currently being debated (cf. Carey, 1982), knowing a word clearly involves possessing a fleshed out understanding of the concept itself, and understanding how that concept fits in with related groups of words--words related by topic, by morphology, or by function. "A vocabulary is a coherent, integrated *system* of concepts" (Miller, 1986, p. 175).

Patterns of word meaning. In addition to and in conjunction with well-developed systems of words, people with good vocabulary knowledge have a rich understanding of how systematically the English language operates (Nagy & Gentner, 1987; Nagy, Scott, Schommer, & Anderson, 1987). Such knowledge encompasses what people know "about words as words, about how words and their meanings are put together, and how they are used in text" (Nagy et al., 1987, p. 3).

Much of what people know about words as words, or patterns of word meaning, is at the unconscious level. "For example, [people] know, at least implicitly, that English verbs of motion typically tell something about the *way* an object moves (e.g., *slide, wobble, plunge, spin*), but not, for example, what shape it is . . . people have to have rich word schemas--expectations about what words are like and constraints on what types of information can be encoded in words" (Nagy et al., 1987, pp. 2-3). Nonetheless, such tacit knowledge is an integral part of a person's vocabulary knowledge and plays an important role in constraining word meanings (Nagy et al., 1987).

The English language depends heavily upon word order to communicate meaning. Words are positioned as English grammar (syntax) dictates. Such syntactic structure enables people to know that the three missing words in the sentences below must be a noun, a verb, and an adjective (Johnson & Pearson, 1978, p. 116):

The _____ went to the game.

We tried to _____ the table.

She blew up the big _____ balloon.

Again, proficient word users apply their understanding of English grammar so automatically that they are little aware of its role in their construction of meaning (Nagy & Gentner, 1987).

An integral part of vocabulary knowledge is an extensive understanding of appropriate usage of words. A key expectation is that words appear in contexts that make sense. People with vast vocabulary knowledge are likely to have read many books (Anderson, Wilson, & Fielding, 1988) and, over the course of time, to have developed expectations about what kind of words authors are prone to use. So, one might expect to find *putative* in a scholarly article, but not in a romance novel or in most conversations. Much of this systematic knowledge apparently operates so automatically that people are not aware of its role in constructing meaning unless an anomaly arises (e.g., if we were to insert, "What's up Doc?" in this report).

In summary, people with well-developed vocabulary knowledge possess rich, interconnecting networks of concepts with words to label much of that knowledge, rather than long lists of dictionary-like definitions in their heads (Anderson & Nagy, in press; Miller, 1986). Woven into such understanding is a keen sense of how the English language operates and a set of expectations about appropriate uses. Much of this knowledge is processed so interactively and automatically that people are rarely, if ever, aware of the role of any one part in constructing meaning. Like word identification, then, application of vocabulary knowledge during reading involves sophisticated, instantaneous use of regular patterns and meaningful connections among words.

Understanding new words. Persons who have depth of vocabulary knowledge have efficient procedural knowledge for gaining an understanding of new words. Such people are competent comprehenders (e.g., Anderson & Freebody, 1981; Davis, 1944, 1968) and monitor information-bearing contexts for sense (Brown, 1985). When they detect an unfamiliar word that is important to their continued construction of meaning, they bring to bear their knowledge of integrated word-meaning systems, how words fit in text contexts, problem solving skills, and a compelling motivation to figure it out.

For example, while reading a text on the development of river systems, suppose a new term, *rills,* is encountered in the following text excerpt: "A river system has several parts. Small rills form first. They join to form creeks, which join to form streams."

Sensing its importance because it initiates a description of the topic, the reader draws upon the meaning envisioned from the text so far, automatically notices from context that rills is a plural noun with some tangible properties, and assumes that it is connected to river systems. After this fairly rapid initial mapping, the reader makes a hypothesis about the meaning of rills and forms a mental model of the word/concept (Elshout-Mohr & van Daalen-Kapteijns, 1987). The reader continues through the text, gains more information about the word, consciously adjusting the model within the framework of river systems concepts or schema and unconsciously within the constraints of the English language. The reader may end up with a fairly well fleshed out understanding of rills or, as is often the case, may end up with some level of partial knowledge, such as: Rills are small waterways. Fuller understanding, such as how rills fits into the entire river system schema, may be mapped out more slowly as further encounters with rills occur over time (cf. Nelson, in press).

Instructional Implications for Developing Vocabulary Knowledge

With the foregoing picture of extensive, well-developed vocabulary knowledge, what can be said about how children might acquire vocabulary knowledge? First, it is not possible to teach children as many words a year as they typically learn, that is, 3,000 words a year. However, because teachers usually introduce far fewer words a year, most words students learn over the course of a year cannot be acquired from direct instruction (Nagy & Herman, 1987). Instead, words must be acquired informally and outside of school, principally through voluntary reading. Incidental word learning is possible because we know that children are able to learn something about the meaning of a new word from a single exposure *if* the word is embedded in a context that is meaningful to students (Carey, 1982; Markman, 1984; Nagy, Herman, & Anderson, 1985). For example, some concepts about new words could be acquired through conversations about dinosaurs at an exhibit, from listening to a dramatic reading of *Julius Caesar*, or by reading an article about baseball. In fact, students who engage in a wide range of reading and other experiences encounter thousands of words in meaningful context and acquire partial knowledge for hundreds of them--one of the most profitable avenues for acquiring vocabulary knowledge (Nagy, Herman, & Anderson, 1985; Nagy, Anderson, & Herman, 1987). Therefore, it makes pedagogical sense to encourage voluntary reading and to provide instruction that enhances the likelihood that students will acquire more vocabulary knowledge on their own.

By contrast, consider the common types of school activities that are meant to teach vocabulary: words and meanings to match on workbook pages, packaged programs that drill on lists of unrelated words, guessing a word meaning by reading a sentence or two, looking up lists of words in the dictionary, and brief introductions of words before students read. If the words are already known, these activities are of no help; they are busywork. If the words are not known, much more support for learning is needed. None of the activities listed above produces the kind of vocabulary knowledge that affects overall comprehension (e.g., Ahlfors, 1979; Tuinman & Brady, 1974), although some level of partial knowledge may be gained when these activities are repeated with a small number of words (Beck & McKeown, 1985).

What does the research suggest as a starting point for vocabulary instruction? Because students' understanding of concepts, networks of concepts, and the words used to label them is critical to vocabulary learning and yet varies greatly, determining what partial knowledge or analogous knowledge students already have about the words they are to learn is recommended. This step will help anchor vocabulary instruction not only to the reading task before students, but also to their level of understanding.

One technique for assessing background knowledge is brainstorming and visually displaying what students know about key words/concepts (Carr, 1985; Heimlich & Pittelman, 1986). Often students know bits and pieces related to a schema (Anderson, 1984b) and have limited understanding of its scope (Bransford & Nitsch, 1978). Once students' background knowledge has been assessed, the teacher can initiate a discussion to show students how these pieces fit together and to broaden their understanding of how words/concepts belong to larger schemata (Stahl & Vancil, 1986; see Marzano & Marzano, 1988, for examples of word clusters). For example, students can be led to see how *frenzy* relates to *hysterical, excitement, calmness*, and to the more general concept of emotions in a novel; how *veins* not only relates to *arteries, carbon dioxide*, and so on, but also to the circulatory system schema in a science unit.

Quality instruction establishes ties between new words, background knowledge, larger schemata, and the naturally occurring contexts of instruction. Instruction in such depth takes time and, therefore, needs to be centered on words that are critical to maintaining comprehension and words that are encountered quite often. Thus, for a novel, words integral to the setting, main characters, developing plot, and resolution would be prime candidates. In an exposition or on a field trip, words related to the main network of concepts would also be central. Instruction must build on concepts and systems of concepts and not rely on giving students superficial contact with individual, seemingly unrelated words. Such knowledge-based development (Anderson & Freebody, 1981) enhances comprehension (Bos, Anders, Filip, & Jaffe, 1985; McKeown, Beck, Omanson, & Perfetti, 1983; Swaby, 1977) and provides students with a base for actively reasoning about the meaning of new words encountered in a variety of contexts.

In addition, students need to understand *how* their knowledge can be used to infer meanings of new words. This is not an easy task because of the complexity of using schemata, along with an understanding of the English language and expectations about appropriate usage. Research supports instruction that explicitly models such integrated thinking for students, then gradually releases responsibility to them (Pearson & Gallagher, 1983). Instruction that allows students gradually to take over the tasks of figuring out word meanings in context may provide students with strategies for acquiring word knowledge independently (Carr, 1985; Herman & Dole, 1988; Schwartz & Raphael, 1985).

An important component in such reasoning about word meanings is an understanding of English morphology. Instruction that reveals how affixes systematically change word meanings has the potential for unlocking understanding of large groups of words. For instance, "for each root word, children who employ this strategy can probably work out the meanings of seven new words. This includes about four words formed with regular or irregular inflections, and about three formed with affixes or as

compounds" (Mason & Au, 1986, p. 119). Given the number of words in printed school materials, around 88,000 (Nagy & Anderson, 1984), such generative power is extremely important for students to grasp.

English syntax (grammar) is another systematic aspect of the English language that students can use to constrain their reasoning about new words embedded in context. For instance, when young children were "shown a picture of a strange action on a strange container filled with strange stuff," they demonstrated an action when they were asked to show *sebbing*, they pointed to the container when asked to show a *seb*, and they indicated the "stuff" when asked to show *some seb* (Brown, 1957, cited in Carey, 1982, p. 375). Their responses indicated that new words can be easily connected to *common* syntactical patterns.

However, complicated or implicit, syntactical patterns especially in some forms of written English, may not be easily understood (e.g., Irwin, 1980). For example, children have more difficulty understanding (a) "The car wouldn't start. It was raining." than (b) "The car wouldn't start because it was raining." The reason is that explicit meaning ties are not given in the first sentence. Unfortunately, some school texts that children are asked to read and learn from often omit these ties. Thus, teachers need to be wary of expecting children to learn from short, choppy texts that lack meaning cues.

Another important instructional component is to bolster children's comprehension strategies for inferring word meanings, as well as to provide opportunities for them to become more familiar with patterns in written English. One way is to make many stories available for them to read at home, to read many stories to them, and to include opportunities for them to discuss words and meanings in context. These experiences, furthermore, promote an awareness of appropriate usage of words, such as expecting a fairy tale to contain a certain flavor and style of language. Such a language-rich environment may do a great deal to develop children's grasp of English language structures, especially when children come from language environments where they have had few opportunities to learn about the syntactic properties of written English (Heath, 1983).

The final instructional principle is that not all words in a text can or should be taught. Students must have the opportunity to apply what they understand about the topic at hand and aspects of the English language just outlined to figure out meanings of unfamiliar words in meaningful contexts. One such context is after reading a story. Students look back, identify a new word and, under the guidance of the teacher, reason about its meaning (for an example see Herman & Dole, 1988, or Duffy, Roehler, & Rackliffe, 1986).

Above all, students who have become infected with a love for and fascination with words possess a key ingredient in continuing to develop vocabulary knowledge (Deighton, 1960; McKeown et al., 1983). In fact, "establishing motivation and desire to acquire new vocabulary is at the very heart of vocabulary acquisition" (Ruddell, 1986, p. 587)--and within the inspirational power of teachers.

Conclusion

Implication of current research on the topics of word identification and vocabulary knowledge have two characteristics in common. The first is that children's learning should be viewed in the context of their overall development in literacy. Learning is cumulative, not disjointed. Young children's understanding affects later acquisition, and acquisition generally takes place in informal as well as formal instructional settings, proceeding best when reading and writing activities are meaningful. In our view, the research supports instructional activities with a broad, rather than a narrow focus, so that children can read or attempt to read and understand many words in a number of text contexts and learn to apply varying strategies for recognition and understanding.

The second characteristic is that word identification ability and vocabulary knowledge involve an appreciation of the regularity of the English language. We hope we have succeeded in communicating that understanding this systematicness is not a trivial task. Many strategies are needed for identifying words and for building vocabulary knowledge. Simple processes of memorization, letter-sound associations or word meaning associations, are not sufficient and cannot form the basis for skilled performance. It follows, then, as the research shows and as we have portrayed in this chapter, that instruction must also be better tuned to children's existing knowledge than was previously assumed. Quite varied formal as well as informal instruction is required so that children have opportunities to rely on lower and higher order thinking skills, including rapid recognition of printed words and inference of their meanings, analysis and synthesis of words into sounds and morphemes, rule-constructing and generalization of those rules to new and related words. Word identification and vocabulary knowledge may be "basic" skills, but they are far from being simple or simply taught.

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