Reading Comprehension Requires Knowledge—of Words and the World

Scientific Insights into the Fourth-Grade Slump and the Nation's Stagnant Comprehension Scores

By E. D. Hirsch, Jr.

While educators have made good progress in teaching children to decode (that is, turn print into speech sounds), it's disheartening that we still have not overcome the "fourth-grade slump" in reading comprehension. We're finding that even though the vast majority of our youngest readers can manage simple texts, many students—particularly those from low-income families—struggle when it comes time in grade four to tackle more advanced academic texts.

To help these students, we must fully understand just where this "fourth-grade slump" comes from. The "slump" was the name that the great reading researcher Jeanne Chall used to describe the *apparently* sudden drop-off between third and fourth grade in the reading scores of low-income students. In her research, Chall found that low-income students in the second and third grades tended to score at (and even above) national averages in reading tests and related measures such as spelling and word meaning. But at the fourth grade, low-income students' scores began a steady drop that grew steeper as the students moved into the higher grades.[1] (For a more detailed discussion of Chall's landmark study, see "The Fourth-Grade Slump" on page 14.) I describe this drop-off as *apparently* sudden because there is now good evidence that it is there, unmeasured, in earlier grades. A large language gap—not just a reading gap—between advantaged and disadvantaged students exists also in third-grade, not to mention second, first, and even earlier.

Researchers have known about the fourth-grade slump in poor children's reading comprehension for several decades, but it was only recently, especially in the work of Betty Hart and Todd Risley, that solid data on children's early language development have been available.[2] We now believe that reading tests make the comprehension gap *seem* much greater in fourth grade because the tests used in earlier grades are heavily focused on testing early reading skills (like decoding) and do not try to measure the full extent of the vocabulary differences between the groups.

Yet it would be a mistake to assume that problems with comprehension are limited to disadvantaged students. According to the most recent evidence from the National Assessment of Educational Progress, most students' reading comprehension scores remain low despite many years of concentrated efforts to improve reading instruction.[3] Effective teaching of reading comprehension to all children has turned out to be a recalcitrant problem. Now that we have good programs that teach children to decode text accurately and fluently, the task of creating programs and methods that teach students to *comprehend* text accurately and fluently is the new frontier in reading research.

It's a challenging problem. The U.S. Department of Education is currently soliciting research proposals to help solve it. That's a very good sign. With renewed scientific attention to this fundamental problem, we can expect real progress in equity and in student achievement—some day. Meanwhile, we already know things about reading comprehension that have immediate implications for teachers. I will try to sum-

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marize some of the most important findings and their implications for classroom practice.

I. A Growing Scientific Consensus

For most of my scholarly life (going back to my first technical publication on the subject in 1960) my research has been concerned with the nature of text comprehension: How do we know we have correctly understood a text? Is reading a displaced version of ordinary oral communication? My active interest in relating that subject to student achievement and educational equity dates to the '70s when I began to study some of the advances being made in cognitive science and psycholinguistics (the study of how our minds produce and comprehend language spoken and written). Now, after several decades of researching this difficult subject of reading comprehension from varied angles in the humanities and sciences, I can report that although what we don't know still far exceeds what we do, there is current scientific agreement on at least three principles that have useful implications for improving students' reading comprehension. The three principles (which subsume a number of others) are these:

1. Fluency allows the mind to concentrate on comprehension;
2. Breadth of vocabulary increases comprehension and facilitates further learning; and
3. Domain knowledge, the most recently understood principle, increases fluency, broadens vocabulary, and enables deeper comprehension.

Fluency Is Important

"Fluency" means "flowing," and in this context it also means "fast." There is a general, though not perfect, correlation between how fast you can comprehend a text and how well you can comprehend it. To most psychologists, including those who don't specialize in reading, it would be surprising if that weren't the case. A person who reads fast has "automated" many of the underlying processes involved in reading, and can, therefore, devote conscious attention to textual meaning rather than to the processes themselves. What's more, fluency is greatly enhanced by word and domain knowledge: While word knowledge speeds up word recognition and thus the process of reading, world knowledge speeds up comprehension of textual meaning by offering a foundation for making inferences.[4] A few of the principles underlying the relationship between fluency and comprehension are explained below.

If decoding does not happen quickly, the decoded material will be forgotten before it is understood. Have you ever tried to understand what is being said in a movie in a foreign language (say in French) that you have studied in school? Even if you know the words, isn't it frustrating that they speak so fast? While you are trying to work out what the actors just said, they are already saying something else, and your mind gets overloaded. The basic difficulty regarding speed and reading comprehension is even more serious than that. If you were able to slow down the movie so that you could concentrate on identifying the words and translating them, you would find in that situation, too, that your understanding would *still* be less than adequate. By having to focus on the sounds, turn them into French words and subsequently into English ones, you tend to lose track of the connections between one sentence and another, and between groups of sentences. You are in the same position as a child who has to translate consciously and slowly from print to sound. Things disappear from your mind before you have a chance to ponder the significance of what is being said. In slowly translating from French to English, you have been handicapped by the severe limits of what cognitive scientists call your "short-term memory" or "working memory."

I vividly remember when I first learned about the severe limits of human working memory and their importance in communication. It was in a wonderful book called *The Psychology of Communication* by the distinguished cognitive scientist George A. Miller.[5] The second chapter was one of the most famous articles ever written in the field of psychology, "The Magical Number Seven, Plus or Minus Two: Some Limits on Our Capacity for Processing Information." The "magical number seven" turned out to be the approximate number of items (whether simple facts, or numbers, or words representing complex concepts) that you can hold in your conscious mind at one time before they start evaporating into oblivion. This "magical number seven" is a limitation that (with some variation) afflicts everyone—including geniuses. One way we overcome this limitation of working memory while reading is by learning how to make a rapid, automatic deployment of underlying reading processes so that they become fast and unconscious, leaving the conscious mind (i.e., the working memory) free to think about what a text means.

This is why fast and accurate decoding is important. Experiments show that a child who can sound out nonsense words quickly and accurately has mastered the decoding process and is on the road to freeing up her working memory to concentrate on comprehension of meaning. Decoding fluency is achieved through accurate initial instruction followed by lots of practice. Typically, it takes several years of decoding practice before children can process a printed text as rapidly as they can process that same text when listening to it.

Students also overcome the limitations of working memory by rapidly grasping what kind of text this is, rapidly identifying words, and by understanding the grammatical connections between them at the basic level of the sentence.[6] This kind of fluency at the sentence level increases with practice and with knowledge of different kinds of writing. Such general language fluency is also intimately connected with well-practiced vocabulary knowledge, meaning how familiar the words and their various connotations are to the student. Take, for example, the following sentence: "Besides having had a lot of useful time in the trenches, Claire will also make a good assistant principal because she is able to keep her eyes on the ball." Educators, with their knowledge of the conventions of language and vocabulary use, will have no problem surmising that Claire has worked with students (probably as a classroom teacher) and is good at staying focused. But notice that to process this simple sentence, you had to interpret two metaphors

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(trenches and ball); and if you were to make a judgment regarding Claire's qualifications to be an assistant principal, you would draw on your domain knowledge as to the demands of that particular job.

Finally, fluency is also increased by domain knowledge, which allows the reader to make rapid connections between new and previously learned content; this both eases and deepens comprehension. An expert in a subject can read a text about that subject much more fluently than she can read a text on an unfamiliar topic.[7] Prior knowledge about the topic speeds up basic comprehension and leaves working memory free to make connections between the new material and previously learned information, to draw inferences, and to ponder implications. A big difference between an expert and a novice reader—indeed between an expert and a novice in any field—is the ability to take in basic features very fast, thereby leaving the mind free to concentrate on important features.

This insight was dramatized in a famous experiment. A Dutch psychologist Adrian de Groot[8] noticed that chess grand masters have a remarkable skill that we amateurs cannot emulate. They can glance for five seconds at a complex mid-game chess position of 25 pieces, perform an intervening task of some sort, and then reconstruct on a blank chess board the entire chess position without making any mistakes. Performance on this task correlates almost perfectly with one's chess ranking. Grand masters make no mistakes, masters very few, and amateurs can get just five or six pieces right. (Remember the magical number seven, plus or minus two!) On a brilliant hunch, de Groot then performed the same experiment with 25 chess pieces in positions that, instead of being taken from an actual chess game, were just placed at random on the board. Under these new conditions, the performances of the three different groups—grand masters, masters, and novices—were all exactly the same, each group remembering just five or six pieces correctly.

The experiment suggests the skill difference between a master reader who can easily reproduce the 16 letters of "the cat is on the mat" and a beginning reader who has trouble reproducing the same letters: t-h-e-c-a-t-i-s-o-n-t-h-e-m-a-t. If, instead of providing expert and child with that written sentence, we change the task and ask them to reproduce a sequence of 16 random letters, the performance of the first-grader and master reader would be much closer. On average, neither would get more than a short sequence of the random letters right. Practiced readers, chess grand masters, and other experts do not possess any special brain centers that novices lack, and they do not perform any better than novices on structurally similar yet unfamiliar tasks. Nonetheless, experts are able to perform remarkable feats of comprehension and memory with real-world situations such as remembering mid-game chess positions or the meanings and even spellings of actual sentences and paragraphs. How do they manage?

They do so partly by chunking—a word used by George A. Miller to denote the way knowledgeable people concentrate multiple components into a single item that takes up just one slot in working memory. "The cat is on the mat" is an easily remembered sentence, and expert readers can easily reproduce the 16 letters not because the letters are individually remembered, but because the sentence is remembered as a chunk out of which the sub-elements can be reconstructed from prior knowledge of written English. Remember, working memory can hold roughly seven items—but those items can be anything from simple numbers to complex previously-learned concepts that can be concentrated in a single word or image. What de Groot found, and what subsequent research has continually confirmed, is that the difference in fluency and higher-order skill between a novice and an expert does not lie in mental muscles, but in what de Groot called "erudition," a vast store of quickly available, previously acquired, knowledge that enables the mind to take in a great deal in a brief time. So, when shown a mid-game board, the chess grand masters were not *separately* remembering the placement of 25 pieces—they were able to draw quickly on previous knowledge of similar past games and the one or two ways in which the pieces were aligned differently from those games.

Experiments have shown that when someone comprehends a text, background knowledge is typically integrated with the literal word meanings of the text to construct a co-

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herent model of the whole situation implied by the text. An expert can quickly make multiple connections from the words to construct a situation model. But a novice will have less relevant knowledge and less well-structured knowledge, and will therefore take more time to construct a situation model. Suppose the text contained the term "World War II." Someone who has the requisite knowledge of that war will be able to take in the term very fast, and, like the chess grand masters, be able to unpack its many layers of meaning when needed. The novice's limited background knowledge will not be as readily accessible as the expert's, and so the novice will only slowly make the few connections that his limited knowledge enables. Inevitably, he will comprehend the text poorly.

Breadth of Vocabulary Is Important

Vocabulary knowledge correlates strongly with reading (and oral) comprehension. This seems so obvious that it might seem pointless to discuss vocabulary in a brief review of research on reading comprehension. True enough. But we know a few significant things about vocabulary acquisition that might be useful in enhancing students' ability to comprehend texts. These are not obvious things, and some aspects of vocabulary acquisition are deeply surprising. A few important insights are discussed next.

In vocabulary acquisition, a small early advantage grows into a much bigger one unless we intervene very intelligently to help the disadvantaged student learn words at an accelerated rate. Hart and Risley[9] have shown that low-income homes on average expose young children to far fewer words and far simpler sentence structures than middle-class homes. (To read more about Hart and Risley's work, see "The Early Catastrophe" on page 4.) A high-performing first-grader knows about twice as many words as a low-performing one and, as these students go through the grades, the differential gets magnified.[10] By 12th grade, the high performer knows about four times as many words as the low performer.[11]

The reason for this growing gap is clear: Vocabulary experts agree that adequate reading comprehension depends on a person already knowing between 90 and 95 percent of the words in a text.[12] Knowing that percentage of words allows the reader to get the main thrust of what is being said and therefore to guess correctly what the unfamiliar words probably mean. (This inferential process is of course how we pick up oral language in early childhood and it sustains our vocabulary growth throughout our lives.)

This means that the communications students read or hear hold very different knowledge and word-acquisition possibilities for advantaged and disadvantaged students. Those who know 90 percent of the words in a text will understand its meaning and, because they understand, they will also begin to learn the other 10 percent of the words. Those who do not know 90 percent of the words, and therefore do not comprehend the passage, will now be even further behind on both fronts: They missed the opportunity to learn the content of the text and to learn more words. The prominent reading researcher Keith Stanovich termed this growing gap the "Matthew Effect" from the passage in the Gospel of Matthew: "Unto every one that hath shall be given, and he shall have abundance: but from him that hath not shall be taken away even that which he hath."

Overcoming this initial disadvantage is a huge challenge. To do so, we need to engage in the best, most enabling kinds of vocabulary building. As we will see, that means explicit vocabulary instruction done in the best possible way and providing an environment that accelerates the incidental acquisition of vocabulary, which is how most vocabulary growth takes place.

A well educated 12th-grader knows an enormous number of words, mostly learned incidentally. But, there is also an important place for explicit vocabulary development, especially in the early years, and especially for children who are behind. Isabel Beck and her colleagues[13] in their excellent guide to explicit vocabulary instruction estimate that students can be taught explicitly some 400 words per year in school. (See "Taking Delight in Words" on page 36 for an example of such instruction.) These 400 words can be of immense importance to those children who are behind and need to be brought to the point of understanding key words as fast as possible. But that is just the beginning. If we want all of our children to comprehend well, they must learn many, many more words each year through incidental means. A 12th-grade student who scores well enough on the verbal portion of the SAT to get into a selective college knows between 60,000 and 100,000 words. There is some dispute among experts regarding the actual number so we might split the difference and assume that the number is about 80,000 words. If we assume that a child starts acquiring vocabulary at age two, and that the 12th-grader is 17 years old, he has acquired 80,000 words in 15 years. Multiplying 365 days times 15 we get 5,475 days. We divide that number into 80,000, and we find that the high-achieving 12th-grader has learned some 15 words a day—over 5,000 words a year. But of course, the 15-words-a-day estimate is just a mathematical average that describes a haphazard and complex process occurring along a very broad front. (For a brief account of this process, see "Words Are Learned Incrementally" on page 18.)

Most vocabulary growth results incidentally, from massive immersion in the world of language and knowledge. Recent work in cognitive science holds promise for making progress on this incidental learning front. It has long been known that the growth of word knowledge is slow and incremental, requiring multiple exposures to words. One doesn't just learn a word's meaning and then have the word. One gradually learns the word's denotations and connotations and its modes of use little by little over many, many language experiences.[14] The high-performing 12th-grader who knows 80,000 words knows them with very different degrees of complexity and precision, and has learned them not by learning 15 words a day, but by accruing tiny bits of word knowledge for each of the thousands of words that he encounters every day. As I shall discuss below, this and other considerations mean that we should immerse students for extended periods in the sorts of coherent language experiences that are most conducive to efficient vocabulary learning.

If we don't know the domain, we can't construct a meaningful mental model of what's being said.

Domain Knowledge Is Important

More than vocabulary knowledge is needed to understand most texts. To make constructive use of vocabulary, the reader also needs a threshold level of knowledge about the topic being discussed—what we call "domain knowledge." Consider the following examples.

Domain knowledge enables readers to make sense of word combinations and choose among multiple possible word meanings. A typical newspaper article shows why it's important to know in advance something about the subject matter of a text in order to understand it. If we are reading a story about a baseball game in the newspaper sports section, we must typically know quite a lot about baseball in order to comprehend what is being said. Think of the quantity of baseball knowledge that has to be already in mind to understand the simple sentence "Jones sacrificed and knocked in a run." Strung together in this fashion, the literal words are almost meaningless. A baseball-ignorant Englishman reading that sentence would be puzzled even if there were nothing amiss with his fluency or general knowledge of words like "sacrificed." Words have multiple purposes and meanings, and their meaning in a particular instance is cued by the reader's domain knowledge. The word "sacrifice" has different connotations in a baseball story and in the Bible.

Domain knowledge is necessary to give meaning to otherwise confusing sentences. I once read an anecdote about an elderly person who went to hear the great Albert Einstein lecture on relativity at Princeton University. She is reported to have said after the lecture: "I understood all the words. It was just how they were put together that baffled me." What she meant was that the everyday words that Einstein used in his lecture referred to a particular knowledge domain. If we don't know that domain, we can't construct a meaningful mental model of what's being said. Here's a sentence by Einstein such as might have been heard in his Princeton lecture: "It will be seen from these reflections that in pursuing the general theory of relativity we shall be led to a theory of gravitation, since we are able to produce a gravitational field merely by changing the system of coordinates." I know all those words, but since I can't imagine how changing coordinates will "produce" gravity, I can't comprehend what that sentence means.

For a more everyday example, take this sentence from the February 2003 issue of *National Geographic*: "Gigantic and luminous, the earliest star formed like a pearl inside shells of swirling gas." Most adults, drawing on their knowledge of the Big Bang theory, pearl formation (and the use of metaphor, which I return to below), and gasses, can comprehend this sentence. But we would expect different degrees of comprehension among, say, physicists, amateur astronomers, and you and me. Likewise, we should expect little comprehension among average sixth-graders—not just because of the words used, but because of the extensive domain knowledge those words represent in this context.

Reading (and listening) require the reader to make inferences that depend on prior knowledge—not on decontextualized "inferencing" skills. Many basal reading series direct teachers to use valuable teaching time to instruct students in "inferencing skills." But a simple example illustrates that inferencing itself is a fairly basic skill that most children already have: If somebody says to a child, "Hey, shut up. I'm trying to read," most children, advantaged or disadvantaged, can infer the connection between the first statement and the second. They have prior knowledge of the fact that hearing somebody talk can be distracting and make reading difficult. So they are able to construct a mental model that meaningfully connects the sentence "Hey shut up" with the sentence "I'm trying to read." In contrast, many children may not understand the simple sentence, "I wanted to take a vacation in Mexico this year, but my wife can only be away from her job in July." The children who don't understand the connection between the clauses don't lack an inferencing skill; they lack the geographical knowledge that Mexico is extremely hot in July—and not most people's idea of a pleasant vacation spot.

Speaking and writing always convey meanings that are not explicitly given by the words themselves. If speakers or writers tried to make everything explicit, they would take far too much time to say anything, and the message would become impossibly long and digressive. We learn from infancy that oral language comprehension requires readers to actively construct meaning by supplying missing knowledge and making inferences. Of course, the need for prior knowledge

is not unique to oral communication but is also necessary to comprehend written texts.

In comprehension, the need for making inferences by activating already existing domain knowledge has been shown by a number of researchers since the 1960s. But the basic insight goes back further than that. In Greek antiquity it was understood that communication involves the drawing of inferences based on knowledge that is taken for granted. The Greek term for such an implicit argument was "enthymeme," from *en* (in) and *thumos* (mind)—that is, some-

How Words Are Learned Incrementally Over

By Steven A. Stahl

We live in a sea of words. Most of these words are known to us, either as very familiar or at least as somewhat familiar. Ordinarily, when we encounter a word we don't know, we skip it, especially if the word is not needed to make sense of what we are reading (Stahl, 1991). But we remember something about the words that we skip. This something could be where we saw it, something about the context where it appeared, or some other aspect. This information is in memory, but the memory is not strong enough to be accessible to our conscious mind. As we encounter a word repeatedly, more and more information accumulates about that word until we have a vague notion of what it "means." As we get more information, we are able to define that word. In fact, McKeown, Beck, Omanson, and Pople (1985) found that while four encounters with a word did not reliably improve reading comprehension, 12 encounters did.

What happens when someone sees a word for the first time in a book? Consider the following paragraph from the *Atlantic Monthly:*

> America's permanent election campaign, together with other aspects of American electoral politics, has one crucial consequence, little noticed but vitally important for the functioning of American democracy. Quite simply, the American electoral system places politicians in a highly vulnerable position. Individually and collectively they are more vulnerable, more of the time, to the *vicissitudes* of electoral politics than are the politicians of any other democratic country. Because they are more vulnerable, they devote more of their time to electioneering, and their conduct in office is more continuously governed by electoral considerations. (King, 1997)

Although I had seen the word *vicissitudes* before, I did not know its meaning. From the context, one can get a general picture of what it means, something like "serendipitous happenings." My *Random House Dictionary* (1978) says "unexpected changing circumstances, as of fortune," so I was fairly accurate in my guess.

When a word is encountered for the first time, information about its orthography (or spelling) is connected to information from the context, so that after one exposure a person may have a general sense of the context in which it appeared ("It has something to do with..."), or a memory of the specific context ("I remember seeing it in an automobile manual"), but not a generalizable sense of the meaning of the word. Dale and O'Rourke (1986) talk about four "levels" of word knowledge:

1. I never saw it before.
2. I've heard of it, but I don't know what it means.
3. I recognize it in context—it has something to do with...
4. I know it.

In ordinary encounters with a word in context, some of the information that is remembered will be reinforced. The information that overlaps between encounters is what is important about the word. Other information will be forgotten. The forgotten information is more incidental. With repeated exposures, some connections become strengthened as that information is found in repeated contexts and become the way the word is "defined."

Consider the word *vicissitudes* in the above context. The concept of *vicissitudes* will likely be linked to other concepts in the context, such as "politicians," "electoral politics," or possibly to the whole scenario presented. Because of the syntax, we know that *vicissitudes* does not directly mean "politics," but is a characteristic of politics. As the word is encountered repeatedly, it will be associated with other concepts, possibly "romance" or "getting a job." (Or as the mother of one of my students told her repeatedly while growing up, "Beware of the vicissitudes of life.") These become the strong components of the concept, such as might be represented in a dictionary definition (McKeown, 1991). If the links to other concepts are not repeated, they may recede in importance. Given the core meaning of the word *vicissitudes,* the fact that the subject of the essay is politics is incidental and likely would be forgotten with repeated exposures.

As a person encounters the word again and again, word meaning grows at a relatively constant rate, dependent on the features of the context. That is, people show as much absolute gain in word knowledge from an unknown word as they show from a word of

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thing kept in mind and taken for granted but not expressed.[15] One example of this characteristic of speech is a truncated syllogism: "All men are mortal, so Socrates is mortal." To make strict logical sense of this statement, we have to infer the missing premise that Socrates is a man.

Likewise, reading comprehension depends on the reader filling in blanks and silently supplying enough of the unstated premises to make coherent sense of what is being read. Once print has been decoded into words, reading comprehension, like listening comprehension, requires the active

Multiple Exposures

RESEARCH ROUND-UP

which they have some partial knowledge, all other things being equal (Schwanenflugel, Stahl, & McFalls, 1997). We found that students made the same amount of growth in word knowledge from a single reading, whether they began by knowing something about a word or not. Thus, vocabulary knowledge seems to grow gradually, moving from the first meaningful exposure to a word to a full and flexible knowledge.

One does not always need to know a word fully in order to understand it in context or even to answer a test item correctly. Adults possess a surprising amount of information about both partially known and reportedly unknown words. Even when people would report never having seen a word, they could choose a sentence in which the word was used correctly at a level above chance or discriminate between a correct synonym and an incorrect one (Durso & Shore, 1991). This suggests that people have some knowledge even of words that they reported as unknown, and that this knowledge could be used to make gross discriminations involving a word's meaning. Curtis (1987) found that people who reported only a partial knowledge of a word's meaning ("I've seen it before") could make a correct response to multiple-choice questions.

When a person "knows" a word, he knows more than the word's definition—he also knows how that word functions in different contexts. For example, the definition of the verb *smoke* might be something like "to inhale and puff the smoke of (a cigarette, etc.)" (Random House, 1978). However, the verb *smoke* describes distinctly different actions in the following sentences:

(a) He smoked a cigarette.
(b) The psychologist smoked his pipe.
(c) The hippie smoked a marijuana cigarette.
(d) The 13-year-old smoked his first cigarette.

These all fit under the general definition, but the actions vary from a typical smoking action in (a), to a puffing in (b), to a deeper and longer inhaling in (c), to an inhaling followed by coughing and choking in (d). Children cannot learn this information from a dictionary definition. Instead, they need to see the word in many different contexts, to see how the word meaning changes and shifts.

Thus, to understand the word in (d) we need to know that 13-year-olds are generally novices at smoking and that smoking can make one cough, if one is not used to it. Some words are embedded in a single knowledge domain, such as *dharma* or *jib.* To understand *dharma,* one must understand at least some basic concepts associated with Hinduism or Buddhism. To understand *jib,* one must know something about sailing. These words are so tied to their knowledge domains that they cannot be defined outside of them. (Some people, e.g., Johnston, 1984, have used vocabulary tests to measure domain knowledge.) Most words can be used in multiple domains but have distinct meanings within those domains. The word *obligation,* for example, has a series of related meanings, depending on whether the obligation is a moral one, or a payment due on a loan, and so on. Anderson and Nagy (1991) argue that words are polysemous, containing groups of related meanings, rather than a single fixed meaning. These meanings have a family resemblance to each other. Consider the word *give* in these different contexts (Anderson & Nagy, 1991):

> John gave Frank five dollars.
> John gave Mary a kiss.
> The doctor gave the child an injection.
> The orchestra gave a stunning performance.

All of these involve some sort of transmitting, with a giver, a recipient, and something, tangible or intangible, that is given. But the act of giving is radically different in each case.

A full and flexible knowledge of a word involves an understanding of the core meaning of a word and how it changes in different contexts. To know a word, we not only need to have *definitional knowledge,* or knowledge of the logical relationship into which a word enters, such as the category or class to which the word belongs (e.g., synonyms, antonyms, etc.). This is information similar to that included in a dictionary definition. In addition, we also need to understand how the word's meaning adapts to different contexts. I have called this *contextual knowledge,* since it comes from exposure to a word in context. This involves exposure to the word in multiple contexts from different perspectives. Children exposed to words in multiple contexts, even without instruction, can be presumed to learn more about those words than students who see a word in a single context (Nitsch, 1978; Stahl, 1991). □

(Sidebar references begin on page 44)

construction of inferences from utterances that are chock full of unstated premises and unexplained allusions.

Irony, metaphor, and other literary devices require background knowledge for their comprehension. Besides filling out logical connections, there are other ways in which relevant background knowledge is activated in reconstructing meaning from a text. One of the most immediately obvious examples is irony, which, by definition, refrains from explicitly stating its meaning. If it did so, it would cease to be irony and become explicit statement. "He's a bright boy." Is the statement straight, in which case he is thought to be intelligent, or is it ironical, in which case he is thought to be stupid? Irony is subject to two contrary interpretations, the straight and the ironical. To decide between these two possibilities the reader has to activate relevant world knowledge not stated in the sentence.

Another important illustration of the way in which background knowledge is activated in the process of comprehending language is metaphor—an almost omnipresent element of speech. "Victory is sweet" is easily and quickly understood by students. So is "War is hell" or "Don't be a wet blanket." We know these can't be meant literally because we know what is being referred to. Researchers have shown that metaphors are often processed just as rapidly as literal meaning—indicating that we are constantly activating background knowledge in comprehension. In part two of this article, I'll show that this idea of taken-for-granted knowledge is an important clue to the sort of instruction that can help students improve their ability to comprehend written texts.

In recent years, efforts to improve reading have focused on how best to teach decoding. And, of course, fluent decoding is an absolute prerequisite to comprehension. But we can easily see from this quick summary of research that comprehension—the goal of decoding—won't improve unless we also pay serious attention to building our students' word and world knowledge.

II. Rethinking the Language Arts Curriculum

To improve reading, schools across the country have been steadily increasing the amount of time allocated to language arts. For example, in Baltimore, Chicago, and the entire state of California, early-grade teachers are already expected to devote 2 ½ hours a day to language arts. In an AFT poll, 80 percent of elementary teachers said their schools recommended a language arts block of two hours or more each day. (If the poll were limited to teachers in the lower elementary grades, the percentage might have been even higher.) Even given the large challenge we face, this is a lot of time—especially since it's usually during the precious morning hours. We need to use the time optimally. As we shall see, we're not. What's happening in that time? Given

What domain knowledge is optimal?

If comprehension of a text depends on vocabulary and domain knowledge, teachers and program designers still need to ask: What kinds of vocabulary and domain knowledge will most effectively advance the comprehension abilities of our students? What content is optimal?

The most notable early attempt to define this body of knowledge was undertaken by Carleton Washburne in the 1920s when he was superintendent of schools in Winnetka, Ill. According to E.D. Hirsch, Washburne carried out "an exhaustive study of the common allusions to persons and places in periodical literature, recognizing that in order to read intelligently, a person must have familiarity with these persons and places." Once Washburne learned what knowledge was taken for granted in writing addressed to the literate general public, he believed he had a practical basis for determining some of the domains that need to be taught in school.

Sixty years later, not knowing of Washburne's work, Hirsch and his colleagues conducted a similar review in the 1980s. They conducted various surveys—of written materials (newspapers, novels, magazines, etc.) and of scholars and educators, to determine what students should know by the end of eighth grade to have a strong foundation for understanding high school material—and ultimately for participating in literate adult society. The result is a fascinating, systematic K-8 trip through the most critical domain knowledge in the arts, history, science, geography, math, and literature. By the end, children have learned about the pharaohs of ancient Egypt, the culture and castes of India, the world's geography, the greatest of its art, and the fundamentals of modern science.

In science, for example, the first-grade sequence has children learning about the human body's skeletal, muscular, and digestive systems; the solar system and the rocks that make up the earth; and an introduction to "the shocking facts" of electricity. The second-grade sequence builds on knowledge of the body to introduce children to cells, tissues, and organs—and to learn more about the digestive system (a topic of great fascination to second-graders); builds on a basic understanding of electricity to introduce the physical sciences; and uses students' acquaintance with the solar system to introduce them to the remarkable world of astronomy, including a first look at the constellations and Galileo's revolutionary claim that the sun and planets did not revolve around the earth.

The Core Knowledge K-8 sequence is available from the Core Knowledge Foundation. To order or read more about the sequence, visit **www.coreknowledge.org/CKproto2/bkstr/seqnc.htm**. A set of seven books offering an elaboration of the sequence for each grade K-6, aimed at parents and teachers, is available at bookstores. —*EDITOR*

Such knowledge could be conveyed through read-alouds, well-conceived vocabulary instruction, and a variety of cumulative activities that immerse children in word and world knowledge.

what we've just reviewed about reading comprehension, how should it be used?

Start Early To Build Word and World Knowledge

As I mentioned above, the typical disadvantaged child enters kindergarten knowing only half as many words as the typical advantaged child. Because of the Matthew Effect, it may never be possible *entirely* to overcome this initial disadvantage on a large scale: As we have seen, word-rich children learn more vocabulary and content than word-poor children from the very same language experiences. On the other hand, intelligent remediation is possible, especially if we start early by encouraging optimal vocabulary growth in preschool and kindergarten. Acquiring word knowledge and domain knowledge is a gradual and cumulative process. Since early learning of words and things is the only way to overcome early disadvantage, the argument for including optimal content in language arts as early as possible seems compelling.

There are strong theoretical and practical advantages to teaching early decoding through simple "decodable texts" that enable the child to progress rapidly in decoding skill. But the top research in this area suggests that 40 minutes of daily decoding instruction is plenty in first grade; and for most second-graders, 20 minutes is ample.[16] That leaves between one and two hours daily (depending on the time allocated to language arts) for activities that foster vocabulary, domain knowledge, and fluency. Such knowledge could be conveyed through read-alouds, well-conceived vocabulary instruction, and a variety of cumulative activities that immerse children in word and world knowledge. But no published basal program I have seen systematically pursues this goal. Wasted opportunity abounds.

Build Oral Comprehension and Background Knowledge

Thomas Sticht has shown that oral comprehension typically places an upper limit on reading comprehension; if you don't recognize and understand the word when you hear it, you also won't be able to comprehend it when reading.[17] This tells us something very important: Oral comprehension generally needs to be developed in our youngest students if we want them to be good readers.

From the earliest ages, reading is much more than decoding. From the start, reading is also accessing and further acquiring language knowledge and domain knowledge. This means that instruction and practice in fluency of decoding need to be accompanied by instruction and practice in vocabulary and domain knowledge. If we want to raise later achievement and avoid the fourth-grade slump, we need to combine early instruction in the procedures of literacy with early instruction in the content of literacy, specifically: vocabulary, conventions of language, and knowledge of the world.

In the earliest grades, before students can read substantive texts on their own, this content will be best conveyed orally. An important vehicle is teacher read-alouds, in which texts selected for their interest, substance, and vocabulary are read aloud to children and followed by discussion and lessons that build children's understanding of the ideas, topics, and words in the story. As illustrated in "Lost Opportunity" on page 24, most of the popular basal reading series include read-alouds in their curriculum, but the content is almost always banal, and read-alouds are generally phased out in second grade despite the fact that research has found that students benefit from read-alouds until eighth grade.[18] Further, the basal series' teacher guides instruct teachers to build background knowledge, but usually on topics that are thoroughly ordinary, like pets, sharing, and even what spreads taste best on toast!

Another problem is that the early grades language-arts curriculum, both in terms of read-alouds and decoding texts, is overwhelmingly devoted to fiction. Literature is a very important domain of knowledge in its own right, but I have seen no convincing challenge to the argument made by Jeanne Chall, who wrote that we need to place a far greater emphasis on nonfiction in early language-arts classes. This emphasis is essential for children to learn the words and concepts they need to understand newspapers, magazines, and books addressed to the general public.[19] But the problem is not just the disproportionate attention to fiction; in addition, the fiction that is offered is typically trivial in content and simple in its language conventions. Fiction can build knowledge and understanding of peoples, lands, times, and ideas that are very important but totally unknown to children. A fine example of such fiction is *The Hole in the Dike,* included in one basal series. The famous legend acquaints students with Holland, its geography, and the power of water and the ingenious dike system that restrains it. But

such fiction is the exception. Far more typical, especially before grades three and four, are stories based in the here and now that address in pedestrian ways the "ideas" children already know about: school, friendship, families, and the like.

Don't Spend Excessive Time Teaching Formal Comprehension Skills

A great deal of time in language arts is currently being spent on teaching children formal comprehension strategies like predicting, classifying, and looking for the main idea. (See "Lost Opportunity" on page 24.) In most language-arts textbooks, these exercises persist throughout the year and over many years. Every researcher believes that there is *initial* value in practicing these comprehension strategies. They teach children to construe a text in the same meaning-seeking way that they already construe the oral speech of adults and their peers. It helps children understand that the text, like a person, is trying to communicate something. But after an initial benefit, further conscious practice of these formal skills is a waste of time, according to Barak Rosenshine, who reviewed the research on the effects of using such methods. Rosenshine found that spending six classes on teaching these skills had the same effect on students' reading comprehension as spending 25 classes on them. After a quick initial bump, there's a plateau or ceiling in the positive effects, and little further benefit is derived.[20]

Rosenshine's finding might have been predicted from the rest of what we know about comprehension. Children have been strategically inferring meaning from speech most of their lives. (Remember: Every child can construe the inference implicit in "Shut up! I'm trying to read.") Students don't lack inferring techniques so much as they lack relevant domain knowledge. So while it's good to devote only a small amount of time to explicitly teaching comprehension skills, this does not mean that the skills will then be abandoned. They will be activated in the course of becoming increasingly familiar with the vocabulary and domain of what is being read. The point of a comprehension strategy is to activate the student's relevant knowledge in order to construct a situation model. That's great, but if the relevant prior knowledge is lacking, conscious comprehension strategies cannot activate it.

Systematically Build Word and World Knowledge

Let's consider why the current basals have failed to advance reading comprehension scores. First of all, they have failed significantly to advance students' vocabulary. Vocabulary researchers agree that to get a good start in learning the connotations of a word, a person needs multiple exposures to the word in different contexts. Such exposure is not supplied by a fragmented selection of reading in which topics leap from a day at the beach to a trip to the vegetable section of the supermarket.

That is the more superficial defect of current programs; another goes deeper. With their very heavy orientation to trivial literature, these programs do not take it upon themselves to enhance students' general knowledge in any coherent way. Wide vocabulary and broad knowledge go together.

The point of a comprehension strategy is to activate the student's relevant knowledge. That's great, but if the relevant prior knowledge is lacking, conscious comprehension strategies cannot activate it.

Language is not an isolated sphere of activity but our fundamental human instrument for dealing with the world. The best way to expand students' language is to expand their understanding of what language refers to. If we want students to know the connotations of the word "apple," the best instruction will include references to real apples—not just to verbal associations like "sweet," round," and "crisp," but to the actual objects that unify those traits. An ideal language program is a knowledge program. It is a program that anchors and consolidates word meaning in the students' minds by virtue of their knowing what the words actually refer to.

The late Jeanne Chall was distressed at the nullity of the world knowledge being conveyed to students by the helter-skelter fictional sketches that did so little to enhance their breadth of knowledge and their vocabulary. She pointed out that world knowledge is an essential component of reading comprehension, because every text takes for granted the readers' familiarity with a whole range of unspoken and unwritten facts about the cultural and natural worlds.

It is now well accepted that the chief cause of the achievement gap between socioeconomic groups is a language gap. Much work on the subject of language and vocabulary neglects a fundamental element of word acquisition that is so basic as to be almost invisible: The relationship between language and the world knowledge to which language refers is extremely strong. In human beings, knowledge of a subject is automatically accompanied by language use that repre-

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sents that knowledge. It is this language/knowledge nexus that establishes the key principle of a language arts curriculum: A coherent and extended curriculum is the most effective vocabulary builder and the greatest contributor to increased reading comprehension.

In the classroom, reading comprehension and vocabulary are best served by spending extended time on reading and listening to texts on the same topic and discussing the facts and ideas in them. The number of classes spent on a topic should be determined by the time needed to understand and become familiar with the topic—and by grade level. In kindergarten and first grade, students might listen to and discuss single topics for just three classes. In fourth grade, the immersion might last two weeks, and in later grades longer. Needless to say, this principle applies to good fictional stories as well as good nonfiction. These texts and topics must be compelling enough that both the teacher and the children want to talk about what they read, and deep enough that there is enough reason to revisit the topic.

Such immersion in a topic not only improves reading and develops vocabulary, it also develops writing skill. One of the remarkable discoveries that I made over the many years that I taught composition was how much my students' writing improved when our class stuck to an interesting subject over an extended period. The organization of their papers got better. Their spelling improved. Their style improved. Their ideas improved. Now I understand why: When the mind becomes familiar with a subject, its limited resources can begin to turn to other aspects of the writing task, just as in reading. All aspects of a skill grow and develop as subject-matter familiarity grows. So we kill several birds with one stone when we teach skills by teaching stuff.

Moreover, there is evidence that by teaching solid content in reading classes we increase students' reading comprehension more effectively than by any other method. Some very suggestive research conducted by John Guthrie and his colleagues shows that reading instruction that focuses on a coherent knowledge domain over an extended time not only enhances students' general vocabularies compared to a control group but also improves their general fluency and motivation to read.[21] This is exactly what we would predict from what has been determined about the processes of reading comprehension and vocabulary growth. For instance, take the rule of thumb that you need to know 90 percent of the words to comprehend a text. As exposure to the domain is extended over time, the percentage of text words familiar to the child will increase. This means that incidental word learning of all the words of the text, both general words and domain-specific words will be continually enhanced with extended immersion in a subject matter. At the same time, general fluency will also be enhanced as the child becomes more familiar with the domain. In short, the principle of content immersion can make language-arts classes become not just more interesting experiences for students but also much more effective vehicles for enhancing their reading and writing skills.

World knowledge is an essential component of reading comprehension, because every text takes for granted the readers' familiarity with a whole range of unspoken and unwritten facts about the cultural and natural worlds.

* * *

The great sociologist James S. Coleman, after spending a career examining the characteristics of effective schools and programs, concluded that the most important feature of a good school program is that it makes good academic use of school time. The consistent theme of Coleman's work had been "equality of educational opportunity"—the title of his monumental "Coleman Report" of 1966.[22] Making good use of school time, he concluded, was the single most egalitarian function the schools could perform, because for disadvantaged children, school time was the only academic-learning time, whereas advantaged students learned a lot outside of school. The main conclusion that people gleaned from Coleman's work was that social advantage counted for more in academic results than schooling did—as schools were then constituted. But there was a second, much more hopeful finding in the Coleman Report that Coleman himself pursued in his later career—the inherently egalitarian and compensatory character of a really good school program. A poor program adversely affects low-income students more than middle-income students who are less dependent on the school in gaining knowledge. By contrast, a good program is inherently compensatory because it has a bigger effect on

low-income than middle-income students. This is because low-income students have more to learn—and in an effective program they begin to catch up.

A good, effective language-arts program that is focused on general knowledge and makes effective use of school time will not only raise reading achievement for all students, it will, by virtue of the Coleman principle, narrow the reading gap—and the achievement gap—between groups. □

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Fourth-Grade Slump

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[1] Later, adolescents and adults may comprehend more complex printed narrative or expository text than spoken text because print remains after reading and can be reviewed, while oral language usually cannot be reviewed. However, children must reach the point where they can understand printed text as well as spoken text before their comprehension of printed text can exceed their comprehension of spoken text.

[2] This is true for children whose first language is English. Non-English-speaking children in English-speaking schools clearly acquire some English. However, as a group, they also clearly remain at a disadvantage compared to English-speaking children in elementary schools.

[3] Of course they can understand simpler text sooner. Many second graders can read and understand "first grade" written text. But they cannot understand stories and expository material in print that they can understand when heard.

READING COMPREHENSION

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