AMERICAN FEDERATION
OF TEACHERS
SPRING 2006

AMERICAN
Educator

Background Knowledge

The Case for Content-Rich Language Arts and a Knowledge-Rich Curriculum Core for the Early Grades

It's been known for some time that background knowledge and the vocabulary that comes with it are vital to reading comprehension. We know that poor children enter school with far smaller vocabularies than their more affluent peers. We know that children who can read and understand at least 90 percent of the words in a passage can understand the passage. Children who can't understand will lose ground each time their classmates read and understand—and they don't. If we don't intervene early to build that background knowledge and vocabulary, it is unlikely that reading comprehension scores will rise. The tragic results are obvious. So, how can we intensively and systematically impart this critical knowledge to all our students as early as possible—especially to students who come from the least advantaged homes?

E.D. Hirsch, Jr. ■ Daniel T. Willingham ■ Susan B. Neuman

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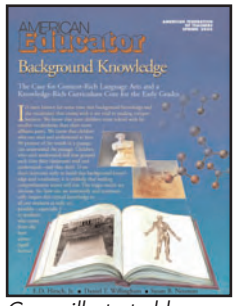

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LETTERS

The New Faces of War Grip Readers

You have done it again! I have shared the Winter 2005-06 issue with administrators and teachers—and I am planning to share some of it with students. The article on spelling ("How Spelling Supports Reading and Why it Is More Regular and Predictable than You May Think") was the best I have ever read. In addition, I was blown away by the child soldiers article ("Child Soldiers: The New Faces of War"), and the cognitive science articles can be read again and again. As a media specialist who was a classroom teacher as well, I appreciate all you are doing to advance the cause of youth in education in this country and in the world.

—PRUDENCE WARREN
Cornwell School
West Hempstead, N.Y.

I lived in Liberia from 1961 to 1963 in the interior near Guinea and Sierra Leone, then in Tanzania on the shores of Lake Victoria from 1964 to 1969. The article "Child Soldiers: The New Faces of War" brought tears to my heart and eyes. I have kept up with African news all these years—especially Liberia.

Thank you for adding these photos to Mr. Singer's report.

I am now 72 years old, but am very sensitive to the problems there. It is difficult and painful for millions in Africa.

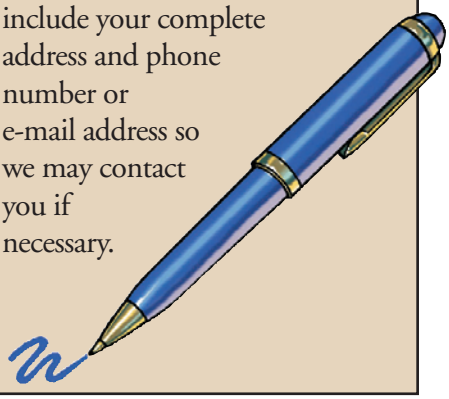
—GEORGE LACKEY
Pharr, Texas

Kudos on your "Child Soldiers" article and gripping photos. I'll share this with my students.

—PETER PERO
Benito Juarez Community Academy
Chicago, Ill.

Let us know what you think!

We welcome comments on *American Educator* articles. Address letters to Editor, *American Educator*, 555 New Jersey Ave. N.W., Washington, DC 20001 or via e-mail at **amered@aft.org**. Letters selected may be edited for space and clarity and must include your complete address and phone number or e-mail address so we may contact you if necessary.



NOTEBOOK

Deng Wenping Succumbs to Silicosis

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In the Summer 2005 issue of *American Educator*, we reported on an AFT delegation that traveled to Hong Kong and China to see how workers are faring. The delegation was especially concerned about workers in China's "free enterprise zones," areas where manufacturers are free to trample workers' rights by paying them little and compromising their health—sometimes with deadly consequences. Less than a year later, it is with great sadness that we provide this update: Deng Wenping, one of the six migrant workers suffering from silicosis that the AFT delegation met with, succumbed to the disease on January 5, 2006. He was only 36 years old and leaves behind his wife, Tang Manzhen, and two young children.

As our initial account of the workers' plight (which is available online at **www.aft.org/pubs-reports/american_educator/issues/summer2005/notebook.htm**) explained in greater detail, Wenping developed silicosis while working as a stone-cutter for the Perfect Gem and Pearl Manufacturing Company in Guangdong Province, China. According to *Deadly Dust*, a recent report by the *China Labor Bulletin*, there is now a silicosis epidemic among jewelry workers in Guangdong. Silicosis (like the better-known "black lung disease" that afflicts miners) is a form of pneumoconiosis, a disease that—despite being highly preventable—accounts for 80 percent of occupational illnesses in China.

In recounting Deng's struggle to receive adequate compensation from the company, Tang Manzhen mentioned that she and her husband had brought a lawsuit against the company. They finally won 230,000 yuan (about $28,000) in July 2005, but it barely covered the family's outstanding debts. Tang now works as a farmer in her home village, just as she and Deng did before they moved to Guangdong to work for Perfect Gem and Pearl Manufacturing. If not for support from charitable organizations in Hong Kong, her children would be unable to continue their schooling.

Deadly Dust *is available online from the* China Labour Bulletin. *Visit* ***www.clb.org.hk/fs/view/downloadables/Deadly_Dust_Dec2005.pdf***.

Teaching Multiplication

Knowing mathematics is a matter of careful study and diligent practice. But knowing mathematics for teaching also requires carefully observing how students react to lessons and constant questioning as to how a lesson or explanation could be more effective. For those of you who are using the Fall 2005 article "Knowing Mathematics for Teaching" to improve your lessons, the authors, Deborah Loewenberg Ball, Heather C. Hill, and Hyman Bass, wish to provide the following elaboration of footnote five, which appeared on page 20.

[5] In the U.S. conventional algorithm for multiplication, one possible progression through cases of growing complexity goes as follows: one digit times one digit (e.g., "basic facts," like 7 x 8, including 0 as a possible factor); two digits times one digit without "carries" (like 24 x 2); two digits times one digit with "carries" (like 24 x 7); two digits times 10 (like 24 x 10); two digits times a single digit multiple of 10 (like 24 x70); two digits times two digits without "carries" (like 24 x 21); two digits times two digits with "carries" in one (like 24 x 15, or 24 x 72) or both (like 24 x 75) of the two intervening single-digit multiplications. These cases present examples of essentially all of the computationally significant phenomena encountered in application of the U.S. conventional algorithm for multi-digit multiplication. In examples like 24 x 705, the presence of the interior 0 in the second factor, if not handled attentively, can be a source of confusion or error in the placement of the digits in the computation.

The Hurricanes May Have Passed, but the Need Hasn't

BILL HABER, ASSOCIATED PRESS, AP

(Above) Hardin Elementary School, New Orleans; (Right) Armstrong Elementary School, New Orleans.

After hurricanes Katrina, Rita, and Wilma all struck the Gulf Coast in eight horrific weeks, images of destruction and despair were transmitted around the world. Among those uprooted and devastated were well over 10,000 AFT members in New Orleans and across the Gulf Coast. In October, AFT's executive council voted to form a disaster relief fund to help members whose families, homes, and careers were torn apart by the hurricanes—and they were determined to make it the largest fundraising effort the AFT has ever taken on. Thousands of members' homes were severely damaged or destroyed. "My house needs to be gutted to the studs," says one AFT member from Louisiana. Another member from Mississippi barely escaped the flood waters that ruined her home. "[During Katrina] my husband and I … were forced to flee to our attic to escape the storm surge that flooded our home with eight feet of water. When the water receded, we were left with only the clothes on our back. All of our belongings and assets were gone."

Because of trouble with their insurance companies, some members are discovering that they've lost not only their houses, but also their life savings. According to John Tuepker, a history teacher at Long Beach High School and past president of the Long Beach Federation of Teachers, "The problem is that insurance companies are calling it a flood, and they are not honoring their hurricane insurance." Tuepker's home was just one of the 14 on his block that were completely destroyed, but he feels the pain of each one acutely—they were all owned by members of his extended family.

School custodian Jerome Troullier, from St. Tammany Parish, La., has taken matters into his own hands: He is trying to rebuild his home himself. "It's basically the same thing every day right now—wake up early, go to work, finish work, go do some repairs on the house, return to the motel late at night, and fall asleep. It's tiring, but it's what I have to do so my family can come back home."

These days, some might consider people like Troullier lucky—at least he still has his job as a custodian. Thousands of members no longer have a place of employment. As *American Educator* goes to press, roughly 7,500 employees of the New Orleans Public Schools were expecting termination notices.

The AFT Disaster Relief Fund is providing $500 grants to affected AFT members. Initially, it was estimated that 6,000 members would apply for disaster relief grants. In fact, over 10,000 members have applied. One member from Destin, Fla., who received a $500 grant, wrote, "Thank you…. It has been a great help. I lost everything…. Hopefully I will soon hear from FEMA about placing a trailer on my destroyed property. Before Katrina, I was a fifth-grade teacher at Hynes Elementary School." Another teacher from Jefferson Parish says "words cannot express the feeling of gratitude I had when I went to the mailbox and a check from the union was there…. It's good to know that somebody still cares for the teachers."

The AFT set an initial goal of $3 million for the fund, but it is now clear that meeting the members' needs will require closer to $5 million. The national AFT has pledged at least $1 million to the relief effort, and the New York State United Teachers has pledged to raise a minimum of $1 million as well. All other affiliates have been asked to raise a combined total of $1 million.

Of course, monetary assistance is not the only way the AFT is working to soften the hurricanes' blows. Members have donated their time, skills, and attention. In the days and weeks after Katrina hit, AFT members and staff worked in centers in Atlanta, Baton Rouge, Jackson, Mobile, and Texas to provide direct assistance to members. AFT Healthcare affiliates sent professionals to the Gulf

Coast to assist the injured and ill. And the AFT formed the Mississippi Gulf Coast School Supplies Project to help schools replace supplies ruined by hurricane damage. Most of the supplies went to Pass Christian, Miss., where three of the four schools there were destroyed by the hurricane.

The AFT Web site also provides useful information to affected members (**www.aft.org/news/2005/katrina/index.htm**), including health tips on cleaning up after flood and wind damage and updates from the Federal Emergency Management Agency (FEMA). Most importantly, the site provides resources for teachers working with children affected by the hurricanes and employment information to help displaced employees find new positions.

Please let your union colleagues know that they have not been forgotten. You can make a tax deductible contribution at **www.aft.org/katrina** or by sending a check payable to AFT Disaster Relief Fund, c/o Connie Cordovilla, 555 New Jersey Ave. N.W., Washington, DC 20001. Please include your name, address, e-mail, and local name/number with your check.

BEN MARGOT, ASSOCIATED PRESS, AP

Conventional Wisdom Proves Wrong: Public Schools Outperform Private and Charter Schools

When key differences—like student demographics—are taken into account, do public schools perform as well as their private- and charter-school counterparts? That's the question Chris Lubienski and Sarah Theule Lubienski sought to answer in their recent report, Charter, Private, Public Schools and Academic Achievement: New Evidence from NAEP Mathematics Data. *The following excerpts provide their key findings (full report at* ***www.ncspe.org/readrel.php?set=pub&cat=126)****.*

"Common wisdom … holds that private schools achieve better academic results. Assumptions of the superiority of private-style organizational models are reflected in voucher and charter programs and in the choice provisions of the No Child Left Behind Act…. Market-oriented school choice reforms are premised on the idea that, by positioning parents as the driving force in the quest for quality, schools will be forced to improve when faced with competition from higher performing rivals.

However, new results from a study of a large, comprehensive dataset on U.S. student achievement seriously challenge assumptions of private school superiority…. Based on the 2003 National Assessment of Educational Progress (NAEP) mathematics exam, this analysis compares achievement in public, charter, and different types of private schools. [We chose to examine math achievement because when it is] compared with other subjects (like reading, for instance), math is more heavily influenced by school than home experiences, so studying math achievement provides clearer insights into the relative performance of different types of schools…. This new analysis … employs advanced statistical techniques (hierarchical linear modeling) to study the relationship between school type and mathematics achievement while controlling for demographic differences in the populations served by the schools.

Major Findings

Without controlling for student background differences, private schools scored higher than noncharter public schools, as would be expected. However, this study examines these patterns further, determining whether they are due simply to the fact that higher proportions of disadvantaged students are enrolled in public schools…. Overall, the study demonstrates that demographic differences between students in public and private schools more than account for the relatively high raw scores of private schools. Indeed, after controlling for these differences, the presumably advantageous 'private school effect' disappears, and even reverses in most cases….

To summarize the most important findings once demographic and location differences were controlled:

- Public schools significantly out-scored Catholic schools (by over 7 points in 4th grade, and almost 4 points in 8th grade).*
- Of all private school types studied, Lutheran schools performed the best. Fourth-grade scores in Lutheran schools were roughly 4 points lower than in comparable public schools, but were (a statistically insignificant) 1 point higher at the 8th grade.
- The fastest growing segment of the private school sector, conservative Christian schools, were also the lowest performing—trailing public schools by more than 10 points at grades 4 and 8.
- Charter schools scored a significant 4.4 points lower than non-charter public schools in 4th grade, but scored (a statistically insignificant) 2.4 points higher in 8th grade.

These notable findings regarding the remarkable performance of public schools are significant, not just statistically, but also in terms of their policy implications. The presumed panacea of private-style organizational models—the private-school advantage—is not supported by this comprehensive dataset on mathematics achievement. These data suggest significant reasons to be suspicious of claims of general failure in the public schools, and raise substantial questions regarding a basic premise of the current generation of school reforms based on mechanisms such as choice and competition drawn from the private sector."

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* To interpret the disparities, consider a 10-11 point disparity as very roughly representing a difference of one grade level.

Once upon a time, there was a big pile of laundry.

The pile was made up of all different colors. A mommy decided she would play a game. *Red!* she said to her child, holding up a red shirt. *Red!* the child said. Mommy put it in the colors pile. Whites went in another pile. *Green like a frog! White like ice cream!* And so it went. Colors, whites. Colors, whites. And on the very last thing – a bib of blue – the child pointed to the colors pile. You should've seen the smile on mommy's face.

Everyday moments can become learning moments. Because learning starts long before school does. So tell stories. Play with the laundry. And even a chore with your child will become much more. Find out more at **bornlearning.org.**

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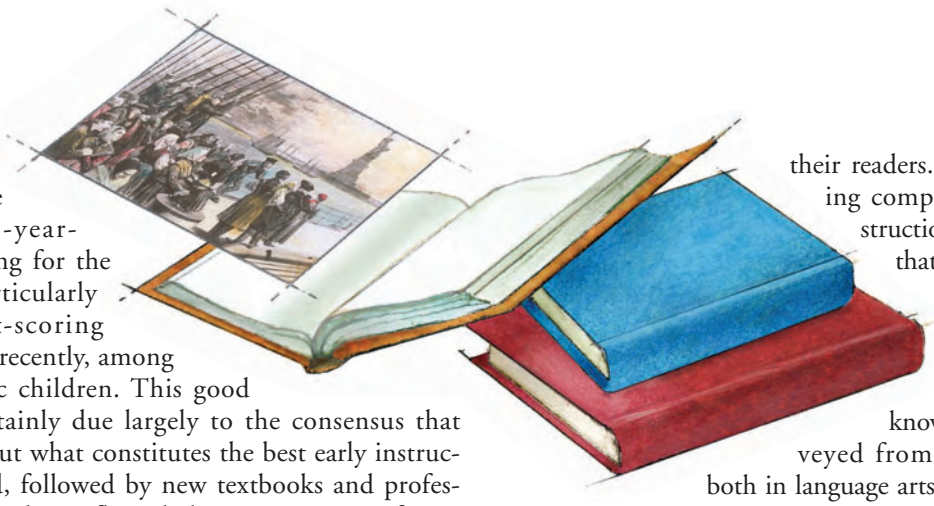
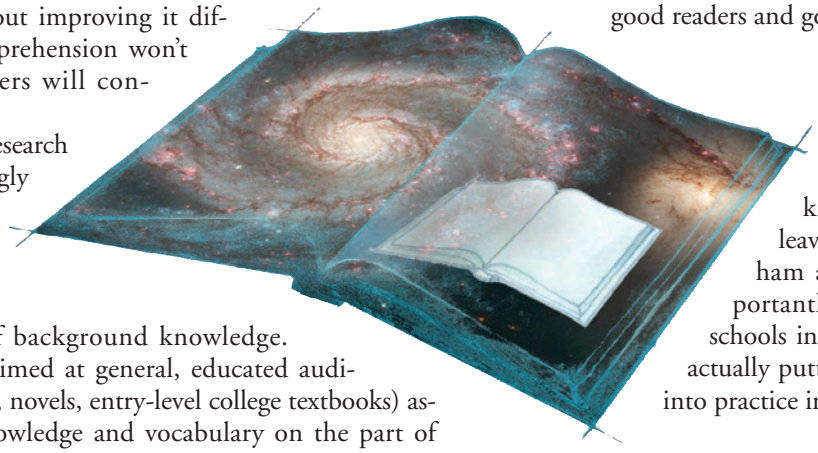
Knowledge: The Next Frontier in Reading Comprehension



Reading scores of the nation's 9-year-olds have been rising for the past 15 years—particularly among the lowest-scoring children and, more recently, among black and Hispanic children. This good news is almost certainly due largely to the consensus that finally emerged about what constitutes the best early instruction in how to read, followed by new textbooks and professional development that reflected the consensus. Unfortunately, there's not the same good news for older readers who are struggling to comprehend secondary-level materials. According to the National Assessment of Educational Progress, these students are not succeeding in great numbers, and over the past 15 years, reading achievement among the nation's 13- and 17-year-olds has changed very little, even though early reading achievement has been rising.

Public impatience with stagnant reading achievement can be felt in enthusiasm for charter schools and vouchers and in the increasingly harsh comments suggesting that reading—in fact school—failure is due to inadequate teacher quality.

But best-selling author and scholar E.D. Hirsch, Jr., says the fault is not with teachers—but with faulty ideas. We're thinking about reading comprehension in the wrong way, he says. And until all of us in education—publishers, colleges of education, researchers, teachers, administrators, and policymakers—begin to think about it differently and, therefore, go about improving it differently, reading comprehension won't improve—and teachers will continue to be "pilloried."



Cognitive science research is making it increasingly clear that reading comprehension requires a student to possess a lot of vocabulary and a lot of background knowledge. Writers of materials aimed at general, educated audiences (i.e., newspapers, novels, entry-level college textbooks) assume background knowledge and vocabulary on the part of their readers. No amount of reading comprehension "skills" instruction can compensate for that lack of knowledge.

Our lead writer, E.D. Hirsch, Jr., makes this case and argues that the knowledge should be conveyed from the earliest grades, both in language arts class (which by mandate is taking more time each day in elementary schools than in the past) and throughout the day through a core (not comprehensive) curriculum that gives all kids, regardless of neighborhood, race, or religion, access to the best knowledge there is. As James Comer, child psychiatrist and school improvement expert, wrote approvingly in reviewing an E.D. Hirsch book, "In order for a truly democratic and economically sound society to be maintained, young people must have access to the best knowledge available so that they can understand the issues, express their viewpoints, and act accordingly."

Susan Neuman, one of the country's top researchers on early childhood issues and reading, argues that it's time for the reading world to take the role of knowledge more seriously, from the earliest grades on. Dan Willingham, author of *American Educator*'s popular "Ask the Cognitive Scientist" column, explains the many, many ways in which knowledge aids reading—and also thinking, reasoning, and problem solving, as well as other critical thinking skills that make for good readers and good citizens.

But all that content, all that knowledge—won't it be a bore for kids? Are we talking about going back to rote memorization, drill and kill, all that stuff we hoped to leave behind? Not at all. Willingham addresses that, but more importantly, so do two teachers—from schools in Texas and New York who are actually putting a content-rich curriculum into practice in their schools.

—Editors

Building Knowledge

The Case for Bringing Content into the Language Arts Block and for a Knowledge-Rich Curriculum Core for all Children

By E.D. Hirsch, Jr.

I am sure that the power of vested interests is vastly exaggerated compared with the gradual encroachment of ideas.... Soon or late, it is ideas, not vested interests, which are dangerous for good or evil.

—J. M. Keynes
The General Theory of Employment, Interest, and Money

Consider the following sentence, which is one that most literate Americans can understand, but most literate British people cannot, even when they have a wide vocabulary and know the conventions of the standard language:

Jones sacrificed and knocked in a run.

Typically, a literate British person would know all the words in the sentence yet wouldn't comprehend it. (In fairness, most Americans would be equally baffled by a sentence about the sport of cricket.) To understand this sentence about Jones and his sacrifice, you need a wealth of relevant background knowledge that goes beyond vocabulary and syntax—relevant knowledge that is far broader than the words of the sentence. Let's consider what we as writers would have to convey to an English person to make this sentence comprehensible.

First, we would have to explain that Jones was at bat. That would entail an explanation of the inning system and the three-outs system. It would entail an explanation of the size and shape of the baseball field (necessary to the concept of a sacrifice fly or bunt) and a digression on what a fly or a bunt is. The reader would also have to have some vague sense of the layout of the bases and what a run is. By the time our English reader had begun to assimilate all this relevant background knowledge, he or she may have lost track of the whole point of the explanation.What was the original sentence? It will have been submerged in a flurry of additional sentences branching out in different directions.

The point of this example is that knowledge of content and of the vocabulary acquired through learning about content are fundamental to successful reading comprehension; without broad knowledge, children's reading comprehension will not improve and their scores on reading comprehension tests will not budge upwards either. Yet, content is not adequately addressed in American schools, especially in the early grades. None of our current methods attempt to steadily build up children's knowledge; not the empty state and district language arts standards, which rarely mention a specific text or piece of information; not the reading textbooks, which jump from one trivial piece to another; and not the comprehension drills conducted in schools in the long periods of 90-120 minutes devoted to language arts. These all promote the view that comprehension depends on having formal skills rather than broad knowledge.

This may sound like an academic point. It is, in fact, an important argument about the science that underlies learning. I believe inadequate attention to building students' knowledge is the main reason why the reading scores of 13- and 17-year-olds on the National Assessment of Educational Progress have not budged in years. I believe this neglect of knowledge is a major source of inequity, at the heart of the achievement gap between America's poor and non-poor. I also believe that if this idea about what is limiting students' comprehension isn't understood and aggressively addressed, reading scores won't move up, no matter how hard teachers try. And the public debate will wrongly continue to pillory teachers and public schools for stagnant achievement scores.

In the pages that follow, I want to make the following argu-

E.D. Hirsch, Jr. is the author of many books and articles, including the bestselling Cultural Literacy *and* The Schools We Need. *He is a fellow of the Academy of Arts and Sciences and founder of the Core Knowledge Foundation. (Full disclosure:* American Educator*'s editor, Ruth Wattenberg, is on the foundation's board.)*
This article is adapted from The Knowledge Deficit*, by E.D. Hirsch, Jr., to be published by Houghton Mifflin Company in April 2006.*

ILLUSTRATED BY NENAD JAKESEVIC


$E = \frac{m_0 c^2}{\sqrt{1 - v^2/c^2}}$

ment: First, that the implicit model currently used to improve reading comprehension is based on faulty, but commonplace, ideas. Second, that a more scientifically accurate picture of reading comprehension exists—and it puts background knowledge and vocabulary, along with fluent decoding ability, at the center of reading comprehension. Third, we can identify the knowledge that is most useful to reading comprehension. Fourth, if we accept these premises, we are obliged to revise the early grades curriculum so that we can impart to all students, in language arts classes and throughout the day, the knowledge that will enable them to read with strong comprehension. And, finally, if we do this, we will help all students become strong comprehenders of high-level texts, and we will disproportionately help our most at-risk students.

I. The Wrong Ideas That Underlie Our Approach to Teaching Reading Comprehension

When I began college teaching in the 1950s, my academic specialty was the history of ideas. I also specialized in the theory of textual interpretation, which, reduced to its essence, is the theory of reading. So I became well-versed in the scientific literature on language comprehension and in American and British intellectual history of the 19th century. This double research interest prepared my mind for disturbing insights about American schooling. I saw that John Maynard Keynes's remark about the power of ideas over vested interests was profoundly right. Root ideas are much more important in practical affairs than we usually realize, especially when they are so much taken for granted that they are hidden from our view.

In American education, the ideas that influence us, though often hidden from view, come to us from the intellectual movement known as Romanticism, which held great sway during our country's formative years. It is thanks to the Romantics (also known as transcendentalists, pragmatists, and, in education, progressives) that the word "natural" has been a term of honor in our country and that the ideas of "nature" and "natural" were elevated to a status that previously had been occupied only by divine law. We can hear these romantic beliefs in John Dewey's writings, which continually use the terms "development" and "growth"—terms that came as naturally to him as they do to us.

Being trained in the history of ideas, I had become familiar with the way in which unnoticed metaphors like "growth" and "development" unconsciously govern our thought—and continue to do so, even when scientific evidence clearly shows that one of the primary goals of education, reading, is not a natural development at all.

Let's ponder "development" for a moment.When a fertilized egg turns into an embryo, that development is indeed something that unfolds naturally. Similarly, in the first two years of life, when a child learns to walk and talk, those are natural developments. Since the child acquires these extremely difficult skills often without conscious adult instruction, we might mistakenly extend trust in natural unfolding to the next stage of life—when a child enters school. And we might expect that given loving exposure to lots of books, a child might learn to read with little explicit instruction in reading mechanics. Hence, the whole language movement, which for so many years led many teachers, teacher educators, textbook publishers, and administrators to neglect decoding and other early reading mechanics.

> This idea is sabotaging efforts to raise reading comprehension levels…. It is time to fault the idea, not the teachers and students.

A naturalistic approach to teaching decoding is not, however, the most deleterious romantic idea influencing the teaching of reading. The most harmful idea is that children do not need a knowledge-rich curriculum to become proficient readers. The word *reading*, of course, has two senses. The first means the process of turning printed marks into sounds and these sounds into words. But the second sense means the very different process of understanding those words. Learning how to read in the first sense, as vital as it is, does not guarantee learning how to read in the second sense, comprehending the meaning of what is read. To become a good comprehender, a child needs a great deal of knowledge. A romantically inspired long delay in beginning to teach that knowledge is socially and economically harmful to our students—especially our most disadvantaged students.

Disparagement of factual knowledge, as found in books, has long been a strong current in American thought. Henry Ford's famous dictum, "History is bunk," is a succinct example. Since the 19th century, such anti-intellectualism has been as American as apple pie, as the great historian

Richard Hofstadter has pointed out, and it came straight out of the Romantic movement into our schools.[1]

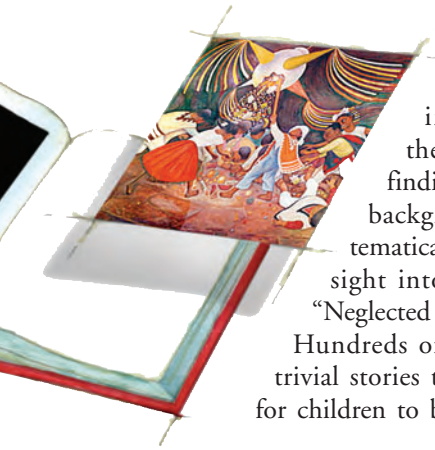
Instead of a respect for the importance of knowledge, Romanticism gave us faith in the half-truth that the most important thing for students to learn is "how to learn." It bequeathed to us a tendency to dismiss the acquisition of broad knowledge as "rote learning" of "mere facts," to subtly disparage "merely verbal" presentations in books and by teachers, and to criticize school knowledge unless it is connected to "real life" in a "hands-on" way. These ideas are now so commonplace that we don't think twice about them; we don't scientifically scrutinize them. Yet, these ideas underlie what we as a nation think about reading comprehension.

Pick up a typical basal reader and the clear implication is that comprehension skill depends on formal "comprehension strategies," such as predicting, summarizing, questioning, and clarifying.[2] Look in them fruitlessly to find evidence that the publishers believe reading depends on imbibing a body of knowledge. I call this romantic idea, "formalism"—a belief that reading comprehension can best be improved by acquiring formal comprehension strategies, not by building children's knowledge base.

This idea is ruinous to reading instruction. It is sabotaging efforts to raise reading comprehension scores. It is causing citizens to question the quality of their schools and is leading policymakers to blame school staff for reading failures. It is time to fault the idea, not the teachers and the students who are doing their best.

These Wrong Ideas Underlie Reading Textbooks and Distort the Use of Classroom Time

Publishers now spend tens of millions of dollars to produce—and schools hundreds of millions to buy—reading programs that are constantly being upgraded and revised. But the guiding ideas behind these programs are typically formalistic and almost indistinguishable from one another. Although the editors of several of these programs have strong credentials in education or psychology, the programs are far from up-to-date with regard to the relevant consensus in cognitive science. For instance, cognitive scientists agree that reading comprehension requires prior "domain-specific" knowledge about the things that a text refers to, and that understanding the text consists of integrating this prior knowledge with the words in order to form a "situation model."[3]



Constructing this mental situation model is what reading comprehension is. But, existing reading programs, while they may pay lip service to this finding about the need for relevant background knowledge, fail to systematically exploit this fundamental insight into the nature of reading. (See "Neglected Knowledge: The Facts," p. 24.) Hundreds of pages of basal text offer up trivial stories that provide little opportunity for children to build their store of knowledge.

Existing reading programs, while they may pay lip service to the need for relevant background knowledge, fail to systematically exploit this fundamental insight into the nature of reading.

They persist, unit after unit, in asking students to "predict," "summarize," "infer," etc.—as if endless use of these strategies will increase students' reading comprehension ability.[4]

Here's an example of how these ideas and practices affect real children in real classrooms. In May 2004, a front-page story in the *Washington Post* described the activities in a third-grade classroom at a public school in Maryland, which the reporter, Linda Perlstein, identified as being typical of activities "across the nation." Perlstein had been sitting in classrooms at the school, observing what went on and talking to students, teachers, and administrators. The piece begins with a comment by one of the students:

> Here is 9-year-old Zulma Berrios's take on the school day: "In the morning we read. Then we go to Mrs. Witthaus and read. Then after lunch we read. Then we read some more."

These reading periods, Perlstein points out, come at the expense of classes in history, science, and art. The reading materials themselves are quite vapid. In this particular class, the children were reading a book about a grasshopper storm. But the point of the class was not to learn anything in depth about grasshoppers; the point was to learn how to ferret meaning out of a text by using formal "strategies." Perlstein writes:

> For 50 minutes, Tracey Witthaus pulls out a small group of third-graders—including Zulma—for Soar to Success, an intensive reading-comprehension program used at many county schools. Instead of studying school desegregation and the anniversary of *Brown v. Board of Education*, Zulma's group finishes a book about a grasshopper storm and practices reading strategies: predict, summarize, question, clarify. "Clarify," said Zulma, who began the year reading at the late first-grade level.

The theory behind these deadening activities is that learning comprehension strategies will give students a shortcut to gain-

What the text doesn't say often far exceeds what it says. Just as with "Jones sacrificed and knocked in a run," the reader or listener has to fill in the blanks and make the unstated connections.… Without this relevant, unspoken background knowledge, we can't understand the text.

ing greater expertise in reading. Supposedly, learning such strategies will quickly provide the skills they need to comprehend unfamiliar texts. But as the teachers in the school pointed out to the reporter, the methods did not seem to be working. Reading scores were not going up significantly. Perlstein reports that "staff members said they aren't sure what they might be doing wrong."

The idea that reading skill is largely a set of general-purpose maneuvers that can be applied to any and all texts is one of the main barriers to our students' achievement in reading. It is true that students benefit from learning and practicing reading comprehension skills, but a key point has gotten lost: More training in these skills is not necessarily better. A meta-analysis has shown that six classes of comprehension skill instruction has the same effect as 25 classes.[5] (This is emphatically not to suggest that some of the methods, such as asking students questions about important content they have read, would be a bad idea. Of course teachers do and should ask students to engage with reading material in a variety of ways, including questioning students about the author's intent, summarizing what they've read, and so forth. The ineffectiveness of an emphasis on strategy arises from two sources: first, conscious strategizing takes up limited mental space that otherwise could be devoted to meaning; second, the skills are being practiced apart from important content. When the questions are asked about trivial content, when learning these strategy skills becomes the end—not the means—for engaging content, and when the time devoted to skills training drives needed content out of the classroom, then reading comprehension is not effectively advanced.) Formal comprehension skills can only take students so far; knowledge is what enables their comprehension to keep increasing. The staff and children at the school Perlstein visited do not need more skills training. They need a revolution in the ideas that now drive reading comprehension instruction.

II. Reading Comprehension Depends Mainly on Knowledge and Knowledge-Related Vocabulary

Recently, schools have begun to do a much better job of teaching all children to become good first-step readers who can turn printed symbols into sounds and words quickly and accurately, a process called decoding. The importance of systematically and effectively teaching decoding cannot be overstated (and the role played by AFT members in making such instruction better understood and more commonplace can hardly be overstated either). But becoming a skilled decoder does not ensure that one will become a skilled reader. There are students who, after mastering decoding, and reading widely can, under the right circumstances, gain greater knowledge and thence better reading comprehension. But such gains will occur only if the student already knows enough to comprehend the meaning of what he or she is decoding. Many specialists estimate that a child (or an adult) needs to understand a minimum of 90 percent of the words in a passage in order to understand the passage and thus begin to learn the other 10 percent of the words.[6] Moreover, it's not just the words that the student has to grasp the meaning of—it's also the kind of reality that the words are referring to (think of our baseball example).[7] When a child doesn't understand those word meanings and those referred-to realities, being good at sounding out words is a dead end. Reading becomes a kind of Catch-22: In order to become better at reading with understanding, you already have to be able to read with understanding.

Long before Joseph Heller's *Catch-22*, this idea was implied in the Gospel of Matthew, which stated that those who already have shall gain more, while those who have not shall be taken away even what they have. Alluding to this biblical passage, cognitive scientists and reading researchers have spoken of the "Matthew effect" in reading. Those who already have good language understanding will gain still more language proficiency, while those who lack initial understanding will fall further and further behind.[8]

"Filling in the Blanks": Why Reading Comprehension—and Reading Comprehension Tests—Require Broad General Knowledge

As scientists have probed more deeply into the nature of language comprehension, they have discovered that what the text implies but doesn't say is a necessary part of its understood meaning. In fact, what the text doesn't say often far exceeds what it says. Just as with "Jones sacrificed and knocked in a run," the reader or listener has to fill in the blanks and make the unstated connections. This is hardly a new observation. The ancient Greeks knew it, and Aristotle even gave the phenomenon a name—enthymeme—which is technically a syllogism with some of the logically necessary steps left out.[9] For instance, if I say, "All men are mortal, so Socrates is mortal," everyone will understand what I say. But that is because their

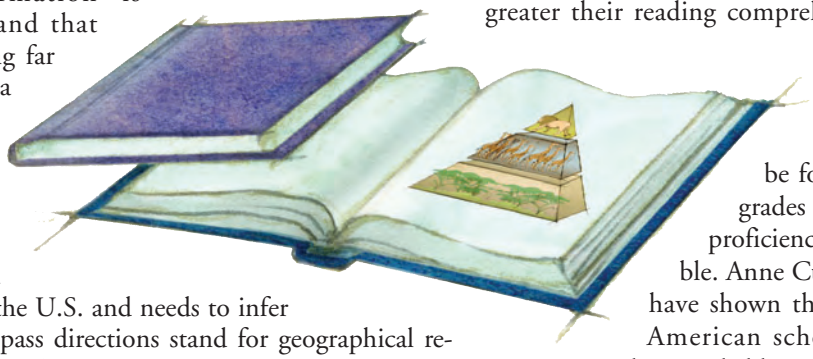
Other things being equal, the earlier children acquire a large vocabulary, the greater their reading comprehension will be in later grades.

relevant knowledge enables them to supply the missing inference: "Socrates is a man."

To different extents, all speech has these blank spaces. Cognitive psychologists have determined that when a text is being understood, the reader (or listener) is filling in a lot of the unstated connections between the words to create an imagined "situation model" based on domain-specific knowledge.[10] This situation model constitutes the understood meaning of the text. Take, for example, this passage from my book *What Your Second-Grader Needs to Know:*

> In 1861, the Civil War started. It lasted until 1865. It was American against American, North against South. The Southerners called Northerners "Yankees." Northerners called Southerners "Rebels," or "Rebs" for short. General Robert E. Lee was in charge of the Southern army. General Ulysses S. Grant was in charge of the Northern army.

Potentially, this passage is usefully informative to a second-grader learning about the Civil War—but only if he or she already understands much of what's addressed in it. Take the phrase "North against South." A wealth of preexisting background information is needed to understand that simple phrase—going far beyond the root idea of compass directions, which is simply the necessary first step. The child needs a general idea of the geography of the U.S. and needs to infer that the named compass directions stand for geographical regions. Then a further inference or construction is needed: The child has to understand that the names of geographical regions stand for the populations of those regions and that those populations have been organized into some sort of collectivity so they can raise armies. That's just an initial stab at unpacking what the child must infer to understand the phrase "North against South." A full, explicit account of the taken-for-granted knowledge that someone would need to construct a situation model for this passage would take many pages of analysis.



To understand language, whether spoken or written, we need to construct a situation model consisting of meanings construed from the explicit words in the text, as well as meanings inferred from relevant background knowledge. The spoken and the unspoken taken together constitute the meaning. Without this relevant, unspoken background knowledge, we can't understand the text.

That is why we are able to understand some texts but not others—no matter how well we can decode the words (imagine trying to understand a technical article on astrophysics). Since relevant, domain-specific knowledge is an absolute requirement for reading comprehension, there is no way around the need for children to gain broad general knowledge in order to gain broad general proficiency in reading.

Among experts on reading, there's one group that understands this particularly well—the makers of standardized reading comprehension tests. Such tests always include a diversity of passages on quite different subjects. Why? Through experimentation, test makers found that such variety is absolutely critical to the validity and reliability of the tests. If they sampled just one kind of subject matter, their tests would prove to be inaccurate as measures of general reading ability. Because of the inevitable influence of background knowledge, someone who reads well about the Civil War may not necessarily read well about molecular interactions. If a test is to measure general reading ability, it must include passages that sample a person's general knowledge of several kinds of subjects. (For more on reading comprehension tests, see "What Do Reading Comprehension Tests Mainly Measure? Knowledge," p. 18.)

Why Building Vocabulary Is Vital and Why It Is Largely Built through Broad Exposure to Content Knowledge

Comprehending a text depends on knowing the meanings of most of its words. An adequate early vocabulary is, therefore, fateful for later reading achievement. Other things being equal, the earlier children acquire a large vocabulary, the greater their reading comprehension will be in later grades. Vocabulary growth is a slow process that gradually accumulates a very large number of words and, therefore, must be fostered intensively in the earliest grades if we are to bring all children to proficiency in reading as quickly as possible. Anne Cunningham and Keith Stanovich have shown that under current conditions of American schooling, vocabulary in second grade is a reliable predictor of academic performance

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in 11th grade.[11] They have also shown that the biggest contribution to the size of any person's vocabulary must come from the printed page (whether it is heard or read), because print uses a greater number of different words than everyday oral speech does.[12]

That a person has learned roughly 60,000 to 100,000 words by 12th grade is one of the most remarkable feats of the human mind. Even though how we do it remains something of a psychological mystery, recent work has taught us enough about vocabulary growth to formulate some conclusions about the most productive means of enlarging children's vocabularies, especially among students whose initial vocabularies are relatively small.

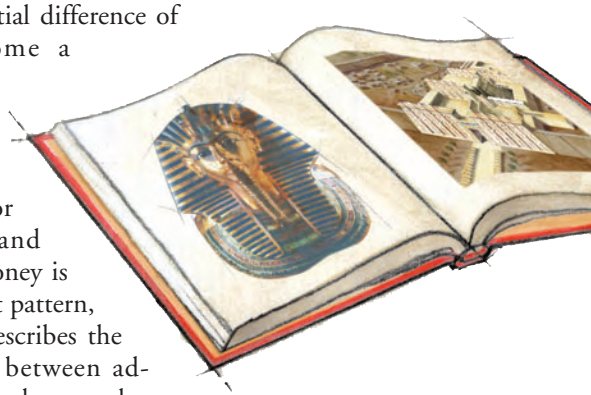
One critical finding is that word learning takes place most efficiently when the reader or listener already understands the context well. For example, researchers have found that we learn the words of a foreign language most effectively when the subject matter is familiar.[13] If you read in French that *"Lyon a battu Lille,"* you will make greater gains in learning what *battu* means if you know something about soccer. This finding appeals to common sense. You can guess accurately what the word ought to mean in the context because you know what is being talked about. This picture of how words are learned in context is supported by recent research, which shows that we infer the meanings of words by grasping the whole meaning of the utterance in the form of a mental situation model. If we are hearing a story about a team of firefighters putting out a fire and we encounter the word *flames* for the first time, we can make a good guess about what it means because we understand the situation referred to in the sentence in which *flames* is used. We must grasp this whole situation (precisely or vaguely) when we understand what is said or written. This understanding of the whole context is the basis for guessing the meanings of new words. This fact explains why we learn words up to four times faster in a familiar context than in an unfamiliar one.[14] An optimal early reading program will exploit this characteristic of word learning by ensuring that the topics of class read-alouds, independent reading, and discussion are consistent over several class periods, so that the topic will become familiar to the students and thus accelerate word learning.

Why a Knowledge Focus Will Disproportionately Help Disadvantaged Children

The Matthew effect in reading, whereby the rich get richer and the poor get poorer, is inevitable in the case of vocabulary and knowledge. As we've seen, experts say that we need to know at least 90 percent of a text's words to understand it.[15] Children who already have sufficient word knowledge will understand the text and begin learning the meanings of the other 10 percent of the words as well as acquire new knowledge through their reading. But those students who know only 70 percent of the words will not understand the text (and thus, will neither begin learning the other 30 percent of the words, nor acquire knowledge from the text). Now, after looking at the text, they are further behind the advantaged group than they were before they read the text. If this pattern continues, the gap between the two groups will grow with each successive language experience.[16]

Let's focus for a bit on the subject of speeding up word learning for disadvantaged children. Between the ages of 2 and 17, an advantaged child learns an average of 10 to 15 new words a day.[†] But the growth in vocabulary is not linear: No one learns the same number of words every day, week, or year. The number of new words gained per unit of time is rather small at age 2, and it rises with each succeeding year. In later life, when people already know most of the words they hear and read, the number of new words they gain per year slows down again.[17]

This nonlinear pattern of vocabulary growth allows us to make a hopeful qualification of the Matthew effect in reading comprehension. Vocabulary growth in the typical school is similar to the growth of money in an interest-bearing bank account. Suppose the interest on money is compounded at 5 percent a year. Somebody who starts out with just $10 in an account will fall further and further behind somebody who starts out with $100. After 10 years, the initial difference of $90 will become a larger difference of $146. That is because the growth rates stay the same for both accounts and the supply of money is not limited. That pattern, unfortunately, describes the vocabulary gap between advantaged and disadvantaged stu-

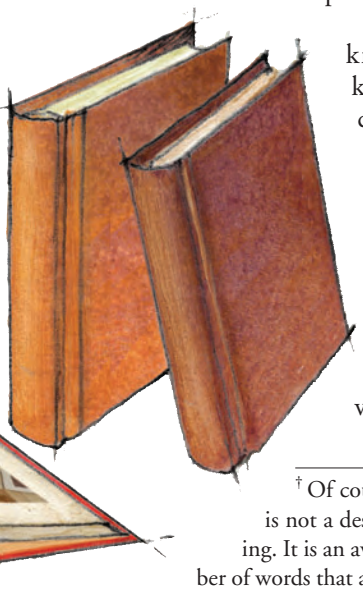


dents—it widens over time.[18] Potentially, though, schools could alter this pattern because the rates of vocabulary growth in the two students do not have to be identical. If a student who is behind in word knowledge can be brought to know 90 percent of the words that she hears and reads in school, then she can pick up new words at a faster rate than the advantaged student who already knows 95 percent of the words heard and read in school. This is because the former child is getting more opportunities to learn new words since she is further from a point of diminishing returns.

Besides this structural possibility for narrowing the vocabulary gap, there is a further opportunity for catching up, depending on the special richness of the vocabulary being studied in school. That is because the vocabulary heard in school is potentially richer than the vocabulary heard outside school. Oral speech tends to use a smaller vocabulary than written speech.[19] Almost all of the rare words that we know have been gained from print—print that we read silently or that is read aloud to us.[20] If school conditions provide enough context familiarity to speed up the learning of these rarer words for all groups, then the relative gain by the disadvantaged groups will be greater and the gap will be narrowed.

III. What Knowledge and How Much?

Such is the case for the fundamental, inescapable importance of substantial, broad background knowledge for reading comprehension (and for performing well on reading comprehension tests). But agreement on this begs the next question: Knowledge of what? What knowledge should the schools be responsible for teaching to all kids? I believe that part of the answer is quite straightforward, and I hope uncontroversial—and to teach it ought to take about 40-60 percent of curricular time. I will return to this question in a moment and explain how I think we should answer it.



But beyond this central core of knowledge that all students should know, how should the rest of students' curricular time be spent? Exactly how much emphasis should schooling give to a particular event, individual, or historical trend? The answers to these questions will always be somewhat subjective. Individuals from different regions and from different religious, ethnic, and racial backgrounds may have particular views about what the proper emphases should be. In addition, local districts, states, schools, and individual teachers will have particular ideas about what should be taught, given their particular histories and their own knowledge of what is interesting, relevant, and useful to the students in their schools and classes. Part of the curriculum, perhaps about half, should be reserved for topics that have local resonance. Different locales will make different choices and the debates over those choices will no doubt be lively and interesting—and hopefully enrich our children's education in many ways.

Part of the curriculum, perhaps about half, should be reserved for topics of community importance…. But, let's also move quickly to identify and impart the half of the curriculum that all students deserve to be taught.

But while we pursue these debates and encourage local areas to make different choices about how to allocate this portion of the curriculum, let's also move quickly to identify what should be in the half of the curriculum that all students deserve to be taught. The question that we need to answer is what must students learn so that as adolescents and adults they are able to comprehend written and spoken material aimed at educated general audiences—newspaper stories of civic interest, political debates, popular books and magazines, entry-level college texts, job-related reading, high school exit tests and SATs, directions and commentaries by employers, testimony heard by juries, etc. Students who possess this knowledge are prepared to participate in civic life, move up career ladders, succeed in college, converse confidently with a wide variety of Americans with whom they work or socialize, and generally have the esteem that comes with being regarded as an educated person.

So, again the question: What knowledge?

Students Need the Knowledge That Allows Them to Read Material Aimed at a "General Audience"

To sketch an answer to the question of what knowledge, we need a good understanding of the notion of the "general audi-

[†] Of course, the figure of 10 to 15 new words a day is not a description of the actual process of word learning. It is an average number, arrived at by taking the number of words that a superior student knows at age 17 and dividing that number by the number of days the student has lived from age 2 to age 17. Children actually gain vocabulary in fits and starts with advances and retreats and slow progress in small increments along a broad front. Words aren't learned through one or even two exposures; knowledge of what words mean and how they can be used gradually accumulates.

ence." When we say we want to educate good readers, we don't mean that we expect them to read a treatise aimed at physicists or constitutional scholars; we mean that we expect them to be good "general readers." But what does that mean? It sounds almost circular, but it means that they possess the shared knowledge that is assumed by individuals who communicate with an educated general audience.

Every newspaper and book editor and every producer for radio and TV is conscious of the need to distinguish what can be taken for granted from what must be explained. Learning the craft of writing is bound up with learning how to gauge what can be assumed versus what must be explained. The general reader that every journalist or TV newscaster must imagine is somebody whose relevant knowledge is assumed to lie between the total ignorance of a complete novice and the detailed knowledge of an expert. A newspaper baseball story cannot assume an audience as uninformed about the game as our imagined British person or one consisting of baseball experts. Every person who speaks and writes must make an estimate of what can be left unexplained and what must be explicitly stated. Proficiency in reading (and listening, speaking, and writing) requires possession of the broad knowledge that the general reader is assumed to have.

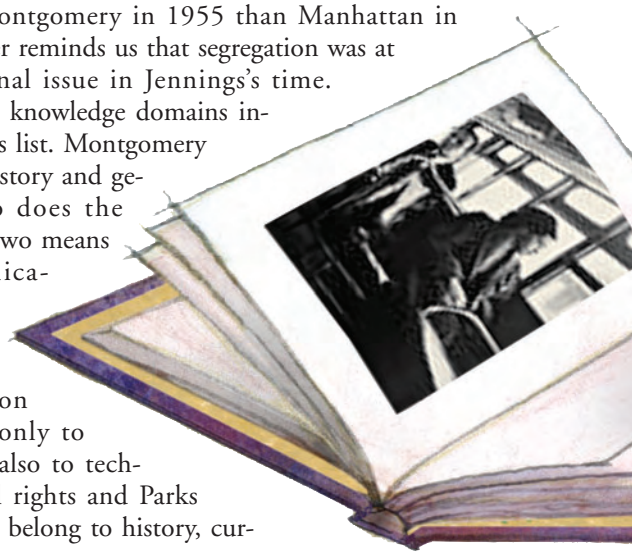
Here are the first three paragraphs of an article by Katherine Greider, taken at random from the City Lore section of the *New York Times* on November 13, 2005. It is an example of writing addressed to a general reader that a literate American high school graduate would be expected to understand.

> As the civil rights figure Rosa Parks lay in state in the Capitol Rotunda two weeks ago, her 19th-century Northern forerunner, a young black schoolteacher who helped integrate New York's transit system by refusing to get off a streetcar in downtown Manhattan, rested in near-perfect obscurity.
>
> Mrs. Parks's resistance on a bus became a central facet of American identity, a parable retold with each succeeding class of kindergartners. But who has ever heard of Elizabeth Jennings?
>
> The disparity is largely an accident of timing. Thanks to television, Americans around the country became a witness to events in 1955 in Montgomery, Ala.; by contrast, Jennings's supporters had to rely on a burgeoning but still fragmented mid-19th-century press. By 1955, when Parks refused to be unseated, segregation was emerging as an issue the nation could not ignore. When Jennings, 24, made her stand, on July 16, 1854, the first eerie rebel yell had yet to rise from a Confederate line. Segregation was a local or perhaps a regional story. It was slavery that was tearing the nation apart.

This example shows that the background knowledge required to understand the general sections of the *New York Times*, such as the City Lore section, is not deep. It is not that of an expert—of course not, for we cannot all be experts on the diverse subjects that are treated by newspapers. If publishers want their papers to be sold and read widely, they must not assume that their readers are experts. They may take for granted only the relevant background knowledge that a literate audience can be expected to possess.

What do readers need to know in order to comprehend this passage? First and foremost, we need to know who Rosa Parks was—indeed, the author suggests that those who do not know of Rosa Parks are less knowledgeable than the typical kindergartner. We need to have at least a vague semantic grasp of key words like integrate, streetcar, obscurity, parable, disparity, and segregation. We must be able to picture "a burgeoning but still fragmented" press and grasp how it contrasts with 1955 television's ability to make Americans a "witness" to events. We need to know some of the things mentioned with exactness, but not others. The author clearly does not expect us to know who Elizabeth Jennings was—but we are expected to know enough about Parks to immediately grasp what Jennings faced when she refused to get off a streetcar. The mere mention of Montgomery, Ala., is assumed to trigger a flood in our minds of facts, film footage, and photos from the bus boycotts. Likewise, the words "rebel yell" and "Confederate line" are assumed to fill our minds with facts and photos from the Civil War. Note, however, that more knowledge is assumed with regard to Montgomery in 1955 than Manhattan in 1854: Greider reminds us that segregation was at best a regional issue in Jennings's time. Consider the knowledge domains included in this list. Montgomery belongs to history and geography; so does the North. The two means of communication and the two means of transportation belong not only to history, but also to technology. Civil rights and Parks lying in state belong to history, cur-

What must readers know to comprehend this passage? Enough about Rosa Parks to immediately grasp what Jennings faced when she refused to get off a streetcar. The mere mention of Montgomery, Ala., is assumed to trigger a flood in our minds of facts, film footage, and photos.



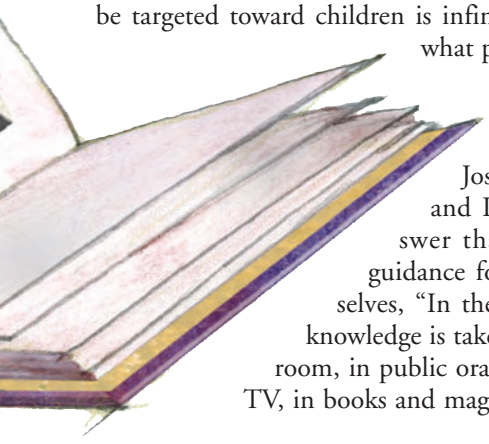
It is remarkable how much of the early curriculum in America can be built by simply asking the question, "Is this information often taken for granted in talk and writing addressed to a general literate audience?"

rent events, and politics. We may infer from this example that only a person with broad general knowledge is capable of reading with understanding the *New York Times* and other such newspapers.

Reading achievement will not advance significantly until schools recognize and act on the fact that it depends on the possession of a broad but definable range of diverse knowledge. Our sketch of the background knowledge needed to understand Greider's short passage offers clues to the kind of instruction that is needed to advance general reading comprehension ability. It will be broad instruction in the worlds of nature and culture that will build the necessary platform for gaining deeper knowledge through listening and reading.

What Knowledge Is Necessary to Be a Good General Reader?

The knowledge that exists in the world and could, in theory, be targeted toward children is infinite. How can we identify what portions of that knowledge are best to help students become strong general readers? My colleagues Joseph Kett and James Trefil and I set out to define an answer that would provide useful guidance for schools. We asked ourselves, "In the American context, what knowledge is taken for granted in the classroom, in public orations, in serious radio and TV, in books and magazines and newspapers addressed to a general audience?" We considered and tried out various scholarly approaches to this problem.



Ultimately, we determined that the best way to answer this question was by asking professional speakers and writers (including, for example, lawyers, who must convince juries, and newspaper reporters) what specific items of knowledge they take for granted when they speak and write. We then used a process that involved regional groups of teachers, as well as administrators, representatives from education and other groups, a multicultural advisory group, and scholars from relevant disciplines to review the critical material, to add to it, and to subtract from it. From people in every region of the country we found a reassuring amount of agreement on the substance of this taken-for-granted knowledge.

Several years after our compilation of such knowledge was published, independent researchers investigated whether reading comprehension ability did in fact depend on knowledge of the topics we had set forth. The studies showed an unambiguous correlation between knowledge of these topics and reading comprehension scores, school grades, and other indexes of reading skill.[21] One researcher investigated whether the topics we set forth as taken-for-granted items are in fact taken for granted in newspaper texts addressed to a general reader. He examined the *New York Times* by computer over a period of 101 months and found that "any given day's issue of the *New York Times* contained approximately 2,700 occurrences" of these unexplained terms, which "play a part in the daily commerce of the published language."[22]

This technical approach to deciding what children need to know in order to join the literate speech community is, of course, just one strategy for identifying the content we need to teach in the early grades. It does not include our ethical, civic, and aesthetic aspirations for education, nor topics that are of particular interest in some places but not others. But this technical approach is a big start. It is remarkable how much of the early curriculum in America can be built by simply asking the question, "Is this information often taken for granted in talk and writing addressed to a general literate audience?" As my colleagues at the Core Knowledge Foundation have shown, a very rich and interesting early education can be based on this principle. Striking examples of success from applying this approach can be found—disadvantaged students gaining ground, and all students gaining high literacy. (See "Engaging Kids with Content: 'The Kids Love It,'" p. 22.)

IV. Maximizing Reading Comprehension, Especially Among Poor Children

Time is of the essence. Because of the Matthew effect, the greatest opportunities for enhancing language comprehension come early; once wasted, they may be lost permanently. What are the best ways to use school time productively so that we bring students from all social backgrounds to proficiency in reading and writing? How can we impart the most enabling language and knowledge as quickly as possible? Most reading activities that teachers and parents engage in with young children have been shown by research to be beneficial. But re-

search rarely asks or answers a crucial question—what is the opportunity cost of engaging in this reading activity rather than that one?

"Opportunity cost" is an important concept from economics that reflects the fact that we forgo some benefits whenever we engage in one activity rather than another. If we read the same story three times to a child, we need to ask, how great are the benefits that the child will accrue by repetition compared to the benefits of using that valuable time in more productive activities, such as reading other stories on the same topic? If we ask students to repeatedly endure lessons and exercises on "main idea" and "prediction" and "inferencing" instead of using that time to familiarize them with important content, are we using the time as well as we could? The principle of opportunity cost in reading instruction has become even more important now that longer periods—as much as two and one-half hours in New York City and California and at least 90 minutes virtually everywhere—are being devoted to language arts in the early grades. This means that language arts are getting time that in the past may have been allotted to history, science, and the arts. Yet those neglected subjects are ultimately among the most essential ones for imparting the general knowledge that underlies reading comprehension.

Bring Content to Reading Instruction

A great opportunity is being lost when an efficient and coherent approach to the knowledge required for reading is neglected in the very place where it is most needed—namely, in the long hours devoted to the subject of reading. Decoding experts suggest that for most children, about 30 minutes per day is necessary to teach decoding in grades 1 and 2 (more and with greater intensity for struggling students).[23] Where schools spend 90-120 minutes per day on reading throughout the elementary grades, that leaves at least an hour per day that could be devoted to imparting the language and world knowledge that is most important for competence in listening, talking, reading, and writing. Substantive topics in literature, history, the arts, and the sciences—all of which literate Americans take for granted—are deeply interesting and highly engaging to children.

For many years, the great reading researcher Jeanne Chall complained that the selections offered in language arts classes did not provide students with the knowledge and language experiences they need for general competence in reading. In the two decades since Chall entered this complaint, little has changed. Regrettably, most early reading materials and programs take such a formalistic view of reading comprehension that they neglect the systematic expansion of children's general

What Do Reading Comprehension Tests Mainly Measure? Knowledge.

I want to outline some facts about reading comprehension tests that are not widely known, yet need to be familiar to any parent, teacher, or citizen who is interested in educational improvement. Let's begin by considering the fourth-grade guidelines for teaching and testing reading comprehension, as published by two representative states (all states issue these kinds of guidelines).

New York

Students will listen, speak, read, and write for information and understanding. As listeners and readers, students will collect data, facts, and ideas; discover relationships, concepts, and generalizations; and use knowledge generated from oral, written, and electronically produced texts.

- interpret and analyze information from textbooks and nonfiction books for young adults, as well as reference materials, audio and media presentations, oral interviews, graphs, charts, diagrams, and electronic databases intended for a general audience;
- compare and synthesize information from different sources;
- use a wide variety of strategies for selecting, organizing, and categorizing information;
- distinguish between relevant and irrelevant information and between fact and opinion;
- relate new information to prior knowledge and experience; and
- understand and use the text features that make information accessible and usable, such as format, sequence, level of diction, and relevance of details.

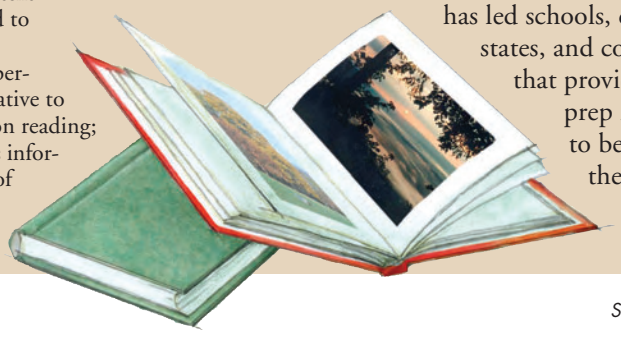
Florida

The student constructs meaning from a wide range of texts.

- reads text and determines the main idea or essential message, identifies relevant supporting details and facts, and arranges events in chronological order;
- identifies the author's purpose in a simple text;
- recognizes when a text is primarily intended to persuade;
- identifies specific personal preferences relative to fiction and nonfiction reading;
- reads and organizes information for a variety of purposes, including making a report, conducting interviews, taking a test, and performing an authentic task; and
- recognizes the difference between fact and opinion presented in a text.

Given such vague guidelines, consider the predicament of schools and students under the current accountability arrangements. What are educators to do? It becomes logical to think like this: *The tests are coming. We don't know what topics the children will be asked to read about (because they are not identified in states' reading guidelines—or, for the most part, in states' content standards). The tests will probe reading comprehension skills, so we must teach those skills.*

How does one prepare students to take this kind of test? Logic has led schools, districts, states, and companies that provide test-prep materials to believe that they must train



knowledge and accompanying vocabulary. The systematic phonics in these programs (which, on the whole, are admirable) are not backed up by a systematic approach to the background knowledge that the children will need for later reading comprehension.[24]

We need to reconceive language arts as a school subject. In trying to make all students proficient readers and writers, there is no avoiding the responsibility of imparting the specific knowledge they will need to understand newspapers, magazines, and serious books directed at the national language community. There is no successful shortcut to teaching and learning this specific knowledge. Those who develop language arts programs at the school level or in publishing houses must understand that the skills they wish to impart are in fact knowledge-drenched and knowledge-constituted. The happy consequence will be reading programs that are much more absorbing, enjoyable, and interesting than the disjointed, banal programs offered to students today.

Topic Immersion

We know that proficient reading requires an adequate vocabulary. We know that children's vocabularies will get bigger when they hear or read rich material, fiction or nonfiction. But not everyone knows how to answer these questions about time use: What is the most effective way to foster vocabulary gain? Is it better to read a child a short text of a different kind each day, or is it better to stay on a topic that stretches over several days or weeks? As we have seen, important research suggests that children can learn words much faster if we stick to the same topic for several sessions, because word learning occurs much faster—up to *four times faster*—when the verbal context is familiar.[25]

Suppose, for example, you are reading to 5-year-old Dmitri a story about kings and queens. If you extend that topic for the next few days by reading more fiction and nonfiction stories about kings and queens, how they lived, and what they did, the chances are that Dmitri will increase his general knowledge and vocabulary faster than if you read about zebras the next day, planets the day after that, and so on. Clearly, then, a good way to induce fast vocabulary gain for young children (for whom so much is new and unfamiliar) is to stay on a subject long enough for the general topic to become familiar.

Oral Language Development/Reading Aloud

The crucial years for gaining a good start in language are the early years.[26] At the youngest ages, 2 through 7, long before

(Continued)

students in the kinds of procedures elicited by the test: Clarify what the passage means, question the author, find the main idea, make inferences about the passage, study the meanings of words, consider which event in the narrative comes first, and which next.

But in fact, this preparation is not mainly what students need. Let's look at a characteristic bit of prose and a typical question from one of these reading tests.

> There is a path that starts in Maine and ends in Georgia, 2,167 miles later. This path is called the Appalachian Trail. If you want, you can walk the whole way, although only some people who try to do this actually make it because it is so far, and they get tired. The idea for the trail came from a man named Benton MacKaye. In 1921, he wrote an article about how people needed a nearby place where they could enjoy nature and take a break from work. He thought the Appalachian Mountains would be perfect for this.

This article is mostly about:

- how the Appalachian Trail came to exist;
- when people can visit the Appalachian Trail;
- who hikes the most on the Appalachian Trail; and
- why people work together on the Appalachian Trail.

A student's actual ability to find the main idea of a passage is not a formal ability to follow procedures that will elicit the main idea, but rather the ability to understand what the text says. No repetitions of classroom exercises will help the test-taker who does not know what hiking is, or what low, tree-covered mountains are like (they are not like the snow-covered Himalayan mountains most often pictured in books), or where Maine and Georgia are. Classroom practice in strategies cannot make up for the student's lack of the background knowledge needed to understand this passage, and no instruction in strategies is required in order to answer the questions quickly and accurately if the student knows about hiking in the Appalachians, Maine, and Georgia.[1] The inferences that we make when we hear or read speech are derived from our relevant knowledge about the domain of the passage. The comprehension skills that students are supposed to learn by practicing "comprehension skills" cannot lead to high test performance because they do not lead to actual comprehension.

Conscious strategizing is also slow and cumbersome. Speed is slower and scores are lower for unfamiliar topics than for familiar ones. This is true for all readers.[2] Tests are time-sensitive, as reading comprehension itself is, because slowness implies mental overload and mental overload impairs understanding. The mental speed that is bestowed by topic familiarity is important not just for completing the test on time, but also for getting the answers right. In sum, a child who already knows about the Appalachian Trail, who has heard or read about it or seen or walked it or read about similar trails, will process the passage much faster and more accurately than a child to whom such things are unfamiliar, even though the two children have identical decoding and strategizing skills. They have learned equally well the lessons that the classroom has taught. Yet these two students make vastly different scores on the reading test because one student possesses more general knowledge than the other.

Every highly valid and reliable reading test contains several different passages sampling several knowledge areas and

(Continued)

children can comprehend through reading as well as they can through listening, progress in language occurs chiefly through listening and talking, not through reading and writing. This reality has rightly resulted in some time being devoted to teacher read-alouds in the early grades. But it's worth considering how we might treat these read-alouds and the conversations they generate differently if we regarded them as absolutely fundamental to imparting necessary knowledge to children. For example, we might consider the effects of topic immersion—reading a sequence of books on a significant topic (over days or weeks) instead of selecting books as stand-alone texts. We would select books in part for the topics and language they brought to the classroom and for the challenging classroom conversations they sparked. We would consider how to use other classroom activities to engage children in the content of the books.

We need to place a great deal of emphasis in early grades reading classes on nonwritten, oral activities—on adults reading aloud coherent and challenging material, on discussing it, on having children elaborate on these materials. There is every scientific reason to predict that an intensive focus on oral language development during the classroom reading period in early grades will not only raise reading achievement for all students, it will also help narrow the gap between social groups.

V. Beyond the Reading Class—Imparting Important Knowledge Systematically, from the Earliest Ages

Great strides could be taken with reading comprehension if we simply brought well-considered content into the reading curriculum. But there's no getting around the fact that that's only the beginning. If we really want to impart to students the general knowledge that will allow them to be strong general readers, they, especially if they're not already from print-rich homes, deserve immersion in well-considered content all day long—and from the earliest ages. And, as we will see, for practical reasons, the specifics of the content—and when it will be taught—can't be decided separately by each school, teacher, or district. Not if we really care about whether our students actually learn what they need to learn in order to be strong readers.

Why Educational Effectiveness and Equity Require Students across Schools to Share a Curriculum Core

I'm now looking at one state's guidelines for language arts. (I won't reveal the state, since its request for me to review the document indicates its own dissatisfaction with them.) This state curriculum guide is quite typical. It is a 103-page document organized into a dozen broad categories, all of which

kinds of writing. That fact in itself gives away the knowledge-based character of reading, since if reading comprehension were a set of all-purpose formal strategies, a single passage would test reading skill perfectly well. But because general reading skill requires broad general knowledge, a valid test must sample several genres and areas of knowledge. Take, for example, the Iowa Test of Basic Skills (ITBS). It contains nine short passages of different genres: fiction about a bird, a biography, some lyric poetry, fiction about sports, exposition about another country, fiction about a TV program, exposition about the habits of an animal, exposition about the lives of Native Americans, and exposition about a religious sect. The prose passages are short—150 to 290 words—and each is followed by roughly four multiple choice questions.

The multiple domains on any valid reading test are chosen not because they directly reflect what is taught in school, but because *they reflect an ability to read passages from an unpredictable diversity of domains*. In order to read a wide array of passages in different domains, a person must have a wide array of knowledge.[3]

Reading Tests Are Useful … but Not for Measuring Yearly Progress in Comprehension

Like all tests, a reading comprehension test is a sampling device. It doesn't test the whole range of possible knowledge domains or kinds of text. That would make it far too long. It offers a few typical samples from a few typical domains, and students' performance on these samples is taken to estimate their reading comprehension over the whole universe of reading tasks that confront the general reader. (The best of the tests do a very good job of making that estimation. For example, scores in early grades predict scores in later years, school grades, and even job performance and income.[4])

But these tests have severe shortcomings when used to measure yearly student progress in the early grades. Although imparting the background knowledge needed for general reading ability is a multiyear project (covering at least the first six years of schooling and beyond), real progress in building the background knowledge and vocabulary that underlie reading comprehension can occur in the early grades without that progress being registered on a reading comprehension test. Especially in the early grades, when children are making irregular, desultory progress in knowledge and vocabulary that cannot be sensitively measured by such tests, general reading tests can be quite inadequate gauges.

For example, if a student has just learned about the Civil War, he may not make a noticeably better grade on a short reading test that samples domains far removed from that subject. But in reality, his ability to read passages about Grant and Lee and Lincoln with comprehension has grown, even if the test does not measure that progress. He will also be able to read about events related to war and history with greater comprehension. He will know what a regiment is and what the word *bloodshed* means, though these are not on the test. He may have learned more about some of the words on the test and still not be able to answer correctly, because some of his gradual gains in word understanding, a slow, subliminal process requiring many exposures to a word, do not reach the measurement threshold of the test.

If schools wish to meet "adequate yearly progress" as required by No Child

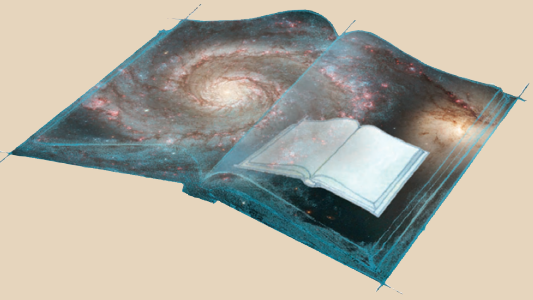
apply to all grades from kindergarten through grade 12. The general categories have process rubrics like "Students shall demonstrate knowledge and understanding of media as a mode of communication," "Students shall employ a wide range of strategies as they write, using the writing process appropriately," and "Students shall apply a wide range of strategies to read and comprehend written materials." Then, in the more "detailed" amplifications of these categories for the early grades, we find directives like, "Distinguish the purpose of various types of media presentations, using informational or entertainment presentations," "Use a variety of planning strategies/organizers," and "Draft information collected during reading and/or research into writing." For later grades, the detailed amplifications are directives like, "Write research reports that include a thesis and use a variety of sources" and "Read a variety of literature, including historical fiction, autobiography, and realistic fiction."

These are empty admonitions. And they constitute the first major shortcoming of these process-oriented, formalistic guidelines—they offer no real guidance. In offering no guidance, they guarantee an incoherent education with huge gaps and boring repetitions. Elementary school students reasonably complain of reading *Charlotte's Web* three years in a row. That's not too surprising.With guidelines like these, why should Mr. Green in grade three, Ms. Jones in grade four, and Ms. Hughes in grade five not treat their students to a book they are very fond of? Of course, while students are reading that estimable work three years running (being bored in two of them), they are missing at least two other estimable books they might have been introduced to.

This kind of problem is not limited to language arts. I once did an analysis of a district science curriculum which, like most American curricula, had a hands-on, formalistic, process orientation and found that students did a hands-on study of seeds in four different grades but were never required to learn about photosynthesis at all.[27] Gaps and repetitions are the reality of American students' school experience even when they stay in the same school—and the gaps are far greater for those many disadvantaged students who must change schools (see "Why the Absence of a Content-Rich Curriculum Core Hurts Poor Children Most," page 27). These gaps and repetitions occur unwittingly, not through the fecklessness of guideline makers nor the incompetence of teachers, but thanks to the formalistic idea that no particular piece of knowledge will boost reading comprehension more than any other. It is true that some of the new state standards can point to increasingly specific guidance in a few areas, but these are the exceptions.

(Continued on page 28)

Take, for example, the Iowa Test of Basic Skills (ITBS). It contains nine short passages of different genres: fiction about a bird, a biography, some lyric poetry, fiction about sports, exposition about another country, fiction about a TV program, exposition about the habits of an animal, exposition about the lives of Native Americans, and exposition about a religious sect.



Left Behind (NCLB), they should systematically teach and then test for the knowledge that leads to proficient reading comprehension. This means that schools must have a specific, grade-by-grade curriculum designed to systematically build the knowledge that an educated reader needs—and a test that has been carefully aligned with that curriculum. The curriculum must be clearly laid out in literature, science, history, and the arts, for these are the large domains that constitute the background knowledge required for reading comprehension. The monitors of NCLB compliance should recognize that adequate yearly progress in early reading is in fact occurring if students show that they are not only decoding well, but also gaining knowledge, as demonstrated on these curriculum-based tests.

What Kinds of Test Preparation Will Enhance Education?

What can calm the frantic and ineffectual test preparation that has overtaken many schools as they labor to meet NCLB's adequate yearly progress requirement? Students and teachers cannot directly prepare for a reading test. (A one-time gain can typically be achieved by devoting a small amount of time to assuring that children are familiar with the testing format and test-taking strategies.) No one should be able to predict the subject matter of the passages on such a test and specifically learn about it. That would be cheating. It would defeat the test's purpose, which is to discover how well the test-taker can be expected to read an unpredictable array of texts in and out of school. The essence of such a test is its unpredictability. But if you cannot predict the subject matter on a valid reading test, how can you prepare students for it? You can't, and, therefore, you shouldn't try. The only useful way to prepare for a reading test is indirectly—by becoming a good reader of a broad range of texts, an ability that requires broad general knowledge.

—E.D.H

(References on page 50)

Engaging Kids with Content: "The Kids Love It"

Can all this content really be taught to kids? Would it be a bore for them, drudgery for teachers? The only way to know is to try it out. The Core Knowledge Foundation produced a Pre-K-8 curriculum sequence based on one central question: What knowledge do writers take for granted when they write for a general, educated audience? The sequence offers teachers grade-by-grade guidelines for teaching a rich content-packed curriculum. It's now being used in hundreds of schools. What's the verdict? "The kids love it." Core Knowledge teachers are quick to note: 1) the curriculum sequence specifies content, but not teaching methods; 2) following the sequence does not take the whole school year; and (3) students find the content fascinating. *American Educator* can't send you on a site visit, but we can bring the teachers' voices to you. Here, Rachel Pacheco, a first-grade teacher at Hawthorne Academy in San Antonio, Texas, and Gloria Farley, a third-grade teacher at Osmond A. Church School in New York City, explain how they use the Core Knowledge Sequence and what it has done for their students.

* * *

Hawthorne Academy has been using the Core Knowledge Sequence since 1992. Over the past several years, it has converted from a regular elementary school to a comprehensive early childhood- through eighth-grade school that begins with full-day pre-kindergarten for 3-year-olds. Despite the fact that 90 percent of the students are economically disadvantaged, 93 percent of the students passed the state reading test in 2005—that's 10 percentage points higher than the statewide passing rate. But their success isn't limited to reading: Hawthorne students surpassed the statewide passing rate (by at least seven percentage points) in mathematics, writing, science, and social studies, as well.

"We use Core Knowledge as the main content in science and social studies, but we also incorporate it in math, language arts, and reading. Our curriculum is driven by the state and district standards—and Core Knowledge provides the meat, or the specific content, that we use to meet those standards. Working together, our first-grade teachers mapped out the curriculum for the year. We organized the content into four units, one for each nine week period. This year-long plan now serves as our guide and helps to keep us on track while still giving us the freedom to decide on our own the 'how-to' of teaching that content.

A recent conversation with a friend who started teaching in another school district in February made me really appreciate Core Knowledge. She knew she had to teach the state standards, but she didn't have any idea what her class had covered so far this year. She feared repeating what had already been taught or perhaps missing something that had not yet been taught. The Core Knowledge Sequence spirals and is mapped out so that children build upon their knowledge rather than repeat the same content each year. So, for example, we just finished our unit on the solar system; it was just an introduction to the nine planets, the phases of the moon, the sun, stars, and constellations. When the children get to third grade, they will study the solar system again. They will review what they learned in first-grade and build upon that to go more in depth with their studies.

Core Knowledge allows for consistency within the grade level so that all first-graders are learning the same thing. Yet, each teacher is still able to teach the topics the way she thinks she should and to personalize the content for her class. We just finished our unit on the Mayas, the Aztecs, and the Incas. After our discussion on the Aztec city of Tenochtitlan, I chose to show my students a video of a computer recreation of this city on a lake. The bilingual teacher across the hallway, Mrs. Alarcon, had her students go home and create their own Tenochtitlan based on what they had learned about this ancient city. The children's projects were amazing! They used many different materials to create a support system that would allow them to build on water. This led to a great discussion about the struggles the Aztecs faced in trying to build this incredible city. Mrs. Alarcon's class went around to the other first-grade classes and presented their project. Needless to say, we will all be using her idea next year.

COURTESY HAWTHORNE ACADEMY

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(Top) Rachel Pacheco, Hawthorne Academy, San Anotnio; (above) Gloria Farley, Osmond A. Church School, New York City

Our children are so excited about what they are learning. When a unit ends, they don't want to stop learning. I have to remind them that they will return to the topic at another grade level. But they say, 'Tell us now, tell us now Miss Pacheco, we want to know now!' And that's what makes it worth it: The children love being in school, they love what they are learning, and they can't wait until it's time to talk about the Mayas, the Aztecs, the solar system, or any other Core Knowledge topic. Parents get excited, too. One said to me, 'Oh my gosh, my child came home today and taught me about the four phases of the moon and the constellations.' Another said, 'I had no idea what Mesopotamia was! My child is teaching me a lot!'

People cannot fully appreciate Core

Knowledge until they visit a Core Knowledge school and speak to the students and teachers. I remember being that first-year teacher thinking, 'Where am I going to find something on Mesopotamia or Ancient Egypt that is appropriate for first grade?' It was hard, but once I started looking and talking to other teachers, I was amazed at what I found. And the kids love it. Teaching and learning have never been so much fun and so exciting."

—Rachel Pacheco, first-grade teacher

* * *

In 1999, before the Osmond A. Church School (PS 124 in geographic district 27) began using the Core Knowledge Sequence, just 33 percent of its fourth-graders scored either proficient or advanced on the state English Language Arts test. But last year, 80 percent of the students scored proficient or advanced. That's 20 percentage points higher than the citywide average—and it's all the more impressive considering that 100 percent of PS 124's students are eligible for the free-lunch program. Last year, 92 percent of the fourth-graders in the school (compared to 77 percent citywide) scored proficient or advanced on the state math test.

"*When I first began teaching here, I didn't know about the Core Knowledge Sequence. It was just here. I think it's great, fabulous. It lends itself to going beyond the regular curriculum. Children are able to read, learn, and appreciate more. It helps me stretch kids to places I didn't know they could go.*

My children love to write poems. We read lots of poetry—'Dream Variation' by Langston Hughes, 'The Crocodile' by Lewis Carroll, and 'Trees' by Sergeant Joyce Kilmer are just a few examples. The kids also write their own poetry, their own couplets.

Core Knowledge drives the entire curriculum. It is a broad-based and diverse curriculum that allows the children to learn about other cultures. For example, I recently read Arabian Nights *aloud to my students, and I combined it with an art lesson by having students design and draw their own rugs.*

The students absolutely enjoy Core Knowledge. They are highly motivated and constantly asking questions. One project that the students loved was a research project we recently completed on orchestra instruments. The students worked in four groups—string, percussion, woodwind, and brass—and each student selected a particular instrument to study. This project culminated with a presentation by each group. I enjoy Core Knowledge too. But I don't have one favorite topic to teach—I really treasure them all because of the many opportunities I have to make connections among topics and relate all of the academic subjects to one another."

—Gloria Farley, third-grade teacher

Samples from the Core Knowledge Sequence for First Grade

American History and Geography

I. Early People and Civilizations
B. Maya, Inca, and Aztec Civilizations

Teachers: Children will study the Maya, Inca, and Aztec civilizations in detail in grade 5. First-grade teachers should examine the fifth-grade guidelines to see how these topics build in the later grade. Here, introduce children to these civilizations…

- Maya in Mexico and Central America
- Aztecs in Mexico
  Moctezuma (also called Montezuma)
  Tenochtitlan (Mexico City)
- Inca in South America
  (Peru, Chile)
  Cities in the Andes, Machu Picchu

II. Early Exploration and Settlement
C. English Settlers

- The story of the Lost Colony
  Sir Walter Raleigh
  Virginia Dare
- Virginia
  Jamestown …

Visual Arts

III. Kinds of Pictures: Portrait and Still Life

Teachers: Introduce children to the terms we use to describe different kinds of paintings, discuss examples, and provide opportunities for children to create their own works in different genres. When you look at the specified works, ask the children about their impressions –what they notice first, and what the picture makes them think of or feel. Go on to discuss lines, shapes, colors, and textures; details not obvious at first; why they think the artist chose to depict things in a certain way, etc.

- Recognize as a portrait or self-portrait:
  Leonardo da Vinci, *Mona Lisa*
  Francisco Goya, *Don Manuel Osorio Manrique de Zuñiga*
  Vincent van Gogh, *Self-portrait* [1889]
- Recognize as a still life:
  Vincent van Gogh, *Irises*
  Paul Cézanne, studies with fruit, such as *Apples and Oranges*
- Recognize as a mural (a painting on a wall):
  Diego Rivera, *The History of Medicine in Mexico*

Science

V. Introduction to Electricity

Teachers: Through reading aloud, observation and experiment, explore with children basic principles of electricity and electrical safety rules.

- Static electricity
- Basic parts of simple electric circuits (for example, batteries, wire, bulb or buzzer, switch)
- Conductive and nonconductive materials
- Safety rules for electricity (for example, never put your finger, or anything metallic, in an electrical outlet; never touch a switch or electrical appliance when your hands are wet or when you're in the bathtub; never put your finger in a lamp socket; etc.)

Note: A variety of materials exist that teachers can use or adapt to teach the material outlined in the sequence. For more information, see the Core Knowledge Web site at ***www.coreknowledge.org****.*

How We Neglect Knowledge—and Why

By Susan B. Neuman

Several years ago, in collaboration with Kathy Roskos, I was studying the effects of a literacy-related activity that made use of a pretend "office" in a Head Start center (Neuman and Roskos, 1993). Using a task developed by Lomax and McGee (1987), I asked 4-year-old Terrell to identify several objects and to describe their use. Specifically, the purpose of the assessment was to determine whether a child's involvement with objects like a calendar, grocery list, map, or letter in a literacy-related play setting might lead to greater understandings of functional print, defined as knowing the name of the object and knowing its purpose. Pointing to the business letter inside an envelope, I asked, "What's this?" "A mail," he said. Even though the protocol called for a dichotomous yes or no, it was hard to resist writing sort of.

Following the initial prompt, I asked him what the object could be used for. He did not respond. Continuing down the list to other literacy-related objects (i.e., a grocery list, a coupon), I found that they, too, were "a mail."

At the time, I assumed an instrumentation error—the instrument was obviously insensitive to a child's language and way with words. The decontextualized objects had, perhaps, lost their meaning. But it was also true that, although Terrell had been very active in the play office setting, he had not necessarily used the contents in meaningful ways or in a dramatic play. Still, I was convinced that due to his interest and activity, Terrell would be ready for kindergarten instruction and would succeed in reading.

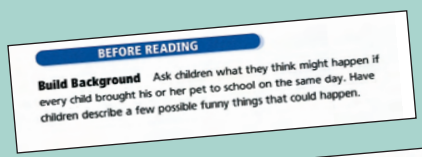
I am not so optimistic anymore. What I failed to recognize in constructing this

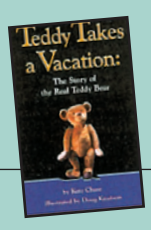
Neglected Knowledge: The Facts

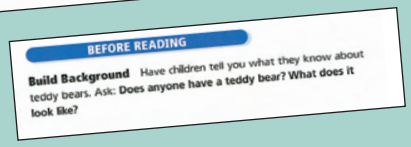
Basal Publishers Misunderstand the Importance of Building Background Knowledge

According to Marilyn Jager Adams (2005), a top reading researcher, the publishers of basal readers—like so many educators across the country—were mislead by the whole-language movement of the 1970s and 1980s. Describing the times, she writes, "Increasingly, teachers began to eschew published curricular materials, and in response, publishers began to displace their orderly lesson designs with a smorgasbord of 'engaging' activities. The proven importance of teaching children the language and background knowledge required for their lessons and texts was reversed to a concern for ensuring that their lessons and texts not exceed the language and background knowledge they already possessed" (p. 230). This is a catastrophic misunderstanding. Instead of systematically *building* children's background knowledge and vocabulary, basals systematically *limited* the background knowledge and vocabulary covered by their texts.

In the Spring 2003 issue of *American Educator*, Kate Walsh provided clear examples of this distortion of the research on background knowledge. Sadly, her examples did not come from basals from the 1970s and 1980s; they were from basals published in 2000 and 2003—documenting that today's basals continue to limit, instead of build, background knowledge. Two of Walsh's examples are reproduced here.







Basal Readers Include Very Little Informational Text

Studies since the mid-1980s have consistently shown that basal readers include very little informational text. For example, Flood and Lapp (1986) looked at the first- through sixth-grade content of eight basals finding that narrative selections accounted for more than 66 percent of the pages. Smith (1991), who looked at the content of three basals for grades one, three, and five, found that 15 to 20 percent was nonfiction content. More recently, Moss and Newton (2002) examined how many selections from informational trade books were included in six popular basal readers published from 1995 to 1997. As the chart on the right shows, informational literature is relatively sparse.

Important Content Is Being Squeezed Out

According to "Quality Counts at 10: A Decade of Standards-Based Reform" (*Education Week*, 2006), only 12 states have elementary-school standards in history/social studies that are "clear, specific, and grounded in content." Furthermore, a survey of 33 states conducted last year found that, at the elementary-school level, instructional time for social studies has been reduced in 16 states—and it has been increased in only two states, New York and South Carolina (Rothman, 2005).

Teachers and parents are worried about important content being squeezed out. In a 2002 AFT poll, 71 percent of teachers agreed (42 percent strongly agreed) that "the pressure of testing has led to a more narrow curriculum,

play setting was that Terrell needed more than theme-related objects. He needed to learn the words and some beginning understandings about what people might do in an office and why one might write a letter. He needed knowledge and vocabulary to convey his ideas. And with such instruction, I suspect that Terrell would have begun to develop the narrative routines, the concepts, and the problem-solving strategies that are, in fact, related to reading success.

* * *

Poor children do not fare well in our society. They have more hearing problems, ear infections, dental problems, lead exposure, poor nutrition, asthma, and poor housing (Rothstein, 2004). These conditions appear to be far more pernicious for children in the early years of development than in the later adolescent years, shaping children's ability and achievement when cognitive connections are forming (Duncan and Brooks-Gunn, 1997).

Hundreds of studies (Jencks and Phillips, 1998) have now documented the dramatic, linear, negative relationships between poverty and children's cognitive-developmental outcomes. Before kindergarten begins, differences in cognitive skills between high-status and low-status children are, on average, 60 percent (Lee and Burkam, 2002). Studies have documented large differences in children's receptive and expressive language skills; in children's ability to identify beginning sounds and letters, colors, and numbers; and in the number of words they have been exposed to prior to entering kindergarten (Hart and Risley, 2003; Denton, West, and Waltston, 2003; Vellutino et al., 1996).

But perhaps even more serious than skill deficiencies are knowledge deficiencies that arise for children who have limited access to the informal informational lessons that can be transmitted through day-to-day interactions. Although a significant amount of research has focused on differences in early language learning (McCardle and Chhabra, 2004), in vocabulary and phonemic awareness and how they might be acquired, there has been relatively little discussion of differences among children in content knowledge and its relationship to achievement. This is a critical

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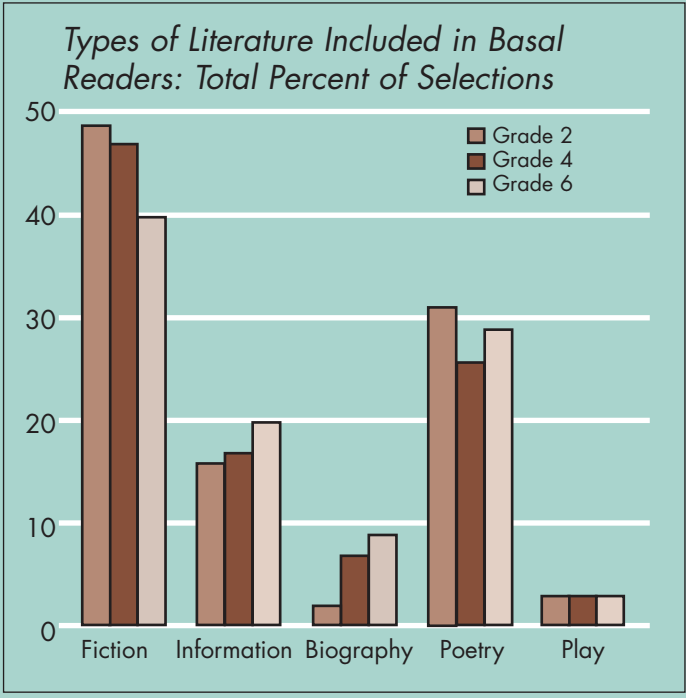

resulting in valuable material not being covered." A 2005 poll found that 82 percent of the public—and 92 percent of those with a great deal of knowledge about No Child Left Behind—are concerned that the reliance on testing in math and English "will mean less emphasis on art, music, history, and other subjects" (Rose and Gallup, 2005).

Little Classroom Time Is Devoted to Informational Text

According to a recent literature review, there is a "scarcity of informational text in primary-grade classrooms (and, to some extent, throughout elementary school)" (Palincsar and Duke, 2004, p. 189). Just how scarce is it? Duke (2000) studied the prevalence of informational text in 20 first-grade classrooms in and around Boston. Half the classrooms were from very high socioeconomic status (SES) districts and half were from very low SES districts. By visiting each of the classrooms four times during one school year, Duke found that, on average, only 3.6 minutes per day of instruction were typically devoted to informational text. The situation was even worse in the classrooms from low SES districts—a mere 1.4 minutes per day, on average, were devoted to informational text.

More Informational Text Aids Children's Reading Progression

What if first-graders were exposed to more informational text? To find out, Duke took 30 first-grade classes from 30 different schools in six low-income districts and broke them into three groups: 1) an experimental group in which teachers drew one-third of their texts from informational genres, one-third from narrative genres, and one-third from other genres (like poetry or procedural texts); 2) a control group in which teachers were given resources (e.g., to buy books) similar to those of the experimental group, but were not asked to change what they teach; and 3) a control group in which there were no changes. The results speak for themselves:

> By the end of grade 1, [the] experimental group … children were better writers of informational text than children in the control groups, had progressed more quickly in reading level, and had shown less decline in attitudes toward recreational reading. Experimental classes that entered school with relatively low literacy knowledge showed higher overall reading and writing ability by the end of grade 1 than comparable control classes (Palincsar and Duke, 2004, p. 189-190).

—Editors

(References on page 51)

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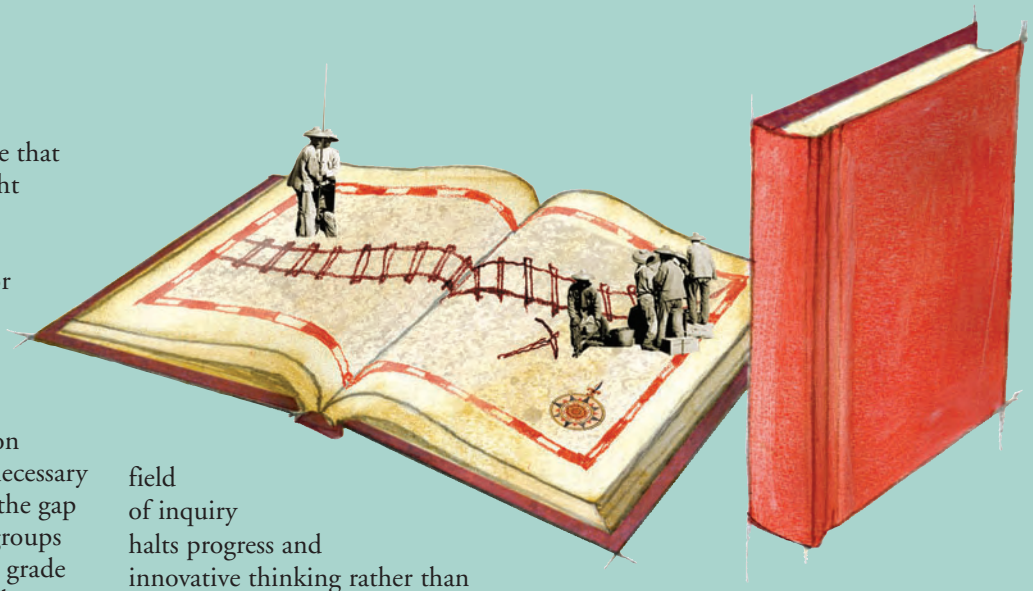
oversight because indications are that limited content knowledge might ultimately account for what appear to be comprehension difficulties (Vellutino et al., 1996) or higher-order thinking difficulties in older children. Therefore, if children's developing conceptual knowledge becomes subordinated to a focus on the relatively small number of necessary procedural skills early on, then the gap between socioeconomic status groups may widen with each successive grade level, building to insurmountable gaps after just a few years of schooling.

To date, much of the discussion on prevention or early intervention for children at risk has focused on whether special interventions, such as Head Start and Even Start, and remedial instruction like Reading Recovery are likely to raise and sustain children's literacy achievement. But it seems to me that the real leverage may not lie in such episodic events. Instead, it may be the continual, systematic, everyday ways we engage children in learning new knowledge and information, starting in the early years. In an analysis of programs with long-term effectiveness for low-income children, Frede (1998) reported the presence of curriculum content and learning processes that cultivate knowledge and skills, with an emphasis on language development. Children who had a broad base of experience in domain-specific knowledge were likely to move more rapidly in acquiring complex skills.

Why Have We Overlooked the Importance of Building Knowledge in Early Childhood?

I can't say for sure why reading experts, by and large, have overlooked the role that knowledge plays in reading, but I can think of three possible reasons. Sometimes, consensus in a particular field of inquiry halts progress and innovative thinking rather than promotes it (Kuhn, 1962). In part, the virtual consensus on the skills necessary to learn how to read may be one reason for the limited attention given to the important role of knowledge in early literacy development. Recent reports (McCardle and Chhabra, 2004), for example, contend that children's future success in becoming skilled readers is dependent on their becoming aware that spoken words are composed of smaller elements of speech, grasping the idea that letters represent these sounds, learning the many system correspondences between sounds and spellings, and acquiring a repertoire of highly familiar words that can be recognized on sight. Much of the research (National Reading Panel Report, 2000), in fact, substantiates the importance of these components in learning to read.



However, research that underlies this model has ignored the environmental factors, including material resources and the quality of the home environment, that play a central role in learning to read. These factors contribute to background knowledge and concepts, vocabulary, familiarity with syntactic and semantic sentences, and verbal reasoning abilities.

The second reason for not recognizing the importance of knowledge in early childhood could be definitional. Although the terms knowledge, skills, and dispositions are clearly familiar to most early childhood educators, rarely have we attempted to define them. As a result, there has been a lack of clarity and understanding about the scope and depth of content knowledge in these early years.

And the third reason for overlooking the importance of knowledge in early childhood might be ideological. The field of early childhood still grapples over the balance between learning processes (i.e., thinking skills), or how children learn, and content, or what they learn (Eisner and Vallance, 1974). More often than not, young children, particularly those in high poverty areas, are subjected to intellectually trivial activities, limited in content and only loosely connected between subjects. Seppanen, Godon, and Metzger (1993) found, for example, that early childhood Title I classrooms did not provide any regular experiences in topics of math, language, and science. Minds atrophy under such conditions.

For early education to work toward helping children attain social and economic equality, we must develop pedagogy that is both sensitive to children's development and representative of conceptual knowledge that has sufficient coherence and depth. Recognizing the divide that begins to separate the "information haves" from the "information have-nots" early on, we need to develop learning experiences that work on the edge of children's competencies and understandings. Research has consistently shown the value of early education in helping to equip children with essential skills. But these skills must be used to develop coherent understandings of knowledge and concepts, the very basic foundations for later learning.

(References on page 51)

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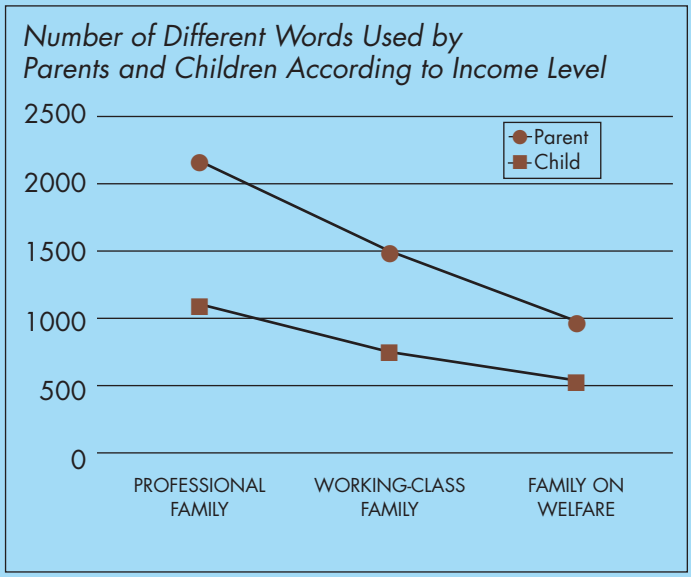
Why the Absence of a Content-Rich Curriculum Core Hurts Poor Children Most

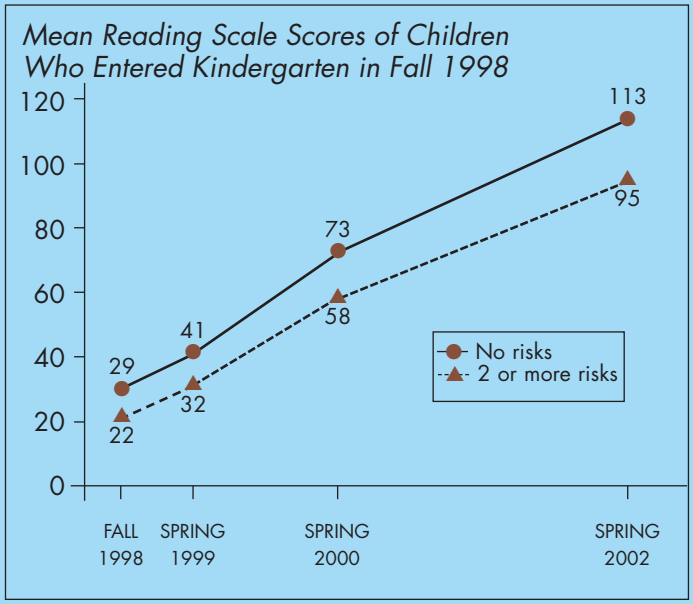
High-level reading comprehension depends on a solid base of background knowledge and vocabulary. Without these building blocks, plus strong decoding skills, children cannot develop into strong comprehenders. They will be unable to comprehend secondary school texts, score well on SAT-like tests, or succeed in college or a career. Knowledge and vocabulary matter for all children's minds. But the evidence is clear: Children who are from less educated, less affluent homes are especially dependent on schools to impart this critical knowledge since they are unlikely to pick it up at home. If schools are able to impart this knowledge cumulatively through a rich, common grade-by-grade curriculum core—where each teacher can systematically build on the knowledge and skills taught by previous teachers—children from less language-rich homes will enjoy and benefit from the kind of curriculum often offered only to wealthier kids. And, when children move from school-to-school, they won't face a wholly new curriculum on top of all else that is new to them.

1. 3-year-olds from lower income homes hear—and use—less than half the words of more advantaged peers[1]



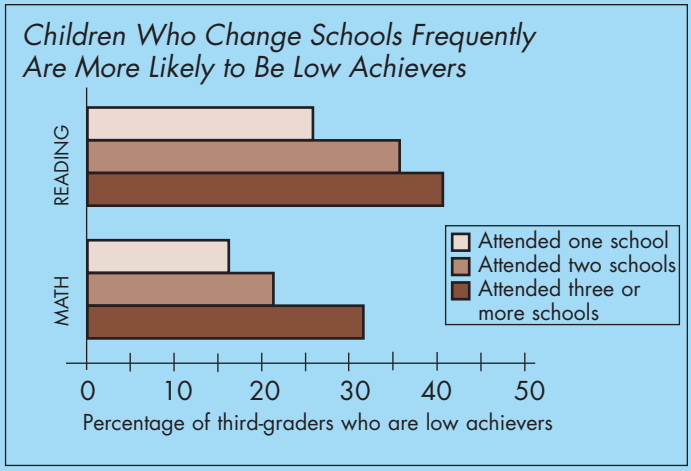
Note: Parents' different words were averaged over in-home observations when the children were 13-36 months old. Children's different words were averaged over the final four in-home observations when they were 33-36 months old.

2. Children from at-risk families enter kindergarten behind in reading, and then fall further behind[2]

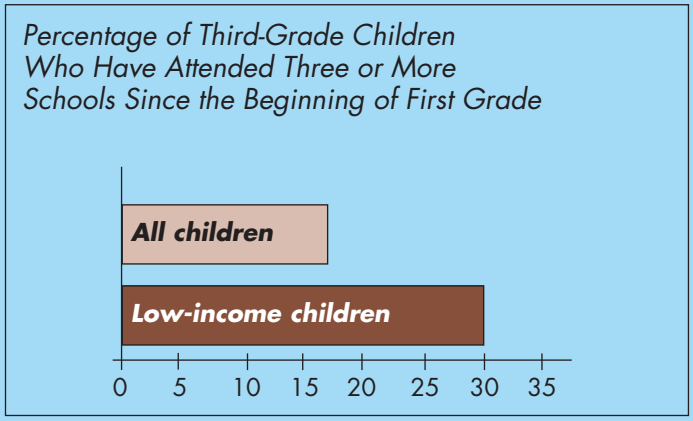


Note: Risk factors included poverty, home language, mother's highest education, and living in a single-parent household. The assessment was not administered in 2001.

3. Changing schools hurts students' achievement[3]



4. Poor children change schools the most[4]



(References on page 51)

In general, the de facto curriculum in the American school is defined by the textbooks that are used and by the selections within them that are made according to the tastes and beliefs of individual teachers. In other words, the curriculum in most American classrooms is an unknown curriculum, one that assures incoherence from grade to grade and school to school.

Coherence and commonality of curriculum, gained through specifying core content, has decisive educational advantages over our vague, laissez faire curriculum arrangements. Of course, by "commonality of content," I do not mean a 100 percent common curriculum across the nation under which each child in each early grade follows exactly the same course of study. I mean rather a more reasonable percentage of common content, such as Thomas Jefferson and Horace Mann had in view—say, between 40 and 60 percent of the topics that young children are taught.

In addition, to reduce the negative impact of massive student mobility, we must reach agreement not only about what subject matter should be taught in school, but also about the grade level at which that agreed-upon subject matter should be taught. Just as we have created a convention about the standard spelling of *Mississippi*, we need to create a convention about the grade level at which school topics shall be introduced. If we agree that primary-grade children should be taught about the lives of George Washington and Martin Luther King, Jr., then we have an obligation to decide when these topics will be introduced. The ravages of mobility on disadvantaged students ought to exert a powerful moral claim in favor of such a policy, which deserves to trump local sentiments about whether kindergarten is or is not the right place for Washington or King. No one can really answer that question in absolute terms. In most cases, questions about proper grade level have no absolute right answer, because, as Jerome Bruner famously observed, almost any topic, if taught appropriately, can be taught at any school age.[28]

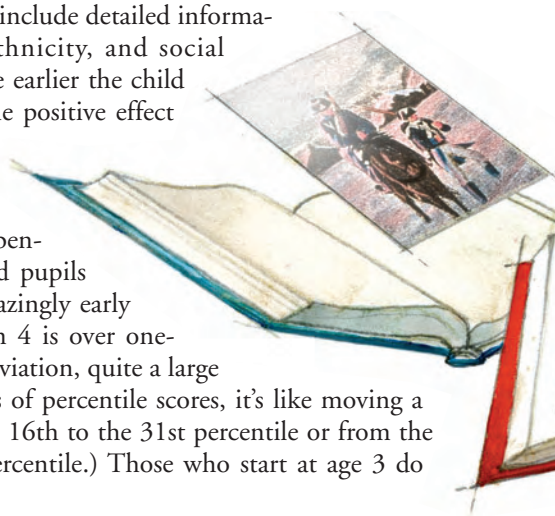
But Bruner's insight emphatically does not argue for laissez faire regarding the sequencing of topics. On the contrary, using an automotive analogy, either side of the road, appropriately demarcated, is suitable for driving in either direction—which is precisely why it is necessary to create a convention for determining whether the right side or the left side will be used. Whichever side of the road a state decides on, that same convention needs to hold for all roads in all the states, because cars cross state lines every day—just as disadvantaged students move across schools (and districts and even states) every day. The consequence of not creating a convention about the sequencing of agreed-upon topics is that some highly mobile students will never read *Charlotte's Web* or Langston Hughes, while others will hear about them endlessly, in kindergarten, grade one, grade two, and beyond.

Why Equity Requires Knowledge-Rich Preschool for Children from Low-Income Homes

Research from many quarters argues that the sooner children can be exposed to and engaged with words, knowledge, language, and language conventions, the better off they'll be. The reason for this is clear: because the powerful Matthew effect will be working for them, not against them. That this is especially true for children from the poorest, least language-rich homes should be obvious.

To reduce the negative impact of massive student mobility, we must reach agreement not only about what subject matter should be taught in school, but also about the grade level at which that agreed-upon subject matter should be taught.

When children are offered coherent, cumulative knowledge from preschool on, reading proficiency is the result. The fullest evidence for the validity of this prediction comes from large-scale studies conducted by French researchers on the effects of very early knowledge instruction in school on later reading achievement.[29] The French are in a good position to perform such studies. They have been running state-sponsored preschools for more than a hundred years. By age 5, almost 100 percent of French children, including the children of immigrants from Africa, Asia, and southern Europe, attend preschools. At age 4, 85 percent of all children attend, and astonishingly, at age 2, 30 percent of all children attend. Analyses of records from tens of thousands of students—records that include detailed information about race, ethnicity, and social class—show that the earlier the child starts, the greater the positive effect on reading will be. By the end of fifth grade in France, the relative benefit to disadvantaged pupils who start at the amazingly early age of 2 rather than 4 is over one-half of a standard deviation, quite a large effect size. (In terms of percentile scores, it's like moving a student up from the 16th to the 31st percentile or from the 50th to the 69th percentile.) Those who start at age 3 do



Schools that enroll many poor children can't be merely effective; to bring their students to proficient reading levels, they need to be supereffective. They need an extraordinary level of help, support, and good ideas to meet the challenges they face.

better in later reading than those who start at age 4, and starting school at age 4 is better than starting at age 5. These studies show that the long-term gain in starting early is greater for disadvantaged than for advantaged students.

* * *

Effective use of school time is especially important in all areas of learning connected with the advancement of language comprehension, which is inherently a slow process. For children who grow up in highly articulate homes where they hear a wealth of language every day, the need to use time effectively to enlarge language comprehension is not as critical as it is for children who grow up in language-barren circumstances. For those growing up in such homes, schools themselves should become highly effective and efficient imparters of language in all its aspects: vocabulary, syntax, knowledge, etc. If we can do that, greater reading comprehension, higher school achievement, and greater equity will be the result.

When James Coleman, the great sociologist of education, analyzed the school characteristics that had the greatest impact on educational achievement and equity, he found that schools with greater academic intensity—a persistent, goal-directed focus on academics—produced not only greater learning, but also narrowed the achievement gap between ethnic groups.[30] That such academically focused schools would raise general achievement is obvious since an intense focus on academics is self-evidently the most likely means to raise academic achievement. The finding on narrowing the achievement gap is more interesting, and it has positive implications for both advantaged and disadvantaged students.

The theoretical explanation for Coleman's finding about equity is this: When students learn more in school during the course of a classroom period and during an entire year, disadvantaged students begin to catch up, even when their advantaged peers are learning more or less the same things they are. That is because disadvantaged students start out knowing less, so each additional bit of learning is proportionally more enabling to them than to students who already knew more. If we are reading a story about Johnny Appleseed and some students know how plants grow while others don't, the latter group, the botanically challenged students, will be the ones who learn most from the story (assuming they know at least 90 percent of the words), although both groups will learn something new about Johnny Appleseed.

And there is a further reason for the equity effect that Coleman observed. When a lot of learning is going on in school, the proportion of the academic knowledge gained in school increases and the proportion gained outside school decreases. When students are learning many academic things in the classroom, that will narrow the academic gap because disadvantaged students are more dependent on schools for gaining academic information than advantaged students. Advantaged students have a chance to learn a lot of academically relevant things from their homes and peer groups, whereas disadvantaged students learn academically relevant things mostly from their schools. Boosting the in-school proportion thus reduces the impact of the unfair distribution of out-of-school learning opportunities.

There is another point to be made here. A school that enrolls a heavily middle-class population faces a far lower hurdle in getting its children to reach high reading levels than does a counterpart school enrolling a heavily low-income population. The first school enrolls students who typically entered school ahead in their background knowledge and vocabulary and will have substantial access to knowledge and vocabulary in their non-school lives, as well (whether from summer camp, vacation trips, educated parents and relatives, museum visits, etc.). The counterpart school, with a heavily low-income student population, typically enrolls children who entered kindergarten already behind and have fewer opportunities to gain this knowledge and vocabulary outside school. In comparison to the first school, the low-income school's task of bringing its students to proficient reading comprehension levels is enormous. Schools that enroll many poor children can't be merely effective; to bring their students to proficient reading levels, they need to be supereffective. They need an extraordinary level of help, support, and good ideas to meet the challenges they face. I believe that the ideas put forward here can help these schools be supereffective, as their students, and the nation, need them to be. □

(Endnotes on page 50)

How Knowledge Helps

It Speeds and Strengthens Reading Comprehension, Learning—and Thinking

By Daniel T. Willingham

"Knowledge is Good." So read the motto of the mythical Faber College in the 1978 movie, *Animal House*. Those of use who work in education would agree, even if we were unable to express ourselves so eloquently. But why, exactly, is knowledge good? When I've discussed this question with teachers, many have used the metaphor "It's grist for the mill." That is, the goal of education is seen not so much as the accumulation of knowledge, but as the honing of cognitive skills such as thinking critically. Knowledge comes into play mainly because if we want our students to learn how to think critically, they must have something to think about.

It's true that knowledge gives students something to think about, but a reading of the research literature from cognitive science shows that knowledge does much more than just help students hone their thinking skills: It actually makes learning easier. Knowledge is not only cumulative, it grows exponentially. Those with a rich base of factual knowledge find it easier to learn more—the rich get richer. In addition, factual knowledge enhances cognitive processes like problem solving and reasoning. The richer the knowledge base, the more smoothly and effectively these cognitive processes—the very ones that teachers target—operate. So, the more knowledge students accumulate, the smarter they become. We'll begin by exploring how knowledge brings more knowledge and then turn to how knowledge improves the quality and speed of thinking.

I. How Knowledge Brings More Knowledge

The more you know, the easier it will be for you to learn new things. Learning new things is actually a seamless process, but in order to study it and understand it better, cognitive scientists have approached it as a three-stage process. And they've found that knowledge helps at every stage: as you first take in new information (either via listening or reading), as you think about this information, and as the material is stored in memory. We'll consider each of these stages in turn.

How Knowledge Helps You Take in New Information

The first stage in which factual knowledge gives you a cognitive edge is when you are taking in new information, whether by listening or reading. There is much more to comprehending oral or written language than knowing vocabulary and syntax. Comprehension demands background knowledge because language is full of semantic breaks in which knowledge is assumed and, therefore, comprehension depends on making correct inferences. In a casual conversation, the listener can gather missing background knowledge and check on his inferences by asking questions (e.g., Did you mean Bob Smith or Bob Jones? What do you mean when you describe him as an entrepreneur?)—but this is not the case when watching a movie or reading a book. (And sometimes it isn't the case in class when a student is too embarrassed to ask a question.)

To provide some concrete examples and simplify the discussion, let's focus on reading—but keep in mind that the same points apply to listening. Suppose you read this brief text: "John's face fell as he looked down at his protruding belly. The invitation specified 'black tie' and he hadn't worn his tux since his own wedding, 20 years earlier." You will likely infer that John is concerned that his tuxedo won't fit, although the text says nothing directly about this potential problem. The writer could add the specifics ("John had gained weight since he last wore his tuxedo, and worried that it would not fit"), but they are not necessary and the added words would make the text dull. Your mind is well able to fill in the gaps because you know that people are often heavier 20 years after their wedding, and that gaining weight usually means that old clothing won't fit. This background knowledge about the world is readily available and so the writer need not specify it.

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ILLUSTRATED BY CHARLOTTE FREMAUX


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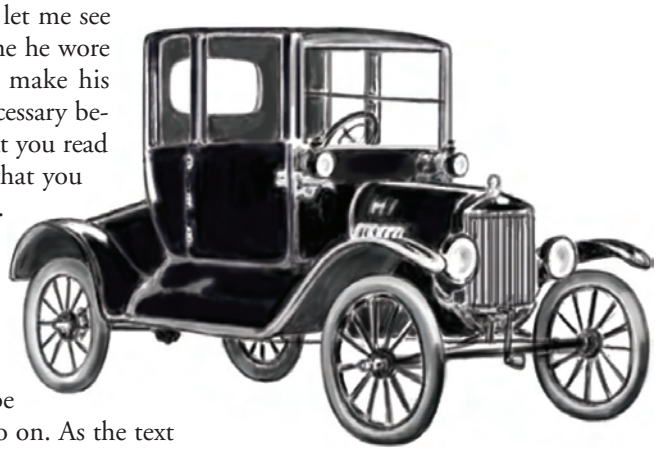
Thus, an obvious way in which knowledge aids the acquisition of more knowledge lies in the greater power it affords in making correct inferences. If the writer assumes that you have some background knowledge that you lack, you'll be confused. For example, if you read, "He was a real Benedict Arnold about it" and you don't know who Benedict Arnold was, you're lost. This implication of background knowledge is straightforward and easy to grasp. It is no surprise, then, that the ability to read a text and make sense of it is highly correlated with background knowledge (Kosmoski, Gay, and Vockell, 1990). If you know more, you're a better reader.

Most of the time you are unaware of making inferences when you read. For example, when you read the text above it's unlikely you thought to yourself, "Hmmm … let me see now … why am I being told about the last time he wore his tuxedo? Why would thinking about that make his face fall?" Those conscious inferences are unnecessary because the cognitive processes that interpret what you read automatically access not just the literal words that you read, but also ideas associated with those words. Thus, when you read "tux," the cognitive processes that are making sense of the text can access not just "a formal suit of clothing," but all of the related concepts in your memory: Tuxedos are expensive, they are worn infrequently, they are not comfortable, they can be rented, they are often worn at weddings, and so on. As the text illustrates, the cognitive processes that extract meaning also have access to concepts represented by the intersection of ideas; "tux" makes available "clothing," and "20 years after wedding" makes available "gaining weight." The intersection of "clothing" and "gaining weight" yields the idea "clothing won't fit" and we understand why John is not happy. All of these associations and inferences happen outside of awareness. Only the outcome of this cognitive process—that John is concerned his tux won't fit anymore—enters consciousness.

All of these associations and inferences happen outside of awareness. Only the outcome of this cognitive process—that John is concerned his tux won't fit anymore—enters consciousness.



Sometimes this subconscious inference-making process fails and the ideas in the text cannot be connected. When this happens, processing stops and a greater effort is made to find some connection among the words and ideas in the text. This greater effort requires conscious processing. For example, suppose that later in the same text you read, "John walked down the steps with care. Jeanine looked him up and down while she waited. Finally she said, 'Well, I'm glad I've got some fish in my purse.'" Jeanine's comment might well stop the normal flow of reading. Why would she have fish? You would search for some relationship between carrying fish to a formal event and the other elements of the situation (formal wear, stairs, purses, what you've been told of Jeanine and John). In this search you might retrieve the popular notion that wearing a tuxedo can make one look a little like a penguin, which immediately leads to the association that penguins eat fish. Jeanine is likening John to a penguin and thus she is teasing him. Sense is made, and reading can continue. Here, then, is a second and more subtle benefit of general knowledge: People with more general knowledge have richer associations among the concepts in memory; and when associations are strong, they become available to the reading process automatically. That means the person with rich general knowledge rarely has to interrupt reading in order to consciously search for connections.

This phenomenon has been verified experimentally by having subjects read texts on topics with which they are or are not very familiar. For example, Johanna Kaakinen and her colleagues (2003) had subjects read a text about four common diseases (e.g., flu) for which they were likely already familiar with the symptoms, and a text about four uncommon diseases (e.g., typhus) for which they likely were not. For each text, there was additional information about the diseases that subjects likely did not know.

The researchers used a sophisticated technology to unobtrusively measure where subjects fixated their eyes while they read each text. Researchers thus had a precise measure of reading speed, and they could tell when subjects returned to an earlier portion of the text to reread something. The researchers found that when reading unfamiliar texts, subjects more often reread parts of sentences and they more often looked back to previous sentences. Their reading speed was also slower overall compared to when they read familiar texts. These measures indicate that processing is slower when reading about something unfamiliar to you.

Thus, background knowledge makes one a better reader in two ways. First, it means that there is a greater probability that you will have the knowledge to successfully make the necessary inferences to understand a text (e.g., you will know that people are often heavier 20 years after their wedding and, thus, John is worried that his tux won't fit). Second, rich background

knowledge means that you will rarely need to reread a text in an effort to consciously search for connections in the text (e.g., you will quickly realize that with her fish remark, Jeanine is likening John to a penguin).

How Knowledge Helps You Think about New Information

Comprehending a text so as to take in new information is just the first stage of learning that new information; the second is to think about it. This happens in what cognitive scientists call working memory, the staging ground for thought. Working memory is often referred to metaphorically as a *space* to emphasize its limited nature; one can maintain only a limited amount of information in working memory. For example, read through this list one time, then look away and see how many of the letters you can recall.

CN

NFB

ICB

SCI

ANC

AA

There were 16 letters on the list, and most people can recall around seven—there is not sufficient space in working memory to maintain more than that. Now try the same task again with this list.

CNN

FBI

CBS

CIA

NCAA

Much easier, right? If you compare the two lists, you will see that they actually contain the same letters. The second list has been reorganized in a way that encourages you to treat C, N, and N as a single unit, rather than as three separate letters. Putting items together this way is called *chunking*. It greatly expands how much fits in your working memory—and, therefore, how much you can think about. The typical persons' working memory can hold about seven letters or almost the same number of multi-letter chunks or pieces of information. Note, however, that chunking depends on background knowledge. If you weren't familiar with the abbreviation for the Federal Bureau of Investigation, you couldn't treat FBI as a single chunk.

The ability to chunk and its reliance on background knowledge has been tested in a number of studies. These studies show that this ability makes people better able to briefly remember a list of items, just as you could remember more letters in the second example. This benefit has been observed in many domains, including chess (Chase and Simon, 1973), bridge (Engle and Bukstel, 1978), computer programming (McKeithen, Reitman, Rueter, and Hirtle, 1981), dance steps (Allard and Starkes, 1991), circuit design (Egan and Schwartz, 1979), maps (Gilhooly, Wood, Kinnear, and Green, 1988), and music (Sloboda, 1976).

Of course, we seldom want to briefly remember a list. The important aspect of chunking is that it leaves more free space in working memory, allowing that space to be devoted to other tasks, such as recognizing patterns in the material. For example, in one study (Recht and Leslie, 1988), the researchers tested junior high school students who were either good or poor readers (as measured by a standard reading test) and who were also knowledgeable or not about the game of baseball (as measured by a test created for the study by three semi-professional baseball players). The children read a passage written at an early 5th-grade reading level that described a half inning of a baseball game. The passage was divided into five parts, and after each part the student was asked to use a replica of a baseball field and players to reenact and describe what they read. The researchers found that baseball knowledge had a big impact on performance: Poor readers with a high knowledge of baseball displayed better comprehension than good readers with a low knowledge of baseball.

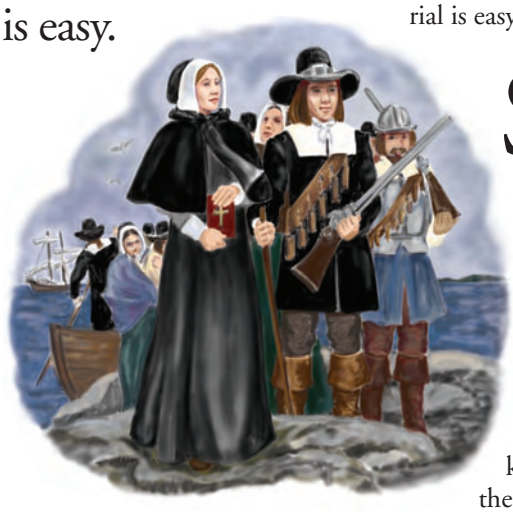
What's going on here? First, the students with a lot of knowledge of baseball were able to read a series of actions and chunk them. (For example, if some of the text described the shortstop throwing the ball to the second baseman and the second baseman throwing the ball to the first baseman resulting in two runners being out, the students with baseball knowledge would chunk those actions by recognizing them as a double play—but the students without baseball knowledge would have to try to remember the whole series of actions.) Second, because they were able to chunk, the students with baseball knowledge had free space in their working memory that they could devote to using the replica to reenact the play as well as providing a coherent verbal explanation. Without being able to chunk, the students with little baseball knowledge simply didn't have enough free space in their working memory to simultaneously remember all of the actions, keep track of their order, do the reenactment, and describe the reenactment.

This study illustrates the importance of the working memory advantage that background knowledge confers (see also Morrow, Leirer and Altieri, 1992; Spilich, Vesonder, Chiesi, and Voss, 1979). Most of the time when we are listening or reading, it's not enough to understand each sentence on its own—we need to understand a series of sentences or paragraphs and hold them in mind simultaneously so that they can be integrated or compared. Doing so is easier if the material can be chunked because it will occupy less of the limited space in working memory. But, chunking relies on background knowledge.

How Knowledge Helps You Remember New Information

Knowledge also helps when you arrive at the final stage of learning new information—remembering it. Simply put, it is easier to fix new material in your memory when you already have some knowledge of the topic (Arbuckle et al, 1990; Beier and Ackerman, 2005; Schneider, Korkel, and Weinert, 1989;

But remembering new information on a familiar topic is relatively easy because developing associations between your existing network and the new material is easy.



Walker, 1988). Many studies in this area have subjects with either high or low amounts of knowledge on a particular topic read new material and then take a test on it some time later; inevitably those with prior knowledge remember more.

A study by David Hambrick (2003) is notable because it looked at real-world learning and did so over a longer period of time than is typical in such studies. First, Hambrick tested college students for their knowledge of basketball. This test took place in the middle of the college basketball season. Two and one-half months later (at the end of the season), subjects completed questionnaires about their exposure to basketball (e.g., game attendance, watching television, and reading magazines or newspapers) and also took tests that measured their knowledge of specific men's basketball events from the prior two and one-half months. The results showed (not surprisingly) that subjects who reported an interest in the game also reported that they had had greater exposure to basketball information. The more interesting finding was that, for a given level of exposure, greater prior basketball knowledge was associated with more new basketball knowledge. That is, the people who already knew a lot about basketball tended to remember more basketball-related news than people with the same exposure to this news but less prior knowledge.* As I said in the introduction, the rich get richer.

* Careful readers may notice that in this study there is some possibility that the college students' interest in basketball (not just their knowledge) could have some effect on their memory of basketball events. A more complicated study controlled for interest by creating experts. Subjects were brought in to pre-learn some information (which then served as their background knowledge) and then return two days later to learn additional knowledge. The researchers still found a memory boost from background knowledge (Van Overschelde and Healy, 2001).

What's behind this effect? A rich network of associations makes memory strong: New material is more likely to be remembered if it is related to what is already in memory. Remembering information on a brand new topic is difficult because there is no existing network in your memory that the new information can be tied to. But remembering new information on a familiar topic is relatively easy because developing associations between your existing network and the new material is easy.

Some researchers have suggested that prior knowledge is so important to memory that it can actually make up for or replace what we normally think of as aptitude. Some studies have administered the same memory task to high-aptitude and low-aptitude children, some of whom have prior knowledge of the subject matter and some of whom do not; the studies found that only prior knowledge is important (Britton, Stimson, Stennett, and Gülgöz, 1998; Recht and Leslie, 1988; Schneider, Korkle, and Weinert, 1989; Walker, 1988). But some researchers disagree. They report that, although prior knowledge always helps memory, it cannot eliminate the aptitude differences among people. Since everyone's memory gets better with prior knowledge, assuming equal exposure to new knowledge (as in a classroom without extra support for slower students), the student with overall lower aptitude will still be behind the student with higher aptitude (Hall and Edmondson, 1992; Hambrick and Engle, 2002; Hambrick and Oswald, 2005; Schneider, Bjorklund, and Maier-Brückner, 1996). In the end, the issue is not settled, but as a practical matter of schooling, it doesn't matter much. What matters is the central, undisputed finding: All students will learn more if they have greater background knowledge.

II. How Knowledge Improves Thinking

Knowledge enhances thinking in two ways. First, it helps you solve problems by freeing up space in your working memory. Second, it helps you circumvent thinking by acting as a ready supply of things you've already thought about (e.g., if you've memorized that 5 + 5 = 10, you don't have to draw two groups of five lines and count them). To simplify the discussion, I'll focus mostly on research that explores the benefits of knowledge for problem solving, which is essentially the type of thinking that students must do in mathematics and science classes. But keep in mind that in much the same way, knowledge also improves the reasoning and critical thinking that students must do in history, literature, and other humanities classes.

How Knowledge Helps You Solve Problems

In the last section, I discussed one way that prior knowledge helps reading: It allows you to chunk some information, which leaves more room in working memory to sort through the implications of a text. You get much the same benefit if you are trying to solve a problem. If you don't have sufficient back-

(Continued on page 36)

Knowledge in the Classroom

One sometimes hears that the *real* goal of education is "learning to learn." As the proverb says, "Give a man a fish, and he will eat for a day; teach a man to fish, and he will eat for a lifetime." Better to teach students how to learn facts on their own, rather than teach them facts. The idea sounds appealing, but if it's coupled with the idea that teachers should emphasize cognitive *processes* (like comprehension and reasoning strategies), and place less emphasis on content, then it's wrong.

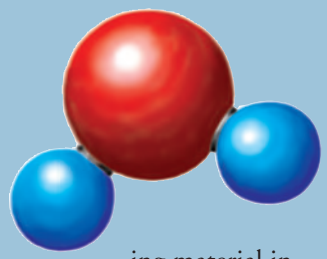
The effects that I described in the main article indicate that many of the cognitive skills we want our students to develop—especially reading with understanding and successfully analyzing problems—are intimately intertwined with knowledge of content. When students learn facts they are not just acquiring grist for the mill—they are enabling the mill to operate more effectively. Background knowledge is absolutely integral to effectively deploying important cognitive processes. What does this mean for teachers?

1. Facts should be meaningful. "Fact learning" should not be understood as "rote memorization." The importance of knowledge to cognition does not mean that teachers should assign lists of facts for their students to memorize.* As described in the main article, facts are useful only if they are meaningfully connected to other bits of knowledge. So, fact learning should be thought of as the kind of learning that results from, for example, reading a richly detailed biography—not a barren timeline of a person's life. Teachers should include opportunities for students to learn new material about the world and connect it to prior knowledge wherever possible. Mindless drilling is not an effective vehicle for building students' store of knowledge.

2. Knowledge acquisition can be incidental. Every fact that students learn need not be explicitly taught—students can learn facts incidentally. *Incidental* learning refers to learning that occurs when you are not specifically trying to learn. Much of what you know stuck in your memory not as a result of your consciously trying to remember it, but as a byproduct of thinking about it, such as when you reflect on a novel word that someone used in conversation or are fascinated by a new fact. When schools use a content-rich curriculum, students have many incidental learning opportunities as they are immersed in meaningful, connected facts throughout the day. Teachers can also look for extra opportunities to provide incidental learning opportunities for their students, for example, by using a vocabulary word that the students likely do not know, but the meaning of which is deducible from the context of the sentence.

3. Not all knowledge needs to be detailed. Note that the cognitive benefits described in this article differ in their knowledge requirements. For example, the knowledge required to increase reading comprehension is often fairly superficial. Using our examples from the main article, you don't need detailed knowledge about penguins or Arnold's life to understand what is meant by the relationship between a fish and a penguin or between Benedict Arnold and a traitor.

Fortunately, this sort of superficial knowledge is easy to pick up incidentally. For example, a rich fourth-grade unit on the American Revolution would likely include extensive information on key players such as King George III, George Washington, and Benjamin Franklin, but nothing more on Benedict Arnold than an aside emphasizing his role as a traitor. Such an aside would usually be enough to enhance reading comprehension. Most of us spend the majority of our time reading material intended for a general audience and for that material, superficial knowledge is sufficient.



Looking at the opposite end of the spectrum, deep knowledge is needed to attain benefits related to thinking such as the recognition of a chunk (as in the example from the main article of the students who have memorized the distributive property). Practice in a number of different situations is required before knowledge can be used with ease for problem solving.

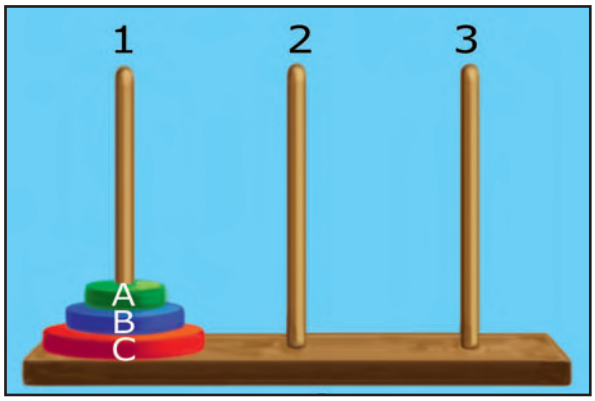
4. Knowledge learning should start early. Building a store of knowledge works like compound interest—it grows exponentially. For that reason, the earlier that students add to their database of knowledge the better. This process begins at home, long before children attend school. (Note that virtually all learning before children start school is incidental.) All teachers should take the job of teaching content to students seriously, but this job is doubly serious for teachers in preschool and early elementary classrooms. Because of the exponential learning rate, once children fall behind their peers, it becomes increasingly difficult to catch up. These young children can learn little, if any, material via reading, so they must learn by listening to fiction and nonfiction books read aloud, by watching demonstrations, through hands-on experiences, and so forth.

—D.W.

*For a full explanation, see "Inflexible Knowledge: The First Step to Expertise" from the Winter 2002 issue of *American Educator.* It's available online at **www.aft.org/pubs-reports/american_educator/winter2002/CogSci.html**.

(Continued from 34)

ground knowledge, simply understanding the problem can consume most of your working memory, leaving no space for you to consider solutions. I can give you a sense of this impact with a sample problem called the *Tower of Hanoi*. The picture shows three pegs with three rings of increasing size. The goal is to move all the rings to the rightmost peg. There are just two rules: You can only move one ring at a time, and you can't put a larger ring on top of a smaller ring. See if you can solve the problem.



With some diligence, you may well be able to solve the problem. The solution is to move the rings as follows: A3, B2, A2, C3, A1, B3, A3.

Now consider this problem:

> In the inns of certain Himalayan villages is practiced a refined tea ceremony. The ceremony involves a host and exactly two guests, neither more nor less. When his guests have arrived and seated themselves at his table, the host performs three services for them. These services are listed in the order of the nobility the Himalayans attribute to them: stoking the fire, fanning the flames, and pouring the tea. During the ceremony, any of those present may ask another, "Honored Sir, may I perform this onerous task for you?" However, a person may request of another only the least noble of the tasks that the other is performing. Furthermore, if a person is performing any tasks, then he may not request a task that is nobler than the least noble task he is already performing. Custom requires that by the time the tea ceremony is over, all the tasks will have been transferred from the host to the most senior of the guests. How can this be accomplished?

You would probably have to read the problem several times just to feel that you understand it—but this problem is actually identical to the *Tower of Hanoi.* Each guest is like a peg, and each task is like a ring. The goal and the rules of transfer are the same. The difference is that this version is much more demanding of working memory. The first version does not require you to maintain the problem in working memory because it is so effectively represented in the figure. The second version requires that the solver remember the order of nobility of the tasks, whereas in the first version you can easily chunk the order of ring size—smallest to largest.

These two problems give you a sense of the advantages of background knowledge for problem solving. The problem solver with background knowledge in a particular domain sees problems in her domain like the *Tower of Hanoi*; everything is simple and easy to understand. When she is outside her domain, however, the same problem solver cannot rely on background knowledge and problems seem more like the confusing tea ceremony. It's all she can do to simply understand the rules and the goal.

These examples put the "grist for the mill" metaphor in a new light: It's not sufficient for you to have some facts for the analytic cognitive processes to operate on. There must be lots of facts and you must know them *well*. The student must have sufficient background knowledge to recognize familiar patterns—that is, to chunk—in order to be a good analytical thinker. Consider, for example, the plight of the algebra student who has not mastered the distributive property. Every time he faces a problem with a(b + c), he must stop and plug in easy numbers to figure out whether he should write a(b) + c or a + b(c) or a(b) + a(c). The best possible outcome is that he will eventually finish the problem—but he will have taken much longer than the students who know the distributive property well (and, therefore, have chunked it as just one step in solving the problem). The more likely outcome is that his working memory will become overwhelmed and he either won't finish the problem or he'll get it wrong.

How Knowledge Helps You Circumvent Thinking

It's not just facts that reside in memory; solutions to problems, complex ideas you've teased apart, and conclusions you've drawn are also part of your store of knowledge. Let's go back to the algebra students for a moment. The student who does not have the distributive property firmly in memory must think it through every time he encounters a(b + c), but the student who does, circumvents this process. Your cognitive system would indeed be poor if this were not possible; it is much faster and less demanding to recall an answer than it is to solve the problem again. The challenge, of course, is that you don't always see the same problem, and you may not recognize that a new problem is analogous to one you've seen before. For example, you may have successfully solved the *Tower of Hanoi* problem and moments later not realized that the tea ceremony problem is analogous.

Fortunately, knowledge also helps with this: A considerable body of research shows that people get better at drawing analogies as they gain experience in a domain. Whereas novices focus on the surface features of a problem, those with more knowledge focus on the underlying structure of a problem. For example, in a classic experiment Michelene Chi and her colleagues (Chi, Feltovich, and Glaser, 1981) asked physics novices and experts to sort physics problems into categories. The novices sorted by the surface features of a problem—whether the problem described springs, an inclined plane, and so on. The experts, however, sorted the problems based on the physical law needed to solve it (e.g., conservation of energy). Experts don't just know more than novices—they actually see problems differently. For many problems, the expert does not *need* to reason, but rather, can rely on memory of prior solutions.

Indeed, in some domains, knowledge is much more important than reasoning or problem-solving abilities. For example, most of the differences among top chess players appear to be in how many game positions they know, rather than in how effective they are in searching for a good move. It seems that

there are two processes to selecting a move in chess. First, there is a recognition process by which a player sees which part of the board is contested, which pieces are in a strong or weak position, and so forth. The second process is one of reasoning. The player considers possible moves and their likely outcome. The recognition process is very fast, and it identifies which pieces the slower reasoning process should focus on. But the reasoning process is very slow as the player consciously considers each possible move. Interestingly, a recent study indicates that the recognition process accounts for most of the differences among top players. Burns (2004) compared the performance of top players at normal and blitz tournaments. In blitz chess, each player has just five minutes to complete an entire game, whereas in a normal tournament, players would have at least two hours. Even though play was so sped up that the slow reasoning processes barely had any time to contribute to performance, the relative ratings of the players were almost unchanged. That indicates that what's making some players better than others is differences in their fast recognition processes, not differences in their slow reasoning processes. This finding is rather striking. Chess, the prototypical game of thinking and reflection, turns out to be largely a game of memory among those who are very skilled. Some researchers estimate that the best chess players have between 10,000 and 300,000 chess-piece chunks in memory (Gobet and Simon, 2000).

Burns's (2004) study of chess skill meshes well with studies of science education. A recent meta-analysis (Taconis, Feguson-Hessler, and Broekkamp, 2001) evaluated the results of 40 experiments that studied ways to improve students' scientific problem-solving skills. The results showed that the successful interventions were those that were designed to improve students' knowledge base. Especially effective were those in which students were asked to integrate and relate different concepts by, for example, drawing a concept map or comparing different problems. Interventions designed to improve the students' scientific problem-solving strategies had little or no impact, even though the goal of all the studies was to improve scientific problem solving.

We've seen how knowledge improves learning and thinking. But what does this mean for the classroom? The box on page 35 offers some strategies for building students' store of knowledge. □

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Virtual Exhibits, Genuine Learning

Museums' Web Sites Are Nearly as Fascinating as the Museums Themselves—and Much More Comprehensive

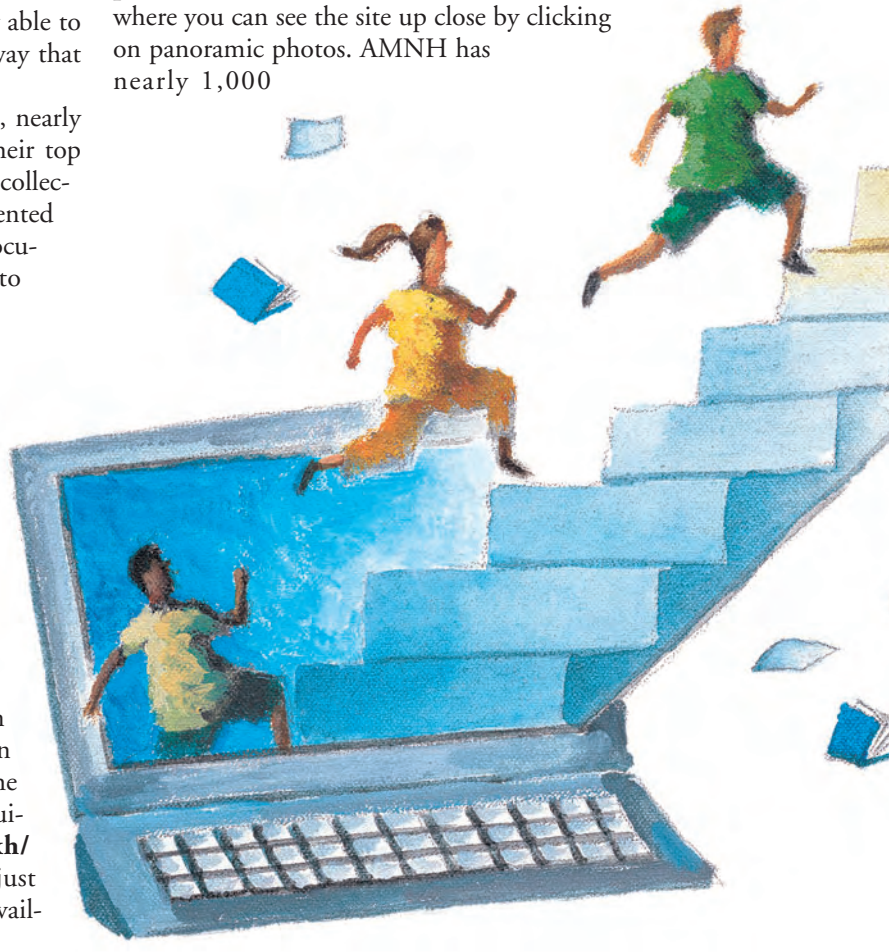
Since museums first began to serve the public in the late 1700s, one of their primary objectives has been education. From the arts to the sciences and from objects to ideas, museums have aimed not only to collect works of local or national significance, but to display them in a way that would be both memorable and informative. In recent decades, museums have expanded their educational missions by developing special tours and exhibits for school children—some have even partnered with teachers to write complementary lesson plans. And yet, despite these efforts, museums have almost always been relegated to the occasional field trip, rarely able to share their vast resources with schools in an ongoing way that would truly enhance the core curriculum.

Thanks to the Internet, that's changing. As of 2002, nearly all medium and large museums had Web sites, and their top priority for those sites was to increase access to their collections.* This means that educators now have unprecedented opportunities to bring digital works of art, historical documents, and demonstrations of scientific principles into the classroom.

American Educator searched about 30 major museums' Web sites to bring you this small sample of the vast array of collections, exhibits, and lesson plans available online. We found too many great resources to call our selections the best—we just hope they will entice you to start your own search. What follows are brief excerpts from three online exhibits:

■ "Beginnings" from the online exhibit "Picturing Hemingway: A Writer in His Time" by the National Portrait Gallery. "Beginnings" explores Hemingway's childhood and young adulthood, with an emphasis on the experiences and people that would later appear in his short stories and novels. The full exhibit reveals the highs and lows of Hemingway's life, ending with his suicide in 1961. It is available at **www.npg.si.edu/exh/hemingway/index.htm**. "Picturing Hemingway" is just one of more than 20 online versions of past exhibits available at **www.npg.si.edu/exhibit/curex12.htm**.

■ Four selections from the online exhibit "Petra: Lost City of Stone" by the American Museum of Natural History (AMNH). This exhibit weaves together the history of Petra, a 2,000-year-old city in Jordan, and the techniques used by archaeologists to uncover that history. The slices of the exhibit shown here offer a brief introduction to Petra, a glimpse of daily life, an account of a devastating earthquake, and a summary of the site's ongoing archaeological work. When you go to the Web site (**www.amnh.org/exhibitions/petra/**), don't miss the "Interactives" section where you can see the site up close by clicking on panoramic photos. AMNH has nearly 1,000



ILLUSTRATED BY PAUL ZWOLAK

online resources for educators, children, and families; they are organized by topic—anthropology, astronomy, biology, earth science, and paleontology—and can be broken out by grade level, title, and type of resource, as well. The main page for diving in is **www.amnh.org/education/resources/**.

■ Discussions of *The Lackawanna Valley* and the *Memorial to Robert Gould Shaw and the Massachusetts Fifty-fourth Regiment* from the online lesson "19th-Century American Art & Literature" by the National Gallery of Art's classroom division. In all, this online lesson features seven works of art that will enhance students' understanding of America in the 1800s; each illustrates a major theme of the time period, including the agrarian society giving way to the industrial revolution and urbanization, westward expansion and its impact on Native Americans, and the role of African-American soldiers in the Civil War. The full lesson is online at **www.nga.gov/education/classroom/19th_century_america/index.shtm**. The NGA's Classroom site (**www.nga.gov/education/classroom/index.mhtm**) contains dozens of lessons that teachers can use to integrate art into almost all academic subjects.

Because online exhibits are usually designed for a general audience, most of them are appropriate for high school students (or advanced 7th- or 8th-grade students). But these exhibits are also a great resource for elementary and middle school teachers. A 3rd-grade teacher doing a unit on ancient peoples, for example, could use the images and content from the Petra exhibit without expecting the students to read the text or navigate the Web site by themselves. Some museums have created sites specifically for children; two such sites—OLogy by the American Museum of Natural History and a Cow's Eye Dissection by the Exploratorium—are described in the box of additional great sites on page 46.

—Editors

* Source: Institute of Museum and Library Services, *Status of Technology and Digitization in the Nation's Museums and Libraries 2002 Report.*

PICTURING HEMINGWAY
A Writer in His Time

This is to tell you about a young man named Ernest Hemmingway [sic]*, who lives in Paris…& has a brilliant future…. I'd look him up right away. He's the real thing.*

—F. Scott Fitzgerald to his editor Max Perkins, October 19, 1924

Beginnings

When Ernest Hemingway arrived in Paris late in 1921 to take up residence in the Anglo-American enclave of avant-garde artists and intellectuals there, his literary aspirations were purely speculative. Yet at 22, this would-be writer somehow engendered credibility; even before he published anything major, many of the enclave's expatriate literati, among them Ezra Pound and Ford Madox Ford, regarded him as a significant talent. The belief in him proved well founded. With the publication of his first novel, *The Sun Also Rises*, in 1926, Hemingway emerged as one of the most original writers of his generation. Over the next several decades, many of his short stories and novels would be embraced as classics almost overnight.

In his own lifetime, Hemingway's fame rested nearly as much on his personality as it did on his art. Between his expertise as an outdoor sportsman, his stints as a war correspondent, and his enthusiasm for bullfighting and boxing, he became a symbol of virile glamour, and his celebrity even among those who never read his books was a phenomenon unique in American letters. His most enduring legacy, however, is his crisp, direct storytelling prose, which has been a shaping influence for countless writers of the 20th century.

Hemingway grew up in the affluent Chicago suburb of Oak Park, the son of a physician father and a musically inclined mother. He accepted the community's conservative universe, and nothing in his youth marked him for a writer whose cynicism and sexual frankness would be the source of dismay for many Oak Parkers. Among the most dismayed were his parents. When his first novel, *The Sun Also Rises*, was due for discussion at her book club, his mother absented herself, unable to bear the shame of it all.

For his part, Hemingway became alienated from both his parents, seeing his mother as overbearing and his father as weak. Those judgments eventually formed the basis of "The Doctor and the Doctor's Wife," his devastatingly negative portrayal of a marriage.

Young Hemingway (far right) with his family, 1906

The Hemingways spent large portions of every summer at their cottage on Walloon Lake in Michigan. There, young Ernest learned early the joys of hunting and fishing. On his third birthday, his father took him fishing for the first time. The expedition proved hugely successful. "He knows when he gets a bite," his mother reported afterward, "and lands them all himself." But the Michigan summers gave Hemingway some-

Young Hemingway fishing, summer 1905

Hemingway on the beach of a lake in Michigan, summer 1916

thing beyond his lifelong love of field and stream. Out of his memories of Walloon would come the settings and characters for some of his finest short stories.

In the photograph on the left, young Hemingway looks every bit the model for Nick Adams, the young man who was the hero in Hemingway's many short stories drawn in large part from his own youthful experiences in Michigan.

The estimation of Hemingway in his high school yearbook was "None are to be found more clever than Ernie." The observation reflected the respect he had earned for his abilities both in academics and in such extracurricular endeavors as his editorship of the school newspaper. The next logical step following graduation seemed to be college. Hemingway, however, was having none of that. Anxious to be independent, he decided instead to go to Kansas City, Mo., and become a reporter for the *Kansas City Star*.

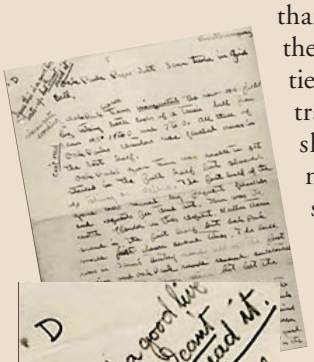
In 1917, the *Kansas City Star* was among the best newspapers in the country. Its staff boasted many bright and talented writers, and Hemingway's exposure to the intellectual interests of these reporters broadened his own perspectives substantially. Their influence doubtless also fed his nascent aspirations to write fiction. As one *Star* veteran recalled years later, just about every reporter during Hemingway's tenure on the paper harbored dreams of writing a novel.

In the spring of 1917, the United States became an active participant in World War I, and massive recruitment of American soldiers began. Hemingway wanted to enlist, but between parental objections and an eye condition that would probably have precluded his acceptance, he never tried. Still, he was determined to be part of the war. By early May 1918, he was in New York waiting to sail for Italy as a member of the Red Cross ambulance corps.

His stint with the ambulance corps proved brief, however. On July 8, shortly after midnight, Hemingway was in the frontlines distributing coffee, candy, and postcards to soldiers. Suddenly, an Austrian trench mortar arced down, spewing its metal shards in all directions. Among the wounded was Hemingway, who sat out the rest of the war as a convalescent.

Among the nurses attending to Hemingway following his battle injuries was an American named Agnes von Kurowsky. Before long he was in love with her. More than six years his senior, Kurowsky kept him at arm's length for awhile, but eventually she succumbed to his ebullient charm. Nevertheless, Kurowsky's feelings for Hemingway were never as deep as his attachment to her, and she broke off the relationship in a letter not long after he returned home.

But Hemingway never forgot this romance, and Kurowsky later became a primary model for the heroine in his novel of World War I, *A Farewell to Arms*.

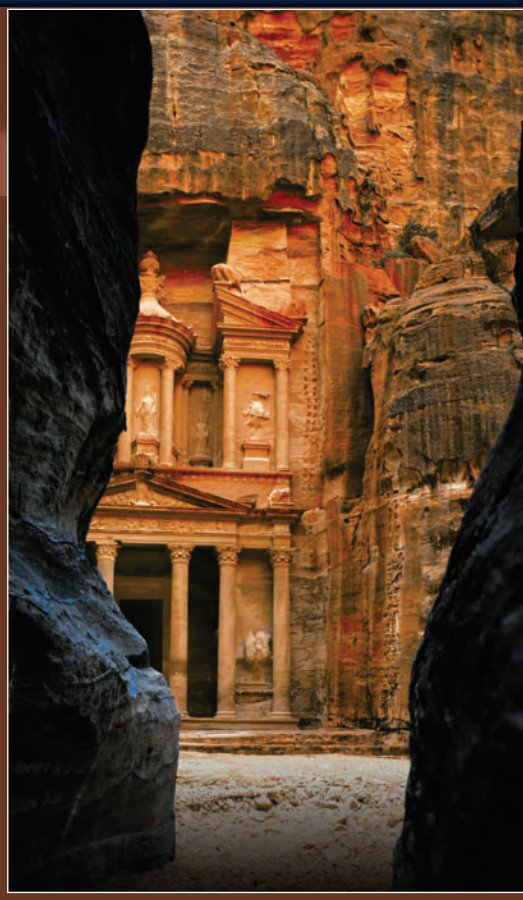


Hemingway received a "D" in this writing exercise for one of his English classes at Oak Park High School. As the teacher's comment indicates, however, it was not content but penmanship that earned him the low grade. When his work was legible, it earned high marks indeed, and the school's English faculty quickly recognized his unusual talent for narrative. But Hemingway was not only good at writing; he liked doing it. According to a contemporary, he was by age 15 writing just "for the fun of it."

Hemingway in his World War I ambulance driver's uniform; (Inset) Hemingway's first love, Agnes von Kurowsky, 1892-1984

IMAGES COURTESY ERNEST HEMINGWAY COLLECTION, JOHN F. KENNEDY LIBRARY, BOSTON.

PETRA
Lost City of Stone



Introduction

Once a flourishing city in the heart of the ancient Near East... then forgotten by the outside world for centuries. Now Petra reveals some of its long-lost secrets.

Deep within the deserts of Jordan lies the ancient city of Petra. Through a narrow gorge it emerges into view, revealing awe-inspiring monuments cut into the surrounding cliffs. What is this astonishing city? Who built it, and why?

Two thousand years ago, Petra stood at a crossroads of the ancient Near East. Camel caravans passed through, loaded with spices, textiles, and incense from distant regions—and through such commerce, the city flourished. Its people, the Nabataeans, harnessed precious water, enabling the population to soar to perhaps 20,000.

The Nabataeans also erected monumental tombs, memorializing their kings and leaders. But over time political control changed, and so did trade routes. Eventually the city fell silent, forgotten by the outside world.

Today archaeologists are discovering clues to Petra's past. The spectacular objects displayed here, many unearthed by recent excavations, shed new light on this extraordinary desert city.

Daily Life

A Life of Ease | Trappings of Wealth | Skilled at the Wheel | Landscape and Cityscape | Room with a View

Trappings of Wealth

In the absence of written accounts of everyday life, household objects and personal ornaments serve as our link to the people of Petra. Even the smallest of these items—handled, worn, and perhaps even loved two thousand years ago—can provide an intimate connection to the ancient city.

The artifacts here, found in the ruins of houses and public buildings, as well as in manufacturing sites and in graves, had more than decorative value to their owners: Symbols such as the scorpion and the cowry shell were used as protective amulets. And the decorative motifs Petra's residents chose, which drew on Greco-Roman as well as Nabataean themes, reinforce our image of their city as a cultural, not simply commercial, crossroads.

PHOTO: PETER JOHN GATES FBIPP

Plaque with musicians, Terra cotta

El Katuteh, Petra, Jordan, 1st-2nd century A.D.

This mold-made terracotta plaque allows us to see not just ancient instruments but the music makers themselves. A man playing a double flute is at the center of this trio of seated musicians; he is flanked by women, one playing a lyre and one playing another stringed instrument. All three wear typical full-length, pleated garments; the man's robe ends in a long sash or braid. The two females are veiled. Music was a staple form of entertainment at Petra and a central element of ceremonial occasions. These particular musicians probably accompanied special funerary banquets held in honor of the dead, perhaps on the anniversary of a death.

The Great Earthquake

Petra has suffered many earthquakes during its long history. The city sits near the boundary of the Arabian plate, one of about a dozen large, moving landmasses that make up Earth's outer shell. Regions where plates intersect are prone to earthquakes; in the eastern Mediterranean, three plates come together, so Petra and its surrounding area are at particular risk.

A quake on May 19, A.D. 363, seems to have struck Petra an especially heavy blow. Contemporary records claim half the city was destroyed, and archaeologists confirm considerable damage to Petra's main theater, its major temples (including the Qasr al-Bint) and the Colonnaded Street. Even worse, the quake disrupted the water supply system. An economically healthy Petra might have rebounded, but changes in trade routes had already sapped the city's vitality. By A.D. 363, it seems, Petra had lost the means to rebuild itself.

How Do We Know?—The Quake Date

In 1976, archaeologists in Petra excavated a small house destroyed by an earthquake in antiquity. Lying in one corner were what seemed to be the remains of a spare-change jar: 85 small bronze coins scattered amid pottery fragments. All the coins bore the image of the Roman emperor Constantius II, and most were minted after a currency reform of A.D. 354. The quake, therefore, could not have happened before then.

Additional evidence came to light that same year when a scholar doing archival research chanced on a letter written in antiquity. Evidently the work of Cyril, bishop of Jerusalem from A.D. 350 to 386, the letter tallies the effects of a great regional earthquake. According to the letter, "nearly half" of Reqem (the Nabataean name for Petra) was destroyed by a quake "at the third hour, and partly at the ninth hour of the night," on May 19, A.D. 363. Cyril tells us, in other words, the date and time not just of the main quake, but of its powerful aftershock.

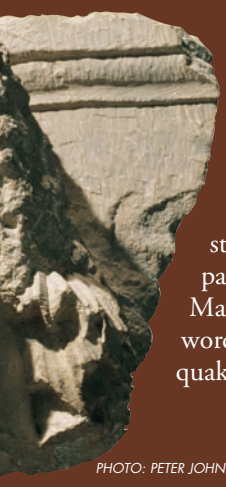


PHOTO: PETER JOHN GATES FBIPP

(Top left and far right) The Treasury in the city of Petra in Jordan
(Center) Bust of a Greco-Roman deity
Marble
Temenos of Qasr al-Bint, Petra, Jordan, 1st century A.D..

PHOTOS COURTESY OF THE AMERICAN MUSEUM OF NATURAL HISTORY

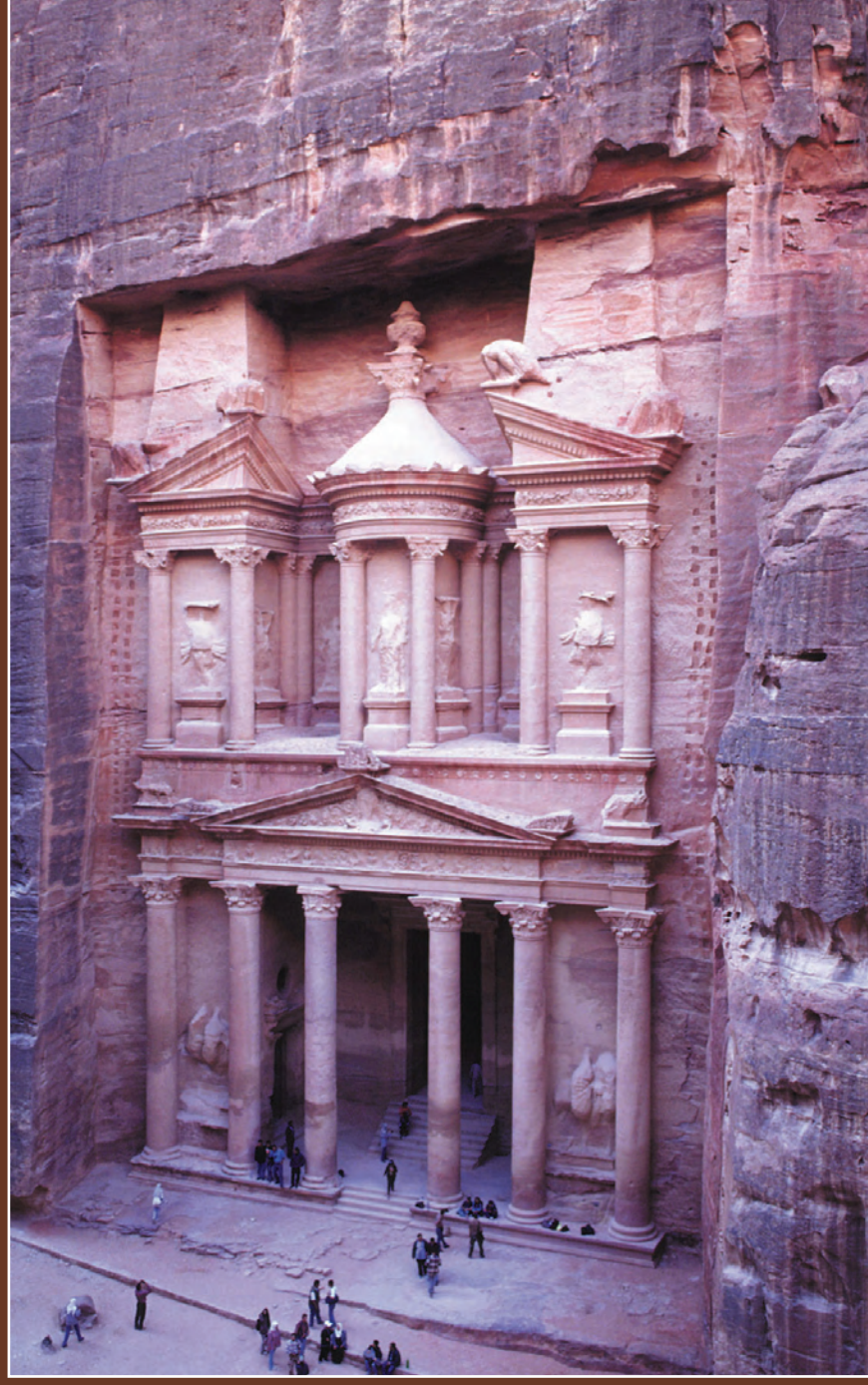


PHOTO © JORDAN TOURISM BOARD, NORTH AMERICA

Petra Today

Our knowledge of Petra changes every day. With less than one-twentieth of the ancient city unearthed, new wonders constantly emerge at the hands of Jordanian, French, Swiss, and American archaeologists. Excavators found an immense pool complex near the Great Temple in 1998; in 2000, a Nabataean villa outside the Siq. In a stunning 2003 discovery, rock-cut tombs came to light beneath the Treasury, challenging old ideas about this iconic building. Now as in the past, Petra has the capacity to astonish.

But this ancient metropolis exists in today's world. Two thousand years of wind and water have taken a toll on its fragile stone. Visitors have increased ten-fold since 1990. The city must be protected from the elements—and its admirers. Scientists and engineers from around the world are rebuilding Nabataean dams and planning restoration of the ancient water supply system, marveling as they work at the genius of Petra's original inhabitants.

19th-Century America in Art & Literature

In the United States, the 19th century was a time of tremendous growth and change. The new nation experienced a shift from a farming economy to an industrial one, major westward expansion, displacement of native peoples, rapid advances in technology and transportation, and a civil war. In this lesson, works of art from the 19th century are paired with written documents, including literary selections, a letter, and a speech. As budding historians, students can use these primary sources from the 19th century to reconstruct the influence of technology, geography, economics, and politics on daily life.

Art Discussion: *The Lackawanna Valley* and Poem

Emily Dickinson's poem "I Like to See it Lap the Miles" (19th century)

I like to see it lap the Miles—
And lick the Valleys up—
And stop to feed itself at Tanks—
And then—prodigious step

Around a Pile of Mountains—
And supercilious peer
In Shanties—by the sides of Roads—
And then a Quarry pare

To fit its sides And crawl between
Complaining all the while
In horrid—hooting stanza—
Then chase itself down Hill—

And neigh like Boanerges—*
Then—prompter than a Star
Stop—docile and omnipotent
At its own stable door—

**Biblical name meaning "sons of thunder"*

The Industrial Revolution in the United States saw the rise of textile mills and mass production in other industries. National roads were built to make transportation easier, but railroads and steamboats made the movement of raw materials and manufactured goods even faster. By 1850, just 20 years after the engine *Tom Thumb* lost its race against a railroad car pulled by a horse, about 9,000 miles of railroad track crossed the nation.

One of the early railroad lines was the Delaware, Lackawanna, and Western. In the 1850s, the president of this new company commissioned the artist George Inness to paint *The Lackawanna Valley* to use for advertising purposes. While documenting the achievements of the railroad, Inness also created a convincing view of Scranton, Pa. The artist took relatively few liberties with his composition, but in compliance with the wishes of his patron, he included four trains and exaggerated the prominence of the railroad's yet-to-be-completed roundhouse, a building for housing and repairing trains.

Steam-powered trains were fueled by wood or coal (this

PHOTO COURTESY OF THE NATIONAL GALLERY OF ART.

George Inness, The Lackawanna Valley *(about 1856). As the inset painting shows, when students move the cursor over the painting, details are highlighted and captions appear. For example, when the tree stumps in the foreground are highlighted, the caption explains that trees were used for railroad ties as well as fuel.*

one uses wood). They released smoke and soot in the air that often made rail travel dirty. It was not uncommon for porters to brush passengers off at the end of the line. In 1831, a passenger wrote this firsthand account of an early trip by rail, quoted in Lorna C. Mason, William Jay Jacobs, and Robert P. Ludlum, *History of The United States, vol. 1: Beginnings to 1877* (Boston: Houghton Mifflin, Co., 1992), 364:

> The [coaches] were coupled together with chains, leaving from two to three feet slack . . . and in stopping, came together with such force as to send [passengers] flying from their seats. . . . black smoke with sparks, coals, and cinders, came pouring back the whole length of the train. Each of the tossed passengers who had an umbrella raised it as a protection against the smoke and fire. They were found to be little protection, for I think in the first mile the last umbrella went overboard, all having their covers burnt off from the flames.

Inness seems to have minimized the smoke in the landscape and painted it a clean billowing white— perfect for a promotional painting.

When the poet Emily Dickinson (1830-1886) was young, trains were so new that people often referred to them as "iron horses." Her poem, "I Like to See it Lap the Miles," compares a train's movements to those of a horse. Dickinson was born and lived in Amherst, Mass. In her late twenties, she became increasingly withdrawn and thereafter seldom ventured outside her home. On one of her rare trips out she stood in a neighbor's woods to watch the first train in her town leave the station.

Art Discussion: *Memorial to Robert Gould Shaw and the Massachusetts Fifty-fourth Regiment* and Letter

At the beginning of the Civil War, Richard Harvey Cain, a student at Wilberforce University in Ohio, was among a group of black students who attempted to join the Union Army in Ohio. Cain was turned down. Below he writes about the events after the first shots were fired at Fort Sumter and the importance of the Massachusetts Fifty-fourth Regiment, the first black troop to be organized in the North during the Civil War.

> I shall never forget the thrill that ran through my soul when I thought of the coming consequences of that shot. There were one hundred and fifteen of us students at the University, who, anxious to vindicate the stars and stripes, made up a company and offered our services to the Governor of Ohio; and sir, we were told that this is a white man's war and that the Negro had nothing to do with it. Sir, we returned, docile, patient, waiting, casting our eyes to the Heavens whence help always comes. We knew that there would come a period in the history of this nation when our strong black arms would be needed. We waited patiently; we waited until Massachusetts, through her noble Governor, sounded the alarm, and we hastened to hear the summons and obey it.

Letter by Richard Harvey Cain written at the time of the Civil War, quoted in Zak Mettger, Till Victory is Won: Black Soldiers in the Civil War *(New York: Puffin Books, 1997), 2.*

PHOTOGRAPH BY JEFF NINTZEL
PHOTO COURTESY U.S. DEPARTMENT OF INTERIOR, NATIONAL PARK SERVICE, SAINT-GAUDENS NATIONAL HISTORIC SITE, CORNISH, N.H.

Augustus Saint-Gaudens, Memorial to Robert Gould Shaw and the Massachusetts Fifty-fourth Regiment (1900). As with the painting (lower left), moving the cursor over the memorial highlights areas and captions appear. One highlight, for example, is of the plain background; the caption explains that the memorial is a "relief sculpture, which means the figures stand out from a flat background."

As the U.S. grew in population and area in the 1800s, it became increasingly divided by the issues of slavery and states' rights. While factories in the North were drawing people from farms to towns and cities, at mid-century, the economy in the South remained tied to agriculture. Of the 11 million people living in the South in 1860, nearly four million were slaves, and most worked on farms. Abolitionists wanted to end slavery, but many people in the South believed in the states' right to decide this issue. Slavery and its spread to the western frontier became two of the most argued issues in the country.

In late 1860, South Carolina seceded from the Union, quickly followed by other southern states. Together they formed the Confederate States of America. When Confederate forces fired on the U.S. Army's Fort Sumter in South Carolina on April 12, 1861, the Civil War began.

As the war progressed, many black men decided to form their own regiments to fight for the Union. In 1862 Congress agreed to their enlistment and more than 186,000 African-American men signed up. They were not paid as much as white soldiers or were not paid at all, were given poor equipment, and often ran out of supplies. To make matters worse, Confederate soldiers threatened to enslave or kill any black soldiers they captured, and kill their white commanders. Overcoming these hardships, black soldiers proved themselves heroically in battle. They led raids, served as spies and scouts, fought in battles, and faced some of the worst confrontations in the war. They helped win the war for the Union.

The Massachusetts Fifty-fourth Regiment, the first African-American troop in the North, began recruitment in February 1863, one month after President Lincoln signed the Emancipation Proclamation. The recruits came from 24 states; one-quarter of them slave states. Among the recruits were barbers, boat-

men, laborers, cabinetmakers, a dentist, and a druggist. Some were as young as 16. Some were fathers enlisting with sons. Members of the regiment included Frederick Douglass' two sons, the grandson of abolitionist Sojourner Truth, and William H. Carney, the first African American to win the Medal of Honor. Robert Gould Shaw, the white son of prominent Boston abolitionists, was appointed to command the regiment, as military policy did not allow black men to serve as officers.

On May 28, the largest crowd in Boston's history assembled to see the Fifty-fourth Massachusetts Volunteer Infantry Regiment march off to fight. Two months later, Shaw and one-third of his men died during the Union's siege at Fort Wagner, one of the forts protecting Charleston, S.C., a bastion of the Confederacy. The brave conduct of this regiment inspired black men like Richard Harvey Cain to enlist in the Union forces.

After the battle of Fort Wagner, proposals were made by men of the Fifty-fourth to erect a memorial. Sculptor Augustus Saint-Gaudens took almost a dozen years to create it. He began with the idea of an equestrian statue of the young Colonel Shaw. The plan evolved into a procession of black soldiers with their leader, moving together toward the goal of emancipation. The monument is cast in very high relief. To make each soldier individualized, Saint-Gaudens created 40 heads using live models of different ages. Seen in profile are the mounted Colonel Shaw and rows of soldiers carrying rifles, packs, and canteens, all led by young drummer boys. Above the procession floats an angel holding an olive branch, symbolizing peace, and poppies, symbolizing death. □

More Great Museum Web Sites

The Wright Brothers & the Invention of the Aerial Age
www.nasm.si.edu/wrightbrothers/
How did a couple of bicycle mechanics, Wilbur and Orville Wright, figure out how to fly? What impact did their research have on the 20th century? This comprehensive, photo-filled exhibit by the National Air and Space Museum weaves together the family history, regional history, and science that allowed the Wright brothers to invent the first successful airplane.

A More Perfect Union: Japanese Americans and the U.S. Constitution
http://americanhistory.si.edu/perfectunion/experience/index.html
"Two centuries ago, the framers of the Constitution wrestled with the fundamental problem of government: how to balance the rights of individual citizens and minority groups against the need for order and defense of the society itself." So begins this fascinating exhibit by the National Museum of American History, which presents the internment of Japanese Americans during World War II as a case study on one of the fundamental struggles of the U.S. Constitution.

Edison Invents: All about Thomas Edison and His Inventions
http://invention.smithsonian.org/centerpieces/edison/
This straightforward, yet very informative exhibit by the National Museum of American History tells the stories behind Edison's inventions—including his love of midnight sing-alongs by the pipe organ in the back of his Menlo Park Laboratory. It also includes easy-to-follow instructions for students to make their own light bulbs.

Lewis and Clark: Mapping the West
www.mnh.si.edu/education/lc/lcmapping/
Though this exhibit by the National Museum of Natural History begins with the historical context of Lewis and Clark's exploration of the northwest, its strength is in its focus on cartography. After an introduction to some basic concepts such as latitude and longitude, students learn about the various techniques Lewis and Clark used to make their maps 200 years ago—including everything from celestial observations to copying the maps of the Indian tribes they encountered along the way.

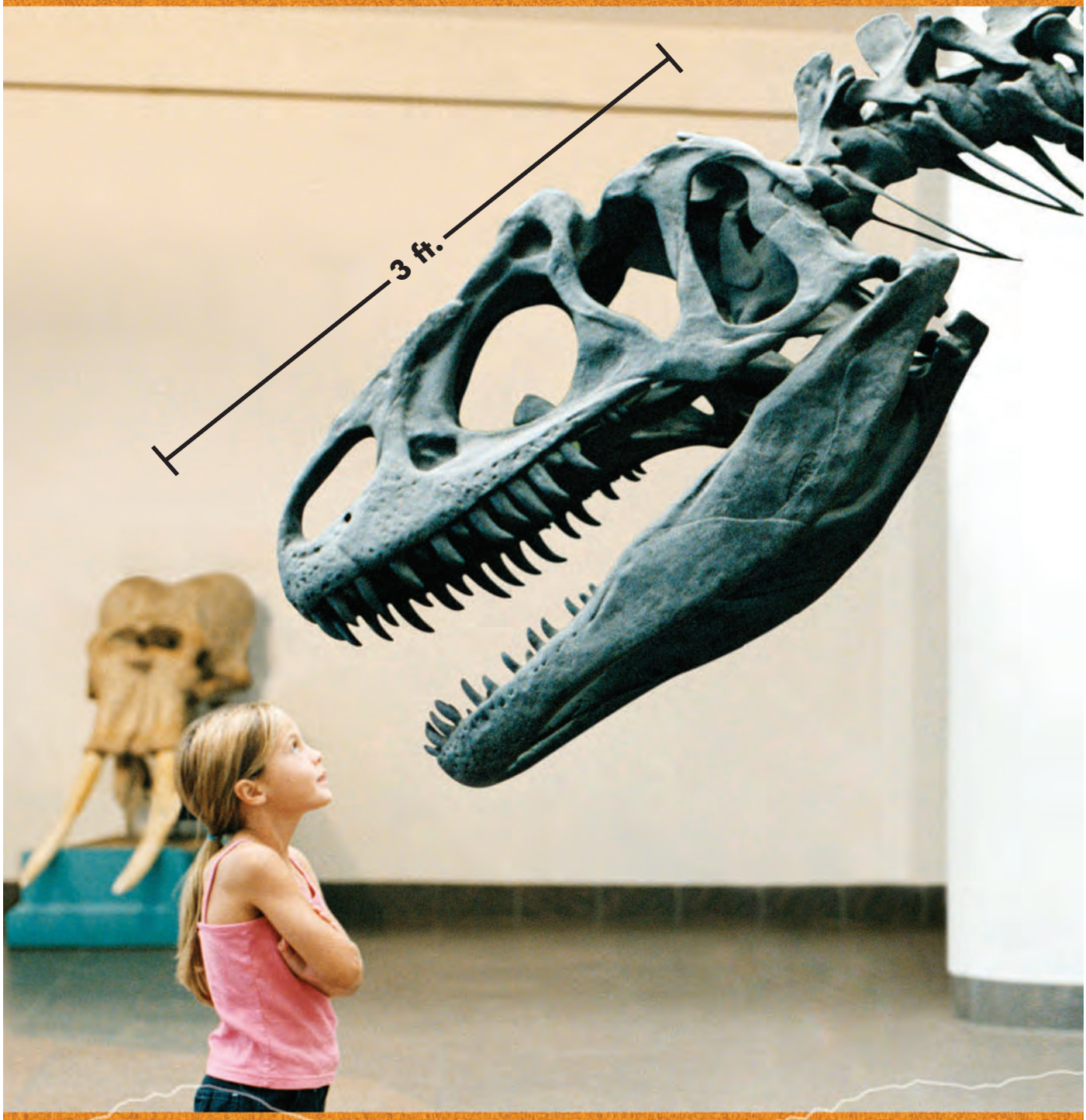
Microscope Imaging Station
www.exploratorium.edu/imaging_station/index.html

Cow's Eye Dissection
www.exploratorium.edu/learning_studio/cow_eye/index.html
Don't have the budget for a research-grade microscope or the stomach for dissecting a cow's eye? These two sites by the Exploratorium bring you the next best thing. The Microscope Imaging Station is a great resource for high school biology teachers; the "Gallery" section has dozens of photos, videos, and video stills of stem cells growing and dividing, white blood cells reacting to a bacterial infection, crawling amoeba, and much more. The Cow's Eye Dissection delivers just what it says through photos, videos, and middle-school-friendly text and drawings while also explaining the structure of the eye and how vision works.

OLogy
http://ology.amnh.org/
OLogy is a set of online exhibits and activities created for elementary and middle school children by the American Museum of Natural History. Mixing the big concepts of the sciences with specific examples, it introduces kids to archaeology, astronomy, biodiversity, planet earth, paleontology, Einstein, genetics, and marine biology.

Timeline of Art History
www.metmuseum.org/toah/splash.htm
Unlike the other sites discussed here, the timeline is not an exhibit or lesson. It is the Metropolitan Museum of Art's brilliant way of presenting its enormous collection online. The timeline extends from 20,000 B.C. to today and reaches around the world, but it is still easy to navigate—just click on a time period and then a region. With contributions by the Met's curatorial, conservation, and educational staff, the timeline presents works of art in their historical context.

ALLOSAURUS was at the top of the food chain in the **JURASSIC.**
{I bet he could eat a lot of cookies.}



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Conjuring Willa Cather

A Teacher on the Magic of Good Examples

By Patricia R. Pickard

"This is how you do it. Watch." Kids will do what we show them. Thirty-six years of rearing a big family and teaching elementary and college students has taught me that our children will learn *anything* that is modeled—good, bad, or indifferent.

At the end of her first week of nursery school, my daughter Sarah came home, hoisted *Curious George* up to the side of her head, pages open as if to an invisible audience, and pretended to read. She chatted her way through the story, paused to ask questions, giggled, and, that book finished, picked up another. Holding the open book out to the side of her pigtail, she began again.

"What are you doing Sarah?" her dad asked.

"I'm reading out of my ear," she replied primly. "That's the way we do it at school."

So the challenge is to model wisely.

But what of the teacher who does not model? Ecologists dread something called "trophic cascade," a situation in which, say, the cougar, a chief carnivore, disappears from the top of the food chain, and its absence causes disarray below. The food chain crumbles, and disruption reigns. The toppled cougar and his ilk are considered "keystone" species. It is like that with teaching and learning. We do not teach our children wisely or well if certain keystone stances are not topmost in our minds and hearts.

Modeling is one of those keystone precepts. The only thing worse than faulty modeling is a teacher who does not credit the power of modeling. Allow me to elaborate.

As a senior in high school, I sought and hoarded Willa Cather nuggets as if I were a squirrel sensing a hard winter. I read *My Ántonia, Death Comes for the Archbishop*, and *A Lost Lady* during one three-week stretch. Cather's strong characters gripped me. I studied how she showed her love of the land and her struggles with nature, her family, and the past. I copied my favorite passages onto snippets of paper and slipped them into my pockets. I taped them to the inside covers of my Algebra 2 textbook and traced them as if they were Braille during a lull in the quadratic equations. I mulled them over. I rolled them around in my mouth.

Before I wrote for school, I reread my favorite Cather excerpts. I peered at the dog-eared pages and underlined passages multiple times. Then I tucked her to one side and wrote. I tried to write as she did. As I drafted, her words echoed. Like a hawk riding the thermals, I was somewhere in my writing I could never have been on my own. In the beginning, Paul McCartney had Buddy Holly; I had Willa Cather.

This is not to say that what I wrote was any good. What I was doing was exercising my writing muscle. I was attending to craft and tuning in to structure and tone. The Zen Buddhists would say that Cather was the bamboo pole for my creative snake.

Until Mrs. Twining's fiat, that is.

Mrs. Twining was the head of the English department at my high school and always taught the honors-track seniors. During World War II, she had been in the Women's Army Corps, and she still held herself as if she had a yardstick down her back. Her trademark gesture was to inhale, draw back her shoulders, and iron her already flat stomach with her hand. I was wary of her and her stern manner. I hoped she would not take aim at me. Up to then, she had left me alone.

That day, she handed back a short piece I had done on my favorite tree. I had written about the "wide-hipped" apple tree in our backyard lot. I had a fabulous time composing. I studied how Willa Cather described trees, and I parsed her writing. I wanted every word to show. I placed my phrases and clauses as she did. I shaped my paragraphs as if she were there coaching me from the sidelines. I looked at my tree and described it better than I ever had described anything before.

Mrs. Twining stood in front of me, her straight skirt forming a right angle to the swirl of books on my desk, my Willa Cather coexisting with the algebra and French texts. She tapped my paper and inhaled. Then, with her fingers held like pincers, as if she did not want to touch more of it than she had to, she extracted one of the Cathers. She fingered its pages. "Patricia," she said, pausing to smooth her stomach, "We don't do this. No more Willa Cather."

And that was that. For several weeks, if I found myself clipping my sentences like Hemingway, or using the gerund in a prior sentence to start my next sentence like E.B. White, or lower-casing everything like e.e. cummings, I'd pull myself

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Patricia R. Pickard is a writer who has been both a K-6 teacher and teacher-educator. This article was excerpted with permission from Education Week*, September 14, 2005, volume 25, issue 03, pp. 35, 37.*

ILLUSTRATED BY ROBERT BARKIN

up short, cross it all out, and start again, on my own. But I would feel lightweight and lost, like a boat whose ballast has been ditched.

Frustrated and confused, I brought my problem to my father. In our family, Dad was the one who knew things about writing. Help sessions happened in the den, while he was trying to catch a catnap, pillow over his face, bow tie tucked in his shirt pocket.

I told him about Mrs. Twining and Willa Cather. I heard him take a deep breath. He flipped the pillow up and looked me in the eye.

"What happens around here when I'm working on a summation?"

"A summation?" I asked.

"You know, at the end of a trial? When I'm preparing my final pitch to the jury?"

"Uh … we have to be quiet?"

"No, what do I have you kids find for me?"

"Oh," I exclaimed, remembering. "We have to scrounge up that special version of the Bible and some book on Abraham Lincoln."

"That's right," he said. "Do you know why?"

When I didn't, he told me.

"I have favorite parts of the King James version that I reread for the cadence," he said, "and of Carl Sandburg's *Lincoln* for the words. I read them over and over for a while before I start writing. I want them in my mind."

"Like what I did with Willa Cather?" I asked.

"Like what you *do* with Willa Cather."

Sweet is the camaraderie of a learning community that values the power of a good model. We are fellow seekers who delight in both the search and the discovery. To document this, the *New York Times* recently asked authors to describe the "hum" inside their heads. The paper wanted to know about writers and the books that influenced them. Implicit throughout was the idea that not only does every learner need a model, but a good one at that. Models provide the hum, whether they are models from books or actual demonstrations from a live human. Teaching without valuing models causes our own educational version of trophic cascade. Not good. □

(Continued from page 29)

Endnotes

[1] Hofstadter, R. (1963). *Anti-Intellectualism in American Life.* New York:Vintage Books.

[2] Walsh, K. (2003). "Basal readers: The lost opportunity to build the knowledge that propels comprehension," *American Educator*, Spring, p. 24-27.

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