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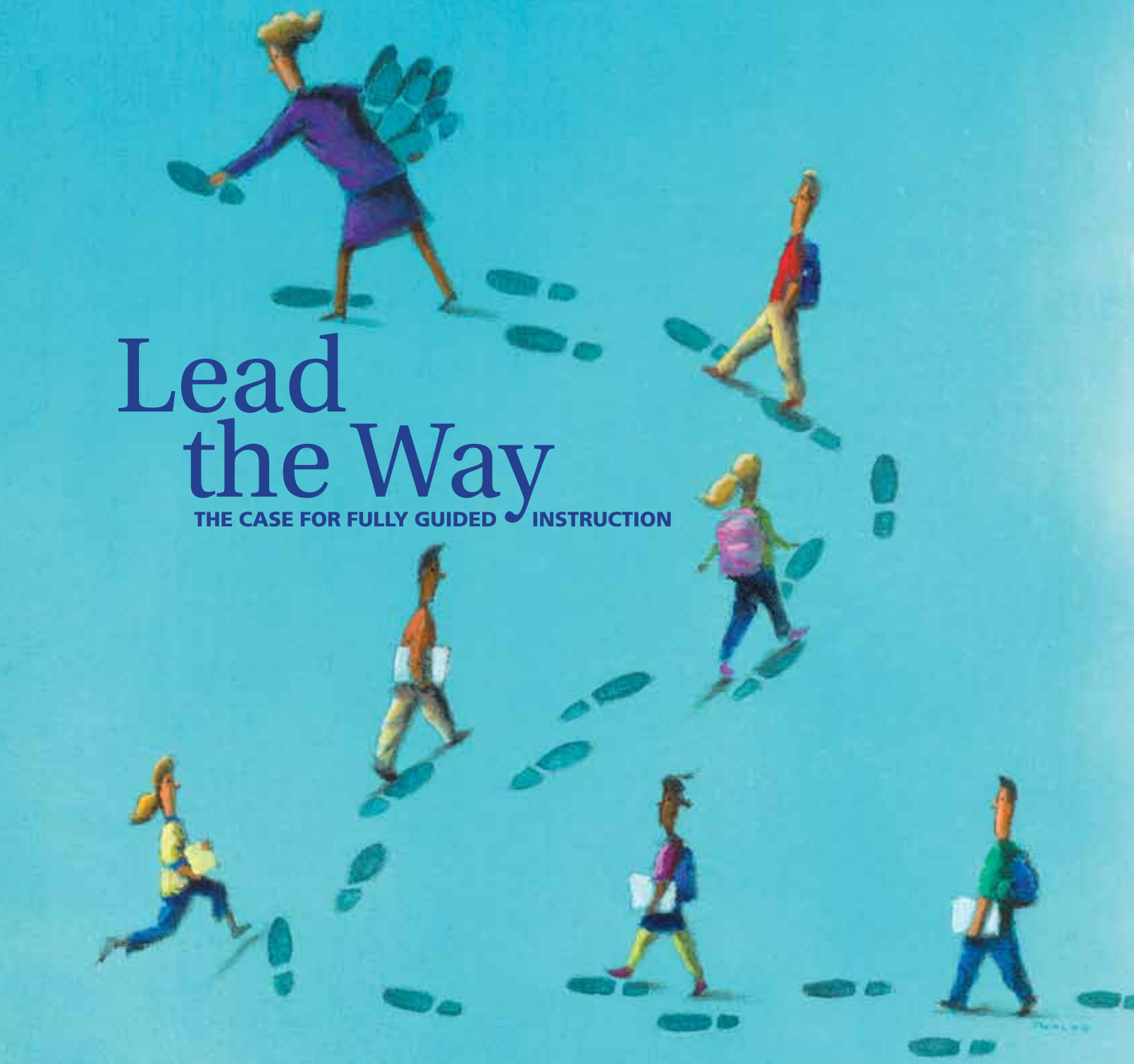

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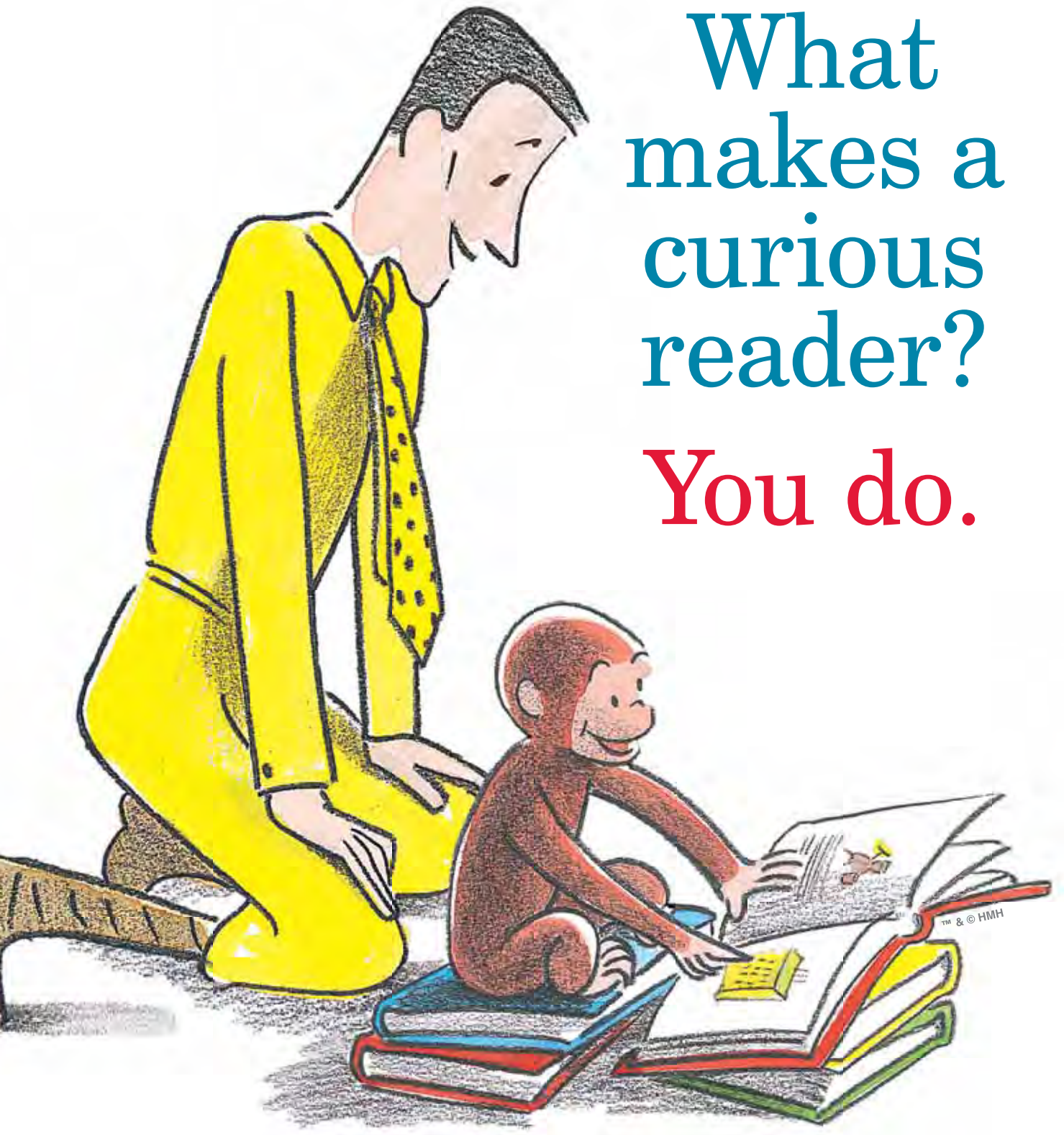

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The Case for Fully Guided Instruction

By Richard E. Clark, Paul A. Kirschner, and John Sweller

Discovery learning, problem-based learning, inquiry learning, constructivist learning—whatever the label, teaching that only partially guides students, and expects them to discover information on their own, is not effective or efficient. Decades of research clearly demonstrates that when teaching new information or skills, step-by-step instruction with full explanations works best.

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Finland Shows Us What Equal Opportunity Looks Like

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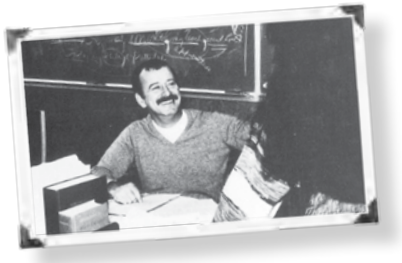

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In addition to having fewer material and social supports, children from low-income families also tend to have chronic stress that can significantly impede their learning. Research shows that besides social service supports, a classroom teacher's warmth toward and high expectations for disadvantaged children can help them reach their potential.

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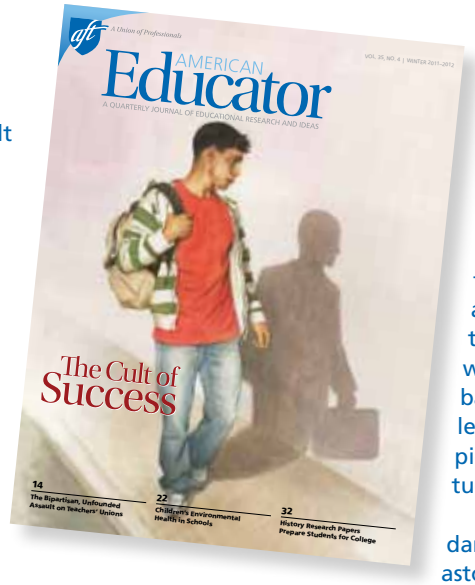
Fresh Perspective on Success



Thank you for such refreshing, validating ideas in "The Cult of Success" by Diana Senechal, which appeared in the Winter 2011–2012 issue. As a high school English teacher, this year I have been drowning in the bombardment of new Common Core standards, teacher evaluation methods, and revamped state testing. I'm not drowning in the sense that I am fearful of low student scores, and subsequently my own personal assessment grade, or that I'm overwhelmed with adapting my current curriculum and lesson plans to New York's new set of standards. I could keep my head above water if I could believe it was a lake worth swimming in.

Some of my most prized personal successes from past years are the unmeasurable, and many extend beyond the classroom: helping a student revise her short story for publication in a local student literary journal, coaching the drama club students through a play that moved many parents to tears, motivating more students to join the school's book circle.

I have successes within my classroom, as well, but those seem under attack from graphs, charts, and other data. I can't statistically prove my students are learning valuable personal and life lessons from Juror #8 and Liesel Meminger, but they are. I can prove they are reading the text closely, supporting their ideas with details, and wording responses in a grammatically appropriate manner, but those things matter less to me during my best lessons.

I agree building skills is important, but so are books—knowing them, loving them, even hating and struggling through them. I want my students in the boat with Santiago, with their hands cut and backs sore; I want them climbing up Juliet's balcony, proclaiming their undying love; I want them making honey with three sisters named after months. I want to guide them through the nitty-gritty, text-based and beyond, and then I want them to take it out the door with them, in their arms, backpacks, and minds. Needless to say, the companion piece, "The Practice of Solitude," was also welcome.

I am lucky enough to teach a dance elective, and I'm always astonished at how it often shows me perfect examples of what teaching should look like. As a teacher, it's been my personal model of successful differentiation and curricular planning. Many of the students who don't shine in any core subject take dance class and thrive. It's a sweet irony, considering it is not a graduation requirement, has no standardized testing attached, and is generally pretty data-less. It's even considered my "extra" class.

So, thank you for the inspiring words. I will take them back to school with me, as the breaths of fresh air I'm currently gasping for. I will try to marry them to the edicts and proclamations passed down from high above, though I realize they may work better in the current educational climate as armor.

–GRETCHEN BLYNT
Downsville Central School
Downsville, NY

The School Librarian as Ally

I support Will Fitzhugh's assertion (in "Meaningful Work" in the Winter 2011–2012 issue) that researching and writing a history paper is important for the college-bound high school student. The history teacher—and all teachers who know the value of teaching students to write a research paper—have an ally in the school librarian. The school librarian stands next to the classroom teacher to tell students how to complete an assignment effectively and efficiently. Together they say, "Here is how to organize yourself with a good research process"; "here are some sources where you can find valuable information"; "here is how to make a works cited list." The librarian reminds students that the research process is applicable to all academic areas. Students work hard but know that the teacher and the librarian are there to help. The librarian also can help in assessment by grading the student's use of the research process and formatting of the works cited, while the classroom teacher is the subject area specialist responsible for grading the content.

It's always gratifying when freshman college students come back to visit; they make sure to thank the library staff for preparing them to write a research paper.

–MARY MONIZ
Librarian
Boston Latin Academy

Clarifying Early College

While I found "The Early College Challenge" in the Fall 2011 issue fascinating, I was surprised that no mention seems to have been made to distinguish another model under the same label—early college entrance for accelerated students.

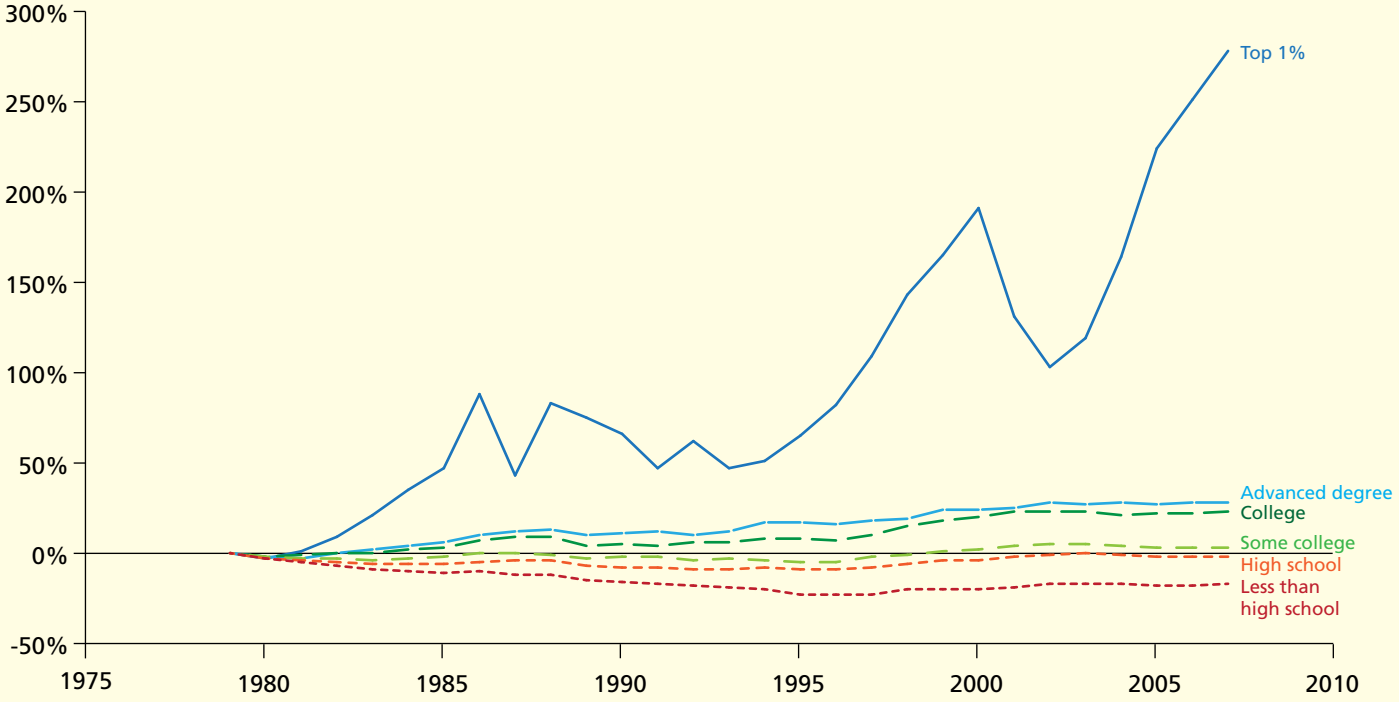
The National Consortium of Early College Entrance Programs involves 10 institutions that deal with intellectually curious high school students who are able to handle college work early. My school, for example, Boston University Academy, which is a division of Boston University (BU), enrolls students in grades 9 through 12 who will all graduate with both a high school diploma and about a year and a half of university credits. Juniors must take 40 percent of their coursework at BU, and seniors can take all of their courses there, plus they must write a senior thesis with a BU professor. If any of our freshmen and sophomores might be ready for university work (and some might even need graduate-level work), they cross the street to take it. On any given day, half of our 160 students are in university classes, plus they have access to the faculty and facilities of this major research institution. Our students can select from 2,000 electives and 22 languages.

So the label "early college" represents support for disadvantaged students needing a better transition to higher education *and* acceleration for very able students eager to spread their wings. Both models are noble, and each needs

The Rich Get Richer

IT SEEMS WE'VE all been trying in recent months to better understand the causes of economic inequality in America. Some have argued that a big source of that inequality is individuals' different levels of educational attainment—but the data just don't support that idea. As this chart from the Economic Policy Institute shows, over the past 30 years, wage growth among those with college degrees has been minimal compared with income growth among the top 1 percent.

Cumulative growth in income for the top 1 percent compared with growth in wages, by education level, 1979–2007



SOURCE: EPI ANALYSIS OF CPS WAGE DATA, 2009, AND CONGRESSIONAL BUDGET OFFICE, 2011, TRENDS IN THE DISTRIBUTION OF HOUSEHOLD INCOME BETWEEN 1979 AND 2007. SEE: "THERE'S MORE TO INEQUALITY THAN EDUCATION" BY JOHN IRONS, NOVEMBER 3, 2011, WWW.EPI.ORG/BLOG/INEQUALITY-EDUCATION.

to be understood by its own merits, despite the confusion caused by the similarity of the label.

–JAMES S. BERKMAN
Head of School
Boston University Academy

Building Bridges

As a Dean of Education at Castleton State College, I was deeply appreciative of the article "Bridging the 'Widest Street in the World'" appearing in the Summer 2011 edition of *American Educator*. At a New England Association of Schools and Colleges conference in Boston in December, I plan to talk about how our college has completed that bridge—and to mention the article by Jeffrey Mirel.

–HONOREE FLEMING, PhD
Dean of Education
Castleton State College
Castleton, VT

Keep Reading

I am wondering how I can continue my subscription to *American Educator*. I taught in the School District of Philadelphia, but retired in July.

–SANDRA MASAYKO
Philadelphia, PA

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Unions Make Democracy Work

By David Madland and Nick Bunker

ILLUSTRATION BY ROB COLVIN, © IMAGES.COM/CORBIS

AT THE END of January, the Department of Labor released data showing, yet again, a slight decline in union membership. At 11.8 percent, the 2011 union membership rate is the lowest in more than 70 years. Unfortunately, the decline was expected because of the one-two punch of long-term trends—such as the escalation of aggressive employer campaigns against union representation—and political attacks such as Wisconsin's new law banning public-sector collective bargaining.

Even though less than 12 percent of all workers are currently union members, Americans—whether unionized or not—should care about this decline because unions give workers a bigger say in our economy and our political system.[1] That helps the middle class, and it's good for democracy.

As our research and a number of academic studies find,[2] unions strengthen the middle class and significantly reduce economic inequality. In fact, studies indicate that the decline in union density explains as much of today's record level of inequality as does the increasing economic return of a college education.[3]

Most research on the importance of unions to the middle class tends to focus on how unions improve market wages for both union and nonunion workers.[4] This research is no doubt vital, but it gives short shrift to the critical role unions play in making democracy work for the middle class.

Unions help boost political participation among ordinary citizens—especially among members, but also among nonunion members—and convert this participation into an effective voice for pro-middle-class policies.

This explains why states with a greater percentage of union members have significantly higher voter turnout rates, as well as higher minimum wages, a greater percentage of residents covered by health insurance, stronger social safety nets, and more progressive tax codes.

That unions are important to the strength of the middle class is easy to see by looking at the close relationship between the two over time. In 1968, the share of income going to the nation's middle class was 53.2 percent, when 28 percent of all workers were members of unions. Since then, union membership steadily declined alongside the share of income going to the middle class. By 2010, the middle class only received 46.5 percent of income as union membership dropped to less than 12 percent of workers.

The middle class weakened over the past several decades because the rich secured the lion's share of the economy's gains. The share of pretax income earned by the richest 1 percent of Americans more than doubled between 1974 and 2007, climbing to 23.5 percent from 9 percent. And for the richest of the rich—the top 0.1 percent—the gains have been even more astronomical—quadrupling over this period,[5] rising to 12.3 percent of all income from 2.7 percent.

Even though unions have weakened, they are still critically important to the middle class: The states with the lowest percentages of workers in unions—North Carolina, Georgia, Arkansas, Louisiana, Mississippi, South Carolina, Tennessee, Virginia, Oklahoma, and Texas—all have relatively weak middle classes. In each of these states, the share of income going to the middle class (the middle 60 percent of the population by income) is below the national average, according to Census Bureau figures.[6]

Unions make the political system work for the middle class in two key ways: increasing voter participation and advocating for policies that help the middle class. As an increasing number of citizens feel their democracy is no longer responsive to their needs, the role unions play is ever more important.

Unions help get ordinary citizens—union and nonunion alike—involved in politics by, for example, knocking on doors, educating workers on the issues, and helping them feel their efforts will make a difference.

Case in point: A 1 percentage point increase in union density in a state increases voter turnout rates by 0.2 to 0.25 percentage points.[7] In other words, if unionization were 10 percentage points higher during the 2008 presidential election, 2.6 million to 3.2 million more Americans would have voted.

Similarly, research shows that self-described working-class citizens—whether unionized or not—are just as likely to vote as other citizens are when unions run campaigns in their congressional district.[8] Yet when unions don't run campaigns, working-class citizens are 10.4 percent less likely to vote than other citizens. A similar pattern holds for communities of color. Voters of color are just as likely to vote as white voters in districts with union campaigns but are 9.3 percent less likely to vote in districts without campaigns.

The figure on the right shows that states with higher levels of unionization have higher levels of voter turnout by highlighting the relationship for all federal elections from 1980 to 2010. This relationship would also hold if we were to look at only presidential elections or only midterm elections. Other factors contribute to voter turnout, but unionization certainly plays an important role in getting the vote out.

Before people take political action, they

David Madland is the director of the American Worker Project at the Center for American Progress Action Fund, where Nick Bunker is a special assistant with the Economic Policy team. *This article is adapted with permission from "Unions Make Democracy Work for the Middle Class," an issue brief published by the Center for American Progress Action Fund. To read the full brief, see www.americanprogressaction.org/issues/2012/01/unions_middleclass.html.*

must think it is worthwhile—that the benefits are greater than the costs. But the costs of action—time, money, and energy—are sometimes higher than the benefits of action.[9] This is especially true with actions such as writing a letter to a member of Congress or tracking the progress of a bill, but it can hold true even for an action as simple as voting.

Unions help decrease the costs and increase the benefits of participation so that more people get involved. They do this in a number of ways—from simply knocking on doors and letting people know about an election and providing information about an issue, to helping people get to the polls or write a letter and making people feel more powerful and thus likely to succeed. Relatively few people participate spontaneously in politics, but rather are likely to take action when groups such as unions mobilize them to do so.[10]

As a result, being a union member makes a person more likely to vote and participate in politics, but unions also increase participation among nonmembers. Nonunion members are often the recipients of union efforts to educate and mobilize. Getting middle- and working-class citizens to vote and otherwise get involved in democracy is especially important because higher-income people are much more likely to participate in politics than the middle class.[11]

Making democracy work for the middle class involves more than getting citizens involved in the political process, however. Ordinary citizens also need some level of influence over which policies are actually debated, their final structure, and whether they get passed or not.[12] This requires expertise and sustained attention as well as resources and the ability to mobilize them at the right time. The problem is that these tasks are nearly impossible for unorganized citizens to perform. As a result, as individuals, ordinary citizens have a very hard time actually influencing policy debates—even when their preferred candidate wins.

Unions play a critical role in translating workers' interests to elected officials and ensuring that government serves the economic needs of the middle class. They do this by encouraging their members and the general public to support certain policies as well as by directly advocating for specific reforms. Unions provide legal and regulatory expertise, create space for collaborative negotiations, ensure effective implementation of policies, mobilize members at key points in the legislative process, and act as a strong counterbalance to powerful interest groups that support policies that would harm the middle class.

Historically and today, unions are one of the few organized interests that have the capacity and the mission to launch sustained and successful policy campaigns during drawn-out political battles.

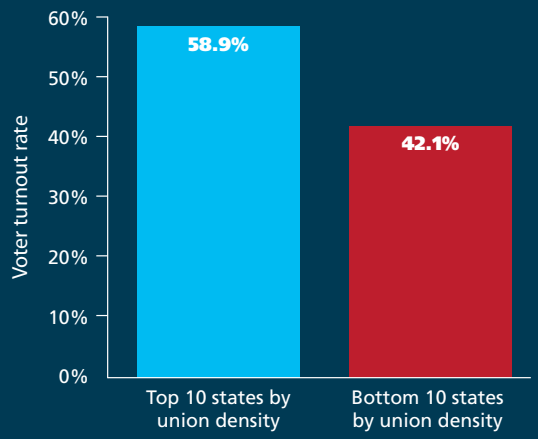
To be sure, not every policy that unions support clearly benefits all of the middle class—some favored policies have been more narrowly targeted to benefit their membership—but as a general rule most of what unions support is about promoting a strong middle class. As Nobel-laureate economist Paul Krugman argues, during the middle part of the last century in the United States, "government policies and organized labor combined to create a broad and solid middle class."[13] Social scientists consistently show that strong labor unions are closely associated with low levels of inequality and more generous social programs that benefit the middle class.[14]

Naysayers argue that unions are just another interest group, but the fact is that organized labor fights for the common interests of many Americans. Unions have in many ways helped workers who have never paid union dues.

What's more, the role unions play in making our democracy work is critical at this juncture, when inequality is at record levels and an increasing number of citizens feel their democracy is no longer responsive to their needs.[15] Indeed, in 2009, 59 percent said they don't think most elected officials care what people like them think, up 10 percentage points from 1987—a time when unions were stronger and inequality lower.[16]

In short, rebuilding the strength of organized labor is necessary if we intend to make democracy work for the middle class.

Voter turnout is higher in states with greater levels of unionization



SOURCES: UNIONSTATS.COM, UNITED STATES ELECTIONS PROJECT (BOTH ARE AVERAGES OF 1980–2010. ELECTIONS ARE ALL FEDERAL ELECTIONS DURING THE PERIOD.)

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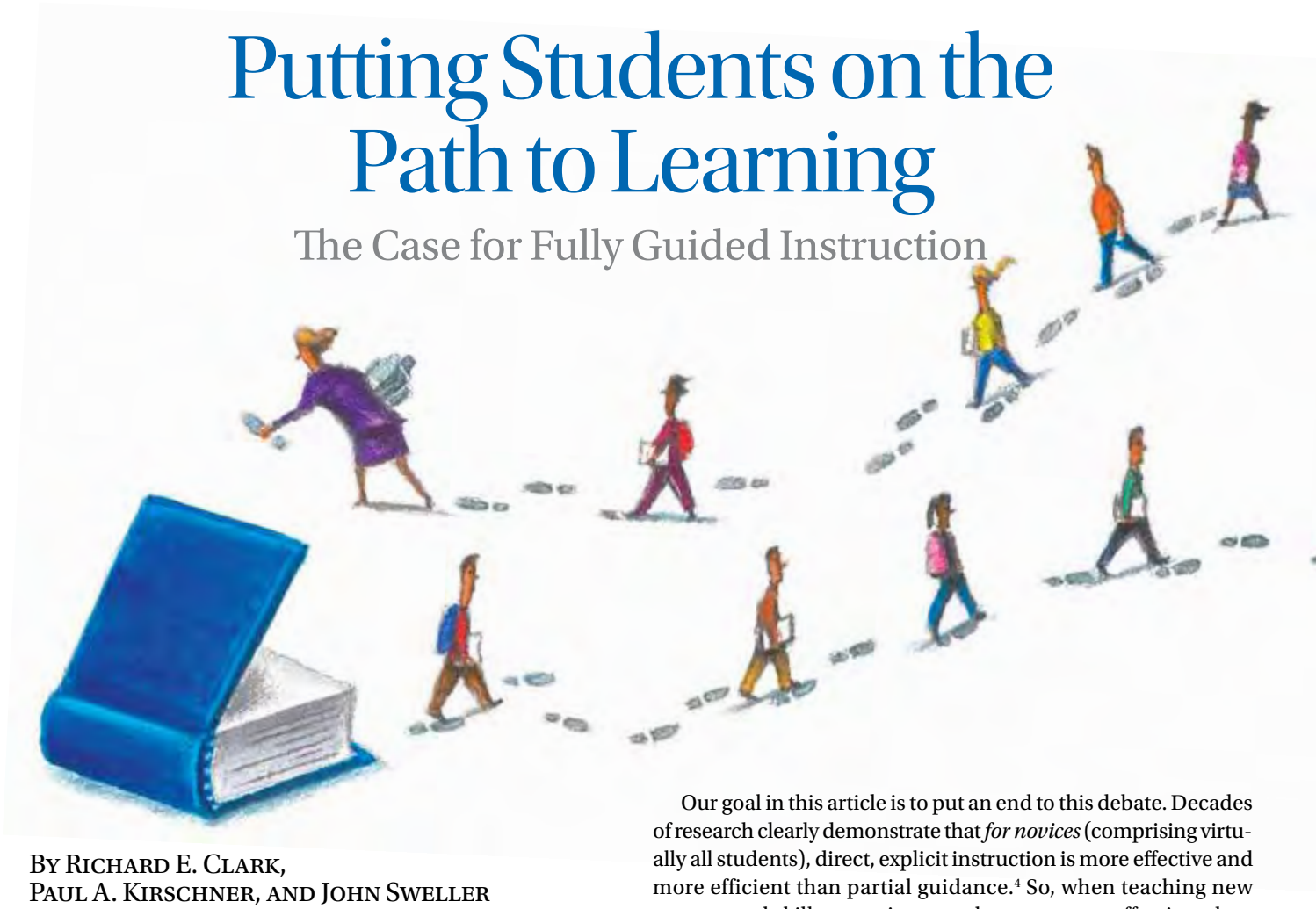
Putting Students on the Path to Learning

The Case for Fully Guided Instruction



By Richard E. Clark, Paul A. Kirschner, and John Sweller

Disputes about the impact of instructional guidance during teaching have been ongoing for more than a half century.[1] On one side of this argument are those who believe that all people—novices and experts alike—learn best when provided with instruction that contains unguided or partly guided segments. This is generally defined as instruction in which learners, rather than being presented with all essential information and asked to practice using it, must discover or construct some or all of the essential information for themselves.[2] On the other side are those who believe that ideal learning environments for experts and novices differ: while experts often thrive without much guidance, nearly everyone else thrives when provided with full, explicit instructional guidance (and should not be asked to discover any essential content or skills).[3]

Richard E. Clark is a professor of educational psychology, clinical research professor of surgery, and director of the Center for Cognitive Technology at the University of Southern California. Paul A. Kirschner is a professor of educational psychology at the Centre for Learning Sciences and Technologies at the Open University of the Netherlands. John Sweller is an emeritus professor of education at the School of Education at the University of New South Wales. *This article summarizes sections of "Why Minimal Guidance During Instruction Does Not Work: An Analysis of the Failure of Constructivist, Discovery, Problem-Based, Experiential, and Inquiry-Based Teaching," by Paul A. Kirschner, John Sweller, and Richard E. Clark, which was originally published in* Educational Psychologist *41, no. 2 (2006): 75–86.*

ILLUSTRATIONS BY PAUL ZWOLAK

Our goal in this article is to put an end to this debate. Decades of research clearly demonstrate that *for novices* (comprising virtually all students), direct, explicit instruction is more effective and more efficient than partial guidance.[4] So, when teaching new content and skills to novices, teachers are more effective when they provide explicit guidance accompanied by practice and feedback, not when they require students to discover many aspects of what they must learn. As we will discuss, this does not mean direct, expository instruction all day every day. Small group and independent problems and projects can be effective—not as vehicles for making discoveries, but as a means of *practicing* recently learned content and skills.

Before we describe this research, let's clarify some terms. Teachers providing explicit instructional guidance *fully explain* the concepts and skills that students are required to learn. Guidance can be provided through a variety of media, such as lectures, modeling, videos, computer-based presentations, and realistic demonstrations. It can also include class discussions and activities—if the teacher ensures that through the discussion or activity, the relevant information is explicitly provided and practiced. In a math class, for example, when teaching students how to solve a new type of problem, the teacher may begin by showing students how to solve the problem and fully explaining the how and why of the mathematics involved. Often, in following problems, step-by-step explanations may gradually be faded or withdrawn until, through practice and feedback, the students can solve the problem themselves. In this way, before trying to solve the problem on their own, students would already have been walked through both the procedure and the concepts behind the procedure.

In contrast, those teachers whose lessons are designed to offer partial or minimal instructional guidance expect students to dis-

cover on their own some or all of the concepts and skills they are supposed to learn. The partially guided approach has been given various names, including discovery learning,[5] problem-based learning,[6] inquiry learning,[7] experiential learning,[8] and constructivist learning.[9] Continuing the math example, students receiving partial instructional guidance may be given a new type of problem and asked to brainstorm possible solutions in small groups with or without prompts or hints. Then there may be a class discussion of the various groups' solutions, and it could be quite some time before the teacher indicates which solution is correct. Through the process of trying to solve the problem and discussing different students' solutions, each student is supposed to discover the relevant mathematics. (In some minimal guidance classrooms, teachers use explicit instruction of the solution as a backup method for those students who did not make the necessary discoveries and who were confused during the class discussion.) Additional examples of minimally guided approaches include (1) inquiry-oriented science instruction in which students are expected to discover fundamental principles by mimicking the investigatory activities of professional researchers,[10] and (2) medical students being expected to discover well-established solutions for common patient problems.[11]

Two bodies of research reveal the weakness of partially and minimally guided approaches: research comparing pedagogies, and research on how people learn. The past half century of empirical research has provided overwhelming and unambiguous evidence that, for everyone but experts, partial guidance during instruction is significantly less effective and efficient than full guidance. And, based on our current knowledge of how people learn, there is no reason to expect that partially guided instruction in K–12 classrooms would be as effective as explicit, full guidance.

I. Research Comparing Fully Guided and Partially Guided Instruction

Controlled experiments almost uniformly indicate that when dealing with novel information (i.e., information that is new to learners), students should be explicitly shown what to do and how to do it, and then have an opportunity to practice doing it while receiving corrective feedback.[12] A number of reviews of empirical studies on teaching novel information have established a solid research-based case against the use of instruction with minimal guidance. Although an extensive discussion of those studies is outside the scope of this article, one recent review is worth noting: Richard Mayer (a cognitive scientist at the University of California, Santa Barbara) examined evidence from studies conducted from 1950 to the late 1980s comparing pure discovery learning (defined as unguided, problem-based instruction) with guided forms of instruction.[13] He suggested that in each decade since the mid-1950s, after empirical studies provided solid evidence that the then-popular unguided approach did not work, a similar approach soon popped up under a different name with the cycle repeating itself. Each new set of advocates for unguided approaches seemed unaware of, or uninterested in, previous evidence that unguided approaches had not been validated. This pattern produced discovery learning, which gave way to experiential learning, which gave way to problem-based and inquiry learning, which has recently given way to constructivist instructional techniques. Mayer concluded that the "debate about discovery has been replayed many times in education, but each time, the research evidence has favored a guided approach to learning."[14] (To learn about these effective guided approaches, please see the companion article by Barak Rosenshine that begins on page 12.)

Research has provided overwhelming evidence that, for everyone but experts, partial guidance during instruction is significantly less effective than full guidance.

Evidence from well-designed, properly controlled experimental studies from the 1980s to today also supports direct instructional guidance.[15] Some researchers[16] have noted that when students learn science in classrooms with pure-discovery methods or with minimal feedback, they often become lost and frustrated, and their confusion can lead to misconceptions. Others[17] found that because false starts (in which students pursue misguided hypotheses) are common in such learning situations, unguided discovery is most often inefficient. In a very important study, researchers not only tested whether science learners learned more via discovery, compared with explicit instruction, but also, once learning had occurred, whether the quality of learning differed.[18] Specifically, they tested whether those who had learned through discovery were better able to transfer their learning to new contexts (as advocates for minimally guided approaches often claim). The findings were unambiguous. Direct instruction involving considerable guidance, including examples, resulted in vastly more learning than discovery. Those rela-

tively few students who learned via discovery showed no signs of superior quality of learning.

In real classrooms, several problems occur when different kinds of minimally guided instruction are used. First, often only the brightest and most well-prepared students make the discovery. Second, many students, as noted above, simply become frustrated. Some may disengage, others may copy whatever the brightest students are doing—either way, they are not actually discovering anything. Third, some students believe they have discovered the correct information or solution, but they are mistaken and so they learn a misconception that can interfere with later learning and problem solving.[19] Even after being shown the right answer, a student is likely to recall his or her discovery—not the correction. Fourth, even in the unlikely event that a problem or project is devised that all students succeed in completing,

minimally guided instruction is much less efficient than explicit guidance. What can be taught directly in a 25-minute demonstration and discussion, followed by 15 minutes of independent practice with corrective feedback by a teacher, may take several class periods to learn via minimally guided projects and/or problem solving.

As if these four problems were not enough cause for concern, there is one more problem that we must highlight: *minimally guided instruction can increase the achievement gap*. A review[20] of approximately 70 studies, which had a range of more- and less-skilled students as well as a range of more- and less-guided instruction, found the following: more-skilled learners tend to learn more with less-guided instruction, but less-skilled learners tend to learn more with more-guided instruction. Worse, a number of experiments found that less-skilled students who chose or were assigned to less-guided instruction received significantly *lower* scores on posttests than on pretest measures. For these relatively weak students, the failure to provide strong instructional support produced a *measurable loss of learning*. The implication of these results is that teachers should provide explicit instruction when introducing a new topic, but gradually fade it out as knowledge and skill increase.

Even more distressing is evidence[21] that when learners are asked to select between a more-guided or less-guided version of the same course, less-skilled learners who choose the less-guided approach tend to like it even though they learn less from it. It appears that guided instruction helps less-skilled learners by providing task-specific learning strategies. However, these strategies require learners to engage in explicit, attention-driven effort and so tend not to be liked, even though they are helpful to learning.

Similarly, more-skilled learners who choose the more-guided version of a course tend to like it even though they too have selected the environment in which they learn less. The reason more guidance tends to be less effective with these learners is that, in most cases, they have already acquired task-specific learning strategies that are more effective for them than those embedded in the more-guided version of the course. And some evidence suggests that they like more guidance because they believe they will achieve the required learning with minimal effort.

If the evidence against minimally guided approaches is so strong, why is this debate still alive? We cannot say with any certainty, but one major reason seems to be that many educators mistakenly believe partially and minimally guided instructional approaches are based on solid cognitive science. Turning again to Mayer's review of the literature, many educators confuse "constructivism," which is a theory of how one learns and sees the world, with a prescription for how to teach.[22] In the field of cognitive science, constructivism is a widely accepted theory of learning; it claims that learners must construct mental representations of the world by engaging in active cognitive processing. Many educators (especially teacher education professors in colleges of education) have latched on to this notion of students having to "construct" their own knowledge, and have *assumed* that the best way to promote such construction is to have students try to discover new knowledge or solve new problems without explicit guidance from the teacher. Unfortunately, this assumption is both widespread and incorrect. Mayer calls it the "constructivist teaching fallacy." Simply put, cognitive activity can happen with or without behavioral activity, and behavioral activity does not in any way guarantee cognitive activity. In fact, the type of active cognitive processing that students need to engage in to "construct" knowledge can happen through reading a book, listening to a lecture, watching a teacher conduct an experiment while simultaneously describing what he or she is doing, etc. Learning requires the construction of knowledge. Withholding information from students does not facilitate the construction of knowledge.

II. The Human Brain: Learning 101

In order to really comprehend why full instructional guidance is more effective and efficient than partial or minimal guidance for novices, we need to know how human brains learn. There are two essential components: long-term memory and working memory (often called short-term memory). Long-term memory is that big mental warehouse of things (be they words, people, grand philosophical ideas, or skateboard tricks) we know. Working memory is a limited mental "space" in which we think. The relations between working and long-term memory, in conjunction with the cognitive processes that support learning, are of critical importance to developing effective instruction.

Our understanding of the role of long-term memory in human

cognition has altered dramatically over the last few decades. It is no longer seen as a passive repository of discrete, isolated fragments of information that permit us to repeat what we have learned. Nor is it seen as having only peripheral influence on complex cognitive processes such as critical thinking and problem solving. Rather, long-term memory is now viewed as the central, dominant structure of human cognition. Everything we see, hear, and think about is dependent on and influenced by our long-term memory.

A seminal series of studies[23] on chess players, for example, demonstrated that expert players perform well even in "blitz" games (which are played in five minutes) because they are not actually puzzling through each move. They have tens of thousands of board configurations, and the best move for each configuration, stored in long-term memory. Those configurations are learned by studying previous games for 10 years or more. Expert players can play well at a fast pace because all they are doing is recalling the best move—not figuring it out. Similar studies of how experts function have been conducted in a variety of other areas.[24] Altogether, the results suggest that expert problem solvers derive their skill by drawing on the extensive experience stored in their long-term memory in the form of concepts and procedures, known as mental schemas. They retrieve memories of past procedures and solutions, and then quickly select and apply the best ones for solving problems. We are skillful in an area if our long-term memory contains huge amounts of information or knowledge concerning the area. That information permits us to quickly recognize the characteristics of a situation and indicates to us, often immediately and unconsciously, what to do and when to do it. (For instance, think about how much easier managing student behavior was in your fifth year of teaching than in your first year of teaching.) Without our huge store of information in long-term memory, we would be largely incapable of everything from simple acts such as avoiding traffic while crossing a street (information many other animals are unable to store in their long-term memory), to complex activities such as playing chess, solving mathematical problems, or keeping students' attention. In short, our long-term memory incorporates a massive knowledge base that is central to all of our cognitively based activities.

What are the instructional consequences of long-term memory? First and foremost, long-term memory provides us with the ultimate justification for instruction: the aim of all instruction is to add knowledge and skills to long-term memory. If nothing has been added to long-term memory, nothing has been learned.

Working memory is the cognitive structure in which conscious processing occurs. We are only conscious of the information currently being processed in working memory and are more or less oblivious to the far larger amount of information stored in long-term memory. When processing novel information, working memory is very limited in duration and capacity. We have known at least since the 1950s that almost all information stored in working memory is lost within 30 seconds[25] if it is not rehearsed and that the capacity of working memory is limited to only a very small number of elements.[26] That number is usually estimated at about seven, but may be as low as four, plus or minus one.[27] Furthermore, when processing (rather than merely storing) information, it may be reasonable to conjecture that the number of items that can be processed may only be two or three, depending on the nature of the processing required.

For instruction, the interactions between working memory and long-term memory may be even more important than the processing limitations.[28] The limitations of working memory only apply to new, to-be-learned information (that has not yet been stored in long-term memory). When dealing with previously learned, organized information stored in long-term memory, these limitations disappear. Since information can be brought back from long-term memory to working memory as needed, the 30-second limit of working memory becomes irrelevant. Similarly, there are no known limits to the amount of such information that can be brought into working memory from long-term memory.

Many educators confuse "constructivism," which is a theory of how one learns and sees the world, with a prescription for how to teach.

These two facts—that working memory is very limited when dealing with novel information, but that it is not limited when dealing with organized information stored in long-term memory—explain why partially or minimally guided instruction typically is ineffective for novices, but can be effective for experts. When given a problem to solve, novices' only resource is their very constrained working memory. But experts have both their working memory and all the relevant knowledge and skill stored in long-term memory.

One of the best examples of an instructional approach that takes into account how our working and long-term memories interact is the "worked-example effect." A worked example is just what it sounds like: a problem that has already been solved (or "worked out") for which every step is fully explained and clearly shown; it constitutes the epitome of direct, explicit instruction.*

*For a short YouTube video of a worked example, go to http://bit.ly/xa0TYQ and see Shaun Errichiello, who teaches seventh-grade math at the Salk School of Science (M.S. 225) in New York City, work through a word problem with fractions.

The "worked-example effect" is the name given to the widely replicated finding that novice learners who try to learn by being required to solve problems perform worse on subsequent test problems, including transfer problems different from the ones seen previously, than comparable learners who learn by studying equivalent worked examples.

The worked-example effect was first demonstrated in the 1980s.[29] Researchers found that algebra students learned more by studying worked examples than by solving equivalent problems. Since those early demonstrations of the effect, it has been replicated on numerous occasions using a large variety of learners studying an equally large variety of materials—from mathematics and science to English literature and world history.[30] For novices, studying worked examples seems invariably superior to discovering or constructing a solution to a problem.

Why does the worked-example effect occur? The limitations of working memory and the relations between working memory and long-term memory discussed earlier can explain it. Solving a problem requires searching for a solution, which must occur using our limited working memory. If the learner has no relevant concepts or procedures in long-term memory, the only thing to do is blindly search for possible solution steps that bridge the gap between the problem and its solution. This process places a great burden on working-memory capacity because the problem solver has to continually hold and process the current problem state in working memory (e.g., Where am I right now in the problem-solving process? How far have I come toward finding a solution?) along with the goal state (e.g., Where do I have to go? What is the solution?), the relations between the goal state and the problem state (e.g., Is this a good step toward solving the problem? Has what I've done helped me get nearer to where I need to go?), the solution steps that could further reduce the differences between the two states (e.g., What should the next step be? Will that step bring me closer to the solution? Is there another solution strategy I can use that might be better?), and any subgoals along the way. Thus, searching for a solution overburdens limited working memory and diverts working-memory resources away from storing information in long-term memory. As a consequence, novices can engage in problem-solving activities for extended periods and learn almost nothing.[31]

If the learner has no relevant concepts in long-term memory, the only thing to do is blindly search for solutions. Novices can engage in problem solving for extended periods and learn almost nothing.

In contrast, studying a worked example* reduces the burden on working memory (because the solution only has to be comprehended, not discovered) and directs attention (i.e., directs working-memory resources) toward storing the essential relations between problem-solving moves in long-term memory. Students learn to recognize which moves are required for particular problems, which is the basis for developing knowledge and skill as a problem solver.[33]

It is important to note that this discussion of worked examples applies to novices—not experts. In fact, the worked-example effect first disappears and then *reverses* as the learners' expertise increases. That is, for experts, solving a problem is more effective than studying a worked example. When learners are sufficiently experienced, studying a worked example is a redundant activity that places a greater burden on working memory than retrieving a known solution from long-term memory.[34] This reversal in effectiveness is not limited to worked examples; it's true of many explicit, fully guided instructional approaches and is known as the "expertise reversal effect."[35] In general, the expertise reversal effect states that "instructional techniques that are highly effective with inexperienced learners can lose their effectiveness and even have negative consequences when used with more experienced learners."[36] This is why, from the very beginning of this article, we have emphasized that guidance is best for teaching *novel* information and skills. This shows the wisdom of instructional techniques that begin with lots of guidance and then fade that guidance as students gain mastery. It also shows the wisdom of using minimal guidance techniques to reinforce or practice previously learned material.

Recommending partial or minimal guidance for novices was understandable back in the early 1960s, when the acclaimed psychologist Jerome Bruner[37] proposed discovery learning as an instructional tool. At that time, researchers knew little about working memory, long-term memory, and how they interact. We now are in a quite different environment; we know much more about the structures, functions, and characteristics of working memory and long-term memory,

*This assumes that the worked example is well designed. It is possible, if one is not careful, to structure a worked example in a manner that places a large burden on working memory. Indeed, it is possible to structure worked examples that impose as heavy a cognitive load as the problem-solving search required to learn via discovery.[32]

the relations between them, and their consequences for learning, problem solving, and critical thinking. We also have a good deal more experimental evidence as to what constitutes effective instruction: controlled experiments almost uniformly indicate that when dealing with novel information, learners should be explicitly shown all relevant information, including what to do and how to do it. We wonder why many teacher educators who are committed to scholarship and research ignore the evidence and continue to encourage minimal guidance when they train new teachers.

After a half century of advocacy associated with instruction using minimal guidance, it appears that there is no body of sound research that supports using the technique with anyone other than the most expert students. Evidence from controlled, experimental (a.k.a. "gold standard") studies almost uniformly supports full and explicit instructional guidance rather than partial or minimal guidance for novice to intermediate learners. These findings and their associated theories suggest teachers should provide their students with clear, explicit instruction rather than merely assisting students in attempting to discover knowledge themselves. □

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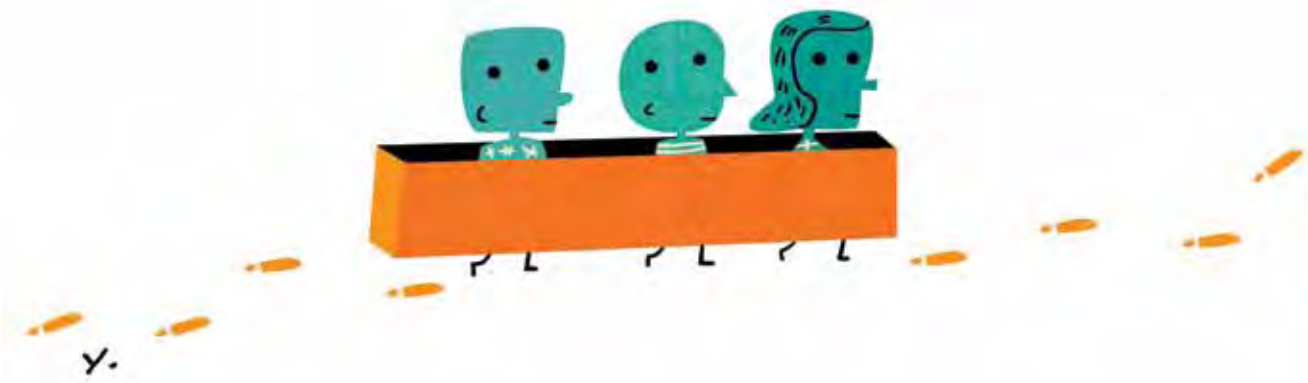
Principles of Instruction

Research-Based Strategies That All Teachers Should Know



By Barak Rosenshine

This article presents 10 research-based principles of instruction, along with suggestions for classroom practice. These principles come from three sources: (a) research in cognitive science, (b) research on master teachers, and (c) research on cognitive supports. Each is briefly explained below.

A: Research in cognitive science: This research focuses on how our brains acquire and use information. This cognitive research also provides suggestions on how we might overcome the limitations of our working memory (i.e., the mental "space" in which thinking occurs) when learning new material.

B: Research on the classroom practices of master teachers: Master teachers are those teachers whose classrooms made the highest gains on achievement tests. In a series of studies, a wide range of teachers were observed as they taught, and the investigators coded how they presented new material, how and whether they checked for student understanding, the types of support they provided to their students, and a number of other instructional activities. By also gathering student achievement data, researchers were able to identify the ways in which the more and less effective teachers differed.

C: Research on cognitive supports to help students learn complex tasks: Effective instructional procedures—such as thinking aloud, providing students with scaffolds, and providing students with models—come from this research.

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Even though these are three very different bodies of research, there is *no conflict at all* between the instructional suggestions that come from each of these three sources. In other words, these three sources supplement and complement each other. The fact that the instructional ideas from three different sources supplement and complement each other gives us faith in the validity of these findings.

Education involves helping a novice develop strong, readily accessible background knowledge. It's important that background knowledge be readily accessible, and this occurs when knowledge is well rehearsed and tied to other knowledge. The most effective teachers ensured that their students efficiently acquired, rehearsed, and connected background knowledge by providing a good deal of instructional support. They provided this support by teaching new material in manageable amounts, modeling, guiding student practice, helping students when they made errors, and providing for sufficient practice and review. Many of these teachers also went on to experiential, hands-on activities, but they always did the experiential activities *after*, not before, the basic material was learned.

The following is a list of some of the instructional principles that have come from these three sources. These ideas will be described and discussed in this article:

- Begin a lesson with a short review of previous learning.[1]
- Present new material in small steps with student practice after each step.[2]
- Ask a large number of questions and check the responses of all students.[3]
- Provide models.[4]
- Guide student practice.[5]
- Check for student understanding.[6]
- Obtain a high success rate.[7]
- Provide scaffolds for difficult tasks.[8]
- Require and monitor independent practice.[9]
- Engage students in weekly and monthly review.[10]

ILLUSTRATIONS BY JAMES YANG

1. Begin a lesson with a short review of previous learning: Daily review can strengthen previous learning and can lead to fluent recall.

Research findings

Daily review is an important component of instruction. Review can help us strengthen the connections among the material we have learned. The review of previous learning can help us recall words, concepts, and procedures effortlessly and automatically when we need this material to solve problems or to understand new material. The development of expertise requires thousands of hours of practice, and daily review is one component of this practice.

For example, daily review was part of a successful experiment in elementary school mathematics. Teachers in the experiment were taught to spend eight minutes every day on review. Teachers used this time to check the homework, go over problems where there were errors, and practice the concepts and skills that needed to become automatic. As a result, students in these classrooms had higher achievement scores than did students in other classrooms.

Daily practice of vocabulary can lead to seeing each practiced word as a unit (i.e., seeing the whole word automatically rather than as individual letters that have to be sounded out and blended). When students see words as units, they have more space available in their working memory, and this space can now be used for comprehension. Mathematical problem solving is also improved when the basic skills (addition, multiplication, etc.) are overlearned and become automatic, thus freeing working-memory capacity.

In the classroom

The most effective teachers in the studies of classroom instruction understood the importance of practice, and they began their lessons with a five- to eight-minute review of previously covered material. Some teachers reviewed vocabulary, formulae, events, or previously learned concepts. These teachers provided additional practice on facts and skills that were needed for recall to become automatic.

Effective teacher activities also included reviewing the concepts and skills that were necessary to do the homework, having students correct each others' papers, and asking about points on which the students had difficulty or made errors. These reviews ensured that the students had a firm grasp of the skills and concepts that would be needed for the day's lesson.

Effective teachers also reviewed the knowledge and concepts that were relevant for that day's lesson. It is important for a teacher to help students recall the concepts and vocabulary that will be relevant for the day's lesson because our working memory is very limited. If we do not review previous learning, then we will have to make a special effort to recall old material while learning new material, and this makes it difficult for us to learn the new material.

Daily review is particularly important for teaching material that will be used in subsequent learning. Examples include reading sight words (i.e., any word that is known by a reader automatically), grammar, math facts, math computation, math factoring, and chemical equations.

When planning for review, teachers might want to consider which words, math facts, procedures, and concepts need to become automatic, and which words, vocabulary, or ideas need to be reviewed before the lesson begins.

> The most effective teachers ensured that students efficiently acquired, rehearsed, and connected knowledge. Many went on to hands-on activities, but always *after*, not before, the basic material was learned.

In addition, teachers might consider doing the following during their daily review:

- Correct homework.
- Review the concepts and skills that were practiced as part of the homework.
- Ask students about points where they had difficulties or made errors.
- Review material where errors were made.
- Review material that needs overlearning (i.e., newly acquired skills should be practiced well beyond the point of initial mastery, leading to automaticity).

2. Present new material in small steps with student practice after each step: Only present small amounts of new material at any time, and then assist students as they practice this material.

Research findings

Our working memory, the place where we process information, is small. It can only handle a few bits of information at once—too much information swamps our working memory. Presenting too much material at once may confuse students because their working memory will be unable to process it.

Therefore, the more effective teachers do not overwhelm their students by presenting too much new material at once. Rather,

these teachers only present small amounts of new material at any time, and then assist the students as they practice this material. Only after the students have mastered the first step do teachers proceed to the next step.

The procedure of first teaching in small steps and then guiding student practice represents an appropriate way of dealing with the limitation of our working memory.

In the classroom

The more successful teachers did not overwhelm their students by presenting too much new material at once. Rather, they presented only small amounts of new material at one time, and they taught in such a way that each point was mastered before the next point was introduced. They checked their students' understanding on each point and retaught material when necessary.

Some successful teachers taught by giving a series of short presentations using many examples. The examples provided concrete learning and elaboration that were useful for processing new material.

Teaching in small steps requires time, and the more effective teachers spent more time presenting new material and guiding student practice than did the less effective teachers. In a study of mathematics instruction, for instance, the most effective mathematics teachers spent about 23 minutes of a 40-minute period in lecture, demonstration, questioning, and working examples. In contrast, the least effective teachers spent only 11 minutes presenting new material. The more effective teachers used this extra time to provide additional explanations, give many examples, check for student understanding, and provide sufficient instruction so that the students could learn to work independently without difficulty. In one study, the least effective teachers asked only nine questions in a 40-minute period. Compared with the successful teachers, the less effective teachers gave much shorter presentations and explanations, and then passed out worksheets and told students to solve the problems. The less successful teachers were then observed going from student to student and having to explain the material again.

Similarly, when students were taught a strategy for summarizing a paragraph, an effective teacher taught the strategy using small steps. First, the teacher modeled and thought aloud as she identified the topic of a paragraph. Then, she led practice on identifying the topics of new paragraphs. Then, she taught students to identify the main idea of a paragraph. The teacher modeled this step and then supervised the students as they practiced both finding the topic and locating the main idea. Following this, the teacher taught the students to identify the supporting details in a paragraph. The teacher modeled and thought aloud, and then the students practiced. Finally, the students practiced carrying out all three steps of this strategy. Thus, the strategy of summarizing a paragraph was divided into smaller steps, and there was modeling and practice at each step.

3. Ask a large number of questions and check the responses of all students: Questions help students practice new information and connect new material to their prior learning.

Research findings

Students need to practice new material. The teacher's questions and student discussion are a major way of providing this necessary practice. The most successful teachers in these studies spent more than half of the class time lecturing, demonstrating, and asking questions.

Questions allow a teacher to determine how well the material has been learned and whether there is a need for additional instruction. The most effective teachers also ask students to explain the process they used to answer the question, to explain how the answer was found. Less successful teachers ask fewer questions and almost no process questions.

In the classroom

In one classroom-based experimental study, one group of teachers was taught to follow the presentation of new material with lots of questions.[11] They were taught to increase the number of factual questions and process questions they asked during this guided practice. Test results showed that their students achieved higher scores than did students whose teachers did not receive the training.

Imaginative teachers have found ways to involve all students in answering questions. Examples include having all students:

- Tell the answer to a neighbor.
- Summarize the main idea in one or two sentences, writing the summary on a piece of paper and sharing this with a neighbor, or repeating the procedures to a neighbor.
- Write the answer on a card and then hold it up.
- Raise their hands if they know the answer (thereby allowing the teacher to check the entire class).
- Raise their hands if they agree with the answer that someone else has given.

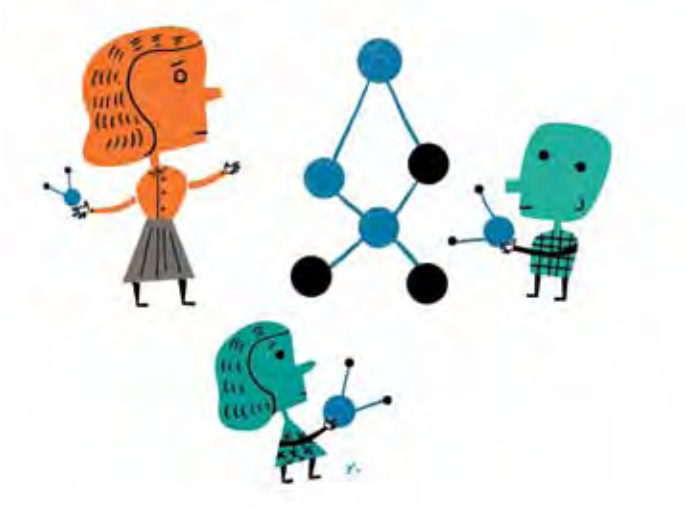
Across the classrooms that researchers observed, the purpose of all these procedures was to provide active participation for the students and also to allow the teacher to see how many students were correct and confident. The teacher may then reteach some material when it was considered necessary. An alternative was for students to write their answers and then trade papers with each other.

Other teachers used choral responses to provide sufficient practice when teaching new vocabulary or lists of items. This made the practice seem more like a game. To be effective, how-

ever, all students needed to start together, on a signal. When students did not start together, only the faster students answered.

In addition to asking questions, the more effective teachers facilitated their students' rehearsal by providing explanations, giving more examples, and supervising students as they practiced the new material.

The following is a series of stems[12] for questions that teachers might ask when teaching literature, social science content, or science content to their students. Sometimes, students may also develop questions from these stems to ask questions of each other.



How are _____ and _____ alike?
What is the main idea of _____?
What are the strengths and weaknesses of _____?
In what way is _____ related to _____?
Compare _____ and _____ with regard to _____.
What do you think causes _____?
How does _____ tie in with what we have learned before?
Which one is the best _____, and why?
What are some possible solutions for the problem of _____?
Do you agree or disagree with this statement: _____?
What do you still not understand about _____?

4. Provide models: Providing students with models and worked examples can help them learn to solve problems faster.

Research findings

Students need cognitive support to help them learn to solve problems. The teacher modeling and thinking aloud while demonstrating how to solve a problem are examples of effective cognitive support. Worked examples (such as a math problem for which the teacher not only has provided the solution but has clearly laid out each step) are another form of modeling that has been developed by researchers. Worked examples allow students to focus on the specific steps to solve problems and thus reduce the cognitive load on their working memory. Modeling and worked examples have been used successfully in mathematics, science, writing, and reading comprehension.

In the classroom

Many of the skills that are taught in classrooms can be conveyed by providing prompts, modeling use of the prompt, and then guiding students as they develop independence. When teaching reading comprehension strategies, for example, effective teachers provided students with prompts that the students could use to ask themselves questions about a short passage. In one class, students were given words such as "who," "where," "why," and "how" to help them begin a question. Then, everyone read a passage and the teacher modeled how to use these words to ask questions. Many examples were given.

Next, during guided practice, the teacher helped the students practice asking questions by helping them select a prompt and develop a question that began with that prompt. The students practiced this step many times with lots of support from the teacher.

Many of the skills taught in classrooms can be conveyed by providing prompts, modeling use of the prompt, and then guiding students as they develop independence.

Then, the students read new passages and practiced asking questions on their own, with support from the teacher when needed. Finally, students were given short passages followed by questions, and the teacher expressed an opinion about the quality of the students' questions.

This same procedure—providing a prompt, modeling, guiding practice, and supervising independent practice—can be used for many tasks. When teaching students to write an essay, for example, an effective teacher first modeled how to write each paragraph, then the students and teacher worked together on two or more new essays, and finally students worked on their own with supervision from the teacher.

Worked examples are another form of modeling that has been used to help students learn how to solve problems in mathematics and science. A worked example is a step-by-step demonstration of how to perform a task or how to solve a problem. The presentation of worked examples begins with the teacher modeling and explaining the steps that can be taken to solve a specific problem. The teacher also identifies and explains the underlying principles for these steps.

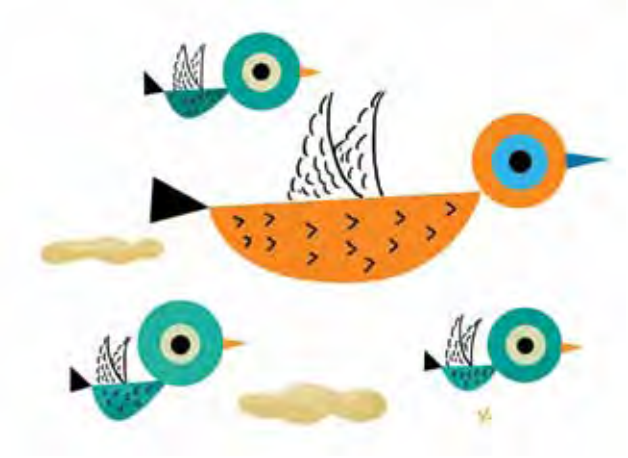
Usually, students are then given a series of problems to complete at their desks as independent practice. But, in research carried out in Australia, students were given a mixture of problems to solve and worked examples. So, during independent practice, students first studied a worked example, then they solved a problem; then they studied another worked example and solved another problem. In this way, the worked examples showed students how to focus on the essential parts of the problems. Of course, not all students studied the worked examples. To correct

this problem, the Australian researchers also presented partially completed problems in which students had to complete the missing steps and thus pay more attention to the worked example.

5. Guide student practice: Successful teachers spend more time guiding students' practice of new material.

Research findings

It is not enough simply to present students with new material, because the material will be forgotten unless there is sufficient rehearsal. An important finding from information-processing research is that students need to spend additional time rephrasing, elaborating, and summarizing new material in order to store this material in their long-term memory. When there has been sufficient rehearsal, the students are able to retrieve this material



easily and thus are able to make use of this material to foster new learning and aid in problem solving. But when the rehearsal time is too short, students are less able to store, remember, or use the material. As we know, it is relatively easy to place something in a filing cabinet, but it can be very difficult to recall where exactly we filed it. Rehearsal helps us remember where we filed it so we can access it with ease when needed.

A teacher can facilitate this rehearsal process by asking questions; good questions require students to process and rehearse the material. Rehearsal is also enhanced when students are asked to summarize the main points, and when they are supervised as they practice new steps in a skill. The quality of storage in long-term memory will be weak if students only skim the material and do not engage in it. It is also important that all students process the new material and receive feedback, so they do not inadvertently store partial information or a misconception in long-term memory.

In the classroom

In one study, the more successful teachers of mathematics spent more time presenting new material and guiding practice. The more successful teachers used this extra time to provide additional explanations, give many examples, check for student understanding, and provide sufficient instruction so that the students could learn to work independently without difficulty. In contrast, the less successful teachers gave much shorter presentations and explanations, and then they passed out worksheets and told students to work on the problems. Under these conditions, the students made too many errors and had to be retaught the lesson.

The most successful teachers presented only small amounts of material at a time. After this short presentation, these teachers then guided student practice. This guidance often consisted of the teacher working the first problems at the blackboard and explaining the reason for each step, which served as a model for the students. The guidance also included asking students to come to the blackboard to work out problems and discuss their procedures. Through this process, the students seated in the classroom saw additional models.

Although most teachers provided some guided practice, the most successful teachers spent more time in guided practice, more time asking questions, more time checking for understanding, more time correcting errors, and more time having students work out problems with teacher guidance.

Teachers who spent more time in guided practice and had higher success rates also had students who were more engaged during individual work at their desks. This finding suggests that, when teachers provided sufficient instruction during guided practice, the students were better prepared for the independent practice (e.g., seatwork and homework activities), but when the guided practice was too short, the students were not prepared for the seatwork and made more errors during independent practice.

6. Check for student understanding: Checking for student understanding at each point can help students learn the material with fewer errors.

Research findings

The more effective teachers frequently checked to see if all the students were learning the new material. These checks provided some of the processing needed to move new learning into long-term memory. These checks also let teachers know if students were developing misconceptions.

In the classroom

Effective teachers also stopped to check for student understanding. They checked for understanding by asking questions, by asking students to summarize the presentation up to that point or to repeat directions or procedures, or by asking students whether they agreed or disagreed with other students' answers. This checking has two purposes: (a) answering the questions might cause the students to elaborate on the material they have learned and augment connections to other learning in their long-term memory, and (b) alerting the teacher to when parts of the material need to be retaught.

In contrast, the less effective teachers simply asked, "Are there any questions?" and, if there were no questions, they assumed the students had learned the material and proceeded to pass out worksheets for students to complete on their own.

Another way to check for understanding is to ask students to think aloud as they work to solve mathematical problems, plan an essay, or identify the main idea in a paragraph. Yet another check is to ask students to explain or defend their position to others. Having to explain a position may help students integrate and elaborate their knowledge in new ways, or may help identify gaps in their understanding.

Another reason for the importance of teaching in small steps, guiding practice, and checking for understanding (as well as obtaining a high success rate, which we'll explore in principle 7) comes from the fact that we all construct and reconstruct knowledge as we learn and use what we have learned. We cannot simply repeat what we hear word for word. Rather, we connect our understanding of the new information to our existing concepts or "schema," and we then construct a mental summary (i.e., the gist of what we have heard). However, when left on their own, many students make errors in the process of constructing this mental summary. These errors occur, particularly, when the information is new and the student does not have adequate or well-formed background knowledge. These constructions are not errors so much as attempts by the students to be logical in an area where their background knowledge is weak. These errors are so common that there is a research literature on the development and correction of student misconceptions in science. Providing guided practice after teaching small amounts of new material, and checking for student understanding, can help limit the development of misconceptions.

The most successful teachers spent more time in guided practice, more time asking questions, more time checking for understanding, and more time correcting errors.

7. Obtain a high success rate: It is important for students to achieve a high success rate during classroom instruction.

Research findings

In two of the major studies on the impact of teachers, the investigators found that students in classrooms with more effective teachers had a higher success rate, as judged by the quality of their oral responses during guided practice and their individual work. In a study of fourth-grade mathematics, it was found that 82 percent of students' answers were correct in the classrooms of the most successful teachers, but the least successful teachers had a success rate of only 73 percent. A high success rate during guided practice also leads to a higher success rate when students are working on problems on their own.

The research also suggests that the optimal success rate for fostering student achievement appears to be about 80 percent. A success rate of 80 percent shows that students are learning the material, and it also shows that the students are challenged.

In the classroom

The most effective teachers obtained this success level by teaching in small steps (i.e., by combining short presentations with supervised student practice), and by giving sufficient practice on each part before proceeding to the next step. These teachers frequently checked for understanding and required responses from all students.

It is important that students achieve a high success rate during instruction and on their practice activities. Practice, we are told, makes perfect, but practice can be a disaster if students are practicing errors! If the practice does not have a high success level, there is a chance that students are practicing and learning errors. Once errors have been learned, they are very difficult to overcome.

As discussed in the previous section, when we learn new material, we construct a gist of this material in our long-term memory. However, many students make errors in the process of constructing this mental summary. These errors can occur when the information is new and the student did not have adequate or well-formed background knowledge. These constructions are not errors so much as attempts by the students to be logical in an area where their background knowledge is weak. But students are more likely to develop misconceptions if too much material is presented at once, and if teachers do not check for student understanding. Providing guided practice after teaching small amounts of new material, and checking for student understanding, can help limit the development of misconceptions.

I once observed a class where an effective teacher was going from desk to desk during independent practice and suddenly realized that the students were having difficulty. She stopped the work, told the students not to do the problems for homework, and said she would reteach this material the next day. She stopped the work because she did not want the students to practice errors.

Unless all students have mastered the first set of lessons, there is a danger that the slower students will fall further behind when the next set of lessons is taught. So there is a need for a high success rate for *all* students. "Mastery learning" is a form of instruction where lessons are organized into short units and all students are required to master one set of lessons before they proceed to the next set. In mastery learning, tutoring by other students or by teachers is provided to help students master each unit. Variations of this approach, particularly the tutoring, might be useful in many classroom settings.

8. Provide scaffolds for difficult tasks: The teacher provides students with temporary supports and scaffolds to assist them when they learn difficult tasks.

Research findings

Investigators have successfully provided students with scaffolds, or instructional supports, to help them learn difficult tasks. A scaffold is a temporary support that is used to assist a learner. These scaffolds are gradually withdrawn as learners become more competent, although students may continue to rely on scaffolds when they encounter particularly difficult problems. Providing scaffolds is a form of guided practice.

Scaffolds include modeling the steps by the teacher, or thinking aloud by the teacher as he or she solves the problem. Scaffolds also may be tools, such as cue cards or checklists, that complete part of the task for the students, or a model of the completed task against which students can compare their own work.

One characteristic of effective teachers is their ability to anticipate students' errors and warn them about possible errors some of them are likely to make.

The process of helping students solve difficult problems by modeling and providing scaffolds has been called "cognitive apprenticeship." Students learn strategies and content during this apprenticeship that enable them to become competent readers, writers, and problem solvers. They are aided by a master who models, coaches, provides supports, and scaffolds them as they become independent.

In the classroom

One form of scaffolding is to give students prompts for steps they might use. Prompts such as "who," "why," and "how" have helped students learn to ask questions while they read. Teaching students to ask questions has been shown to help students' reading comprehension.

Similarly, one researcher developed the following prompt to help students organize material.[13]

1. Draw a central box and write the title of the article in it.
2. Skim the article to find four to six main ideas.
3. Write each main idea in a box below the central box.
4. Find and write two to four important details to list under each main idea.

Another form of scaffolding is thinking aloud by the teacher. For example, teachers might think aloud as they try to summarize a paragraph. They would show the thought processes they go through as they determine the topic of the paragraph and then use the topic to generate a summary sentence. Teachers might think aloud while solving a scientific equation or writing an essay, and at the same time provide labels for their mental processes. Such thinking aloud provides novice learners with a way to observe "expert thinking" that is usually hidden from the student. Teachers also can study their students' thought processes by asking them to think aloud during problem solving.

One characteristic of effective teachers is their ability to anticipate students' errors and warn them about possible errors some of them are likely to make. For example, a teacher might have students read a passage and then give them a poorly written topic sentence to correct. In teaching division or subtraction, the teacher may show and discuss with students the mistakes other students have frequently made.

In some of the studies, students were given a checklist to evaluate their work. Checklist items included "Have I found the most important information that tells me more about the main idea?" and "Does every sentence start with a capital letter?" The teacher then modeled use of the checklist.

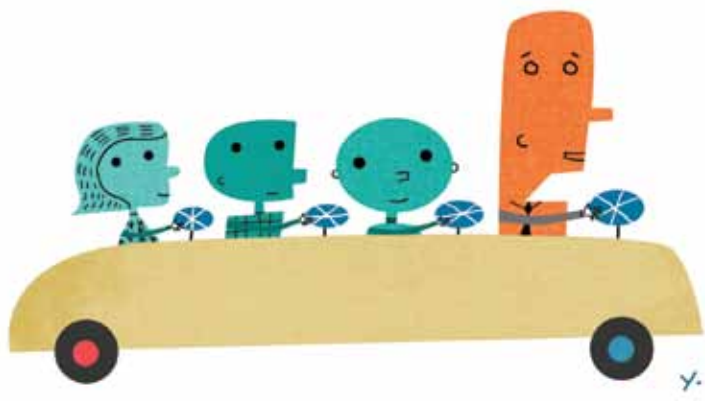
In some studies, students were provided with expert models with which they could compare their work. For example, when students were taught to generate questions, they could compare their questions with those generated by the teacher. Similarly, when learning to write summaries, students could compare their summaries on a passage with those generated by an expert.

9. Require and monitor independent practice: Students need extensive, successful, independent practice in order for skills and knowledge to become automatic.

Research findings

In a typical teacher-led classroom, guided practice is followed by independent practice—by students working alone and practicing the new material. This independent practice is necessary because a good deal of practice (overlearning) is needed in order to become fluent and automatic in a skill. When material is overlearned, it can be recalled automatically and doesn't take up any space in working memory. When students become automatic in an area, they can then devote more of their attention to comprehension and application.

Independent practice provides students with the additional review and elaboration they need to become fluent. This need for fluency applies to facts, concepts, and discriminations that must be used in subsequent learning. Fluency is also needed in operations, such as dividing decimals, conjugating a regular verb in a foreign language, or completing and balancing a chemical equation.



In the classroom

The more successful teachers provided for extensive and successful practice, both in the classroom and after class. Independent practice should involve the same material as the guided practice. If guided practice deals with identifying types of sentences, for example, then independent practice should deal with the same topic or, perhaps, with a slight variation, like creating individual compound and complex sentences. It would be inappropriate if the independent practice asked the students to do an activity such as "Write a paragraph using two compound and two complex sentences," however, because the students have not been adequately prepared for such an activity.

Students need to be fully prepared for their independent practice. Sometimes, it may be appropriate for a teacher to practice some of the seatwork problems with the entire class before students begin independent practice.

Research has found that students were more engaged when their teacher circulated around the room, and monitored and supervised their seatwork. The optimal time for these contacts was 30 seconds or less. Classrooms where the teachers had to stop at students' desks and provide a great deal of explanation during seatwork were the classrooms where students were making errors. These errors occurred because the guided practice was not sufficient for students to engage productively in independent practice. This reiterates the importance of adequately preparing students before they begin their independent practice.

The best way to become an expert is through practice—thousands of hours of practice. The more the practice, the better the performance.

Some investigators[14] have developed procedures, such as cooperative learning, during which students help each other as they study. Research has shown that all students tend to achieve more in these settings than do students in regular settings. Presumably, some of the advantage comes from having to explain the material to someone else and/or having someone else (other than the teacher) explain the material to the student. Cooperative learning offers an opportunity for students to get feedback from their peers about correct as well as incorrect responses, which promotes both engagement and learning. These cooperative/competitive settings are also valuable for helping slower students in a class by providing extra instruction for them.

10. Engage students in weekly and monthly review: Students need to be involved in extensive practice in order to develop well-connected and automatic knowledge.

Research findings

Students need extensive and broad reading, and extensive practice in order to develop well-connected networks of ideas (schemas) in their long-term memory. When one's knowledge on a particular topic is large and well connected, it is easier to learn new information and prior knowledge is more readily available for use. The more one rehearses and reviews information, the stronger these interconnections become. It is also easier to solve new problems when one has a rich, well-connected body of knowledge and strong ties among the connections. One of the goals of education is to help students develop extensive and available background knowledge.

Knowledge (even very extensive knowledge) stored in long-term memory that is organized into patterns only occupies a tiny amount of space in our limited working memory. So having larger and better-connected patterns of knowledge frees up space in our working memory. This available space can be used for reflecting on new information and for problem solving. The development of well-connected patterns (also called "unitization" and "chunking") and the freeing of space in the working memory is one of the hallmarks of an expert in a field.

Thus, research on cognitive processing supports the need for a teacher to assist students by providing for extensive reading of a variety of materials, frequent review, and discussion and application activities. The research on cognitive processing suggests that these classroom activities help students increase the number of pieces of information in their long-term memory and organize this information into patterns and chunks.

The more one rehearses and reviews information, the stronger the interconnections between the materials become. Review also helps students develop their new knowledge into patterns, and it

(Continued on page 39)

17 Principles of Effective Instruction

The following list of 17 principles emerges from the research discussed in the main article. It overlaps with, and offers slightly more detail than, the 10 principles used to organize that article.

- Begin a lesson with a short review of previous learning.
- Present new material in small steps with student practice after each step.
- Limit the amount of material students receive at one time.
- Give clear and detailed instructions and explanations.
- Ask a large number of questions and check for understanding.
- Provide a high level of active practice for all students.
- Guide students as they begin to practice.
- Think aloud and model steps.
- Provide models of worked-out problems.
- Ask students to explain what they have learned.
- Check the responses of all students.
- Provide systematic feedback and corrections.
- Use more time to provide explanations.
- Provide many examples.
- Reteach material when necessary.
- Prepare students for independent practice.
- Monitor students when they begin independent practice.

–B.R.

A Model Lesson

Finland Shows Us What Equal Opportunity Looks Like

ILLUSTRATIONS BY ANDRÉ DA LOBA

By Pasi Sahlberg

International indicators show that Finland has one of the most educated citizenries in the world, provides educational opportunities in an egalitarian manner, and makes efficient use of resources. But at the beginning of the 1990s, education in Finland was nothing special in international terms. The performance of Finnish students on international assessments was close to overall averages, except in reading, where Finnish students did better than most of their peers in other countries. The unexpected and jarring recession of that time period brought Finland to the edge of a financial breakdown. Bold and immediate measures were necessary to fix national fiscal imbalances and revive the foreign trade that disappeared with the collapse of the Soviet Union in 1990.

Today, there are countries around the world where education leaders find their own educational systems in a situation very similar to that of Finland in 1990. The United States, England, Sweden, Norway, and France, just to mention a few, are among those where public education is increasingly challenged because of endemic failure to provide adequate learning opportunities to all children. The story of educational change in Finland brings hope to all those worried about whether improving their educational systems is at all possible.

Finland's system is unique because it has progressed from mediocrity to being a model and "strong performer" over the past three decades. Finland is special also because it has been able to create an educational system where students learn well and where equitable education has translated into little variation in student

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performance between schools in different parts of the country. This internationally rare status has been achieved using reasonable financial resources and less effort than other reform efforts.

The equitable Finnish education system is a result of systematic attention to social justice and early intervention to help those with special needs, and close interplay between education and other sectors—particularly health and social sectors—in Finnish society. It is not only that the education system functions well in Finland, but that it is part of a well-functioning democratic welfare state. Complimentary school lunches, comprehensive welfare services, and early support to those in need have been made available to all children in all Finnish schools—free of charge. Every child has, by law, a right to these welfare services in his or her school. Therefore, attempts to explain the success of the education system in Finland should be put in the wider context and seen as a part of the overall function of democratic civil society. Economists have been interested in finding out why Finland has been able to become the most competitive economy in the world. Educators are trying to figure out the secret of high educational performance of Finland. The quality of a nation or its parts is rarely a result of any single factor. The entire society needs to perform satisfactorily.

For example, in terms of income equality, Finland has been among the most equitable countries in the world, together with other Nordic countries, but income inequality has increased in Finland during the last two decades. Increasing inequality is often related to growing social problems,* such as more prevalent violence, diminishing social trust, worsening child well-being, increasing poverty, and declining educational attainment.[1] Therefore, the challenge for Finland is not to try to maintain high student performance, but to strive to keep the country an equal society and maintain its leading position as having the most equitable education system in the world. In this article, and in the book from which it is drawn (see page 26), I briefly explain how Finland developed that system and explore a few practices that are essential to its equitable outcomes.

From Mediocrity to Excellence and Equity

The story of Finland is a story of survival.

Being a relatively small nation situated between much larger powers of the East and the West has taught Finns to accept existing realities and take chances with available opportunities. Diplomacy, cooperation, problem solving, and seeking consensus have become hallmarks of contemporary Finnish culture. These traits all play an important part in building an educational system that has enjoyed global attention due to its equitable distribution of good teaching and learning throughout the nation.

Most important, Finland had fought for its freedom and survived. External threats experienced during and after World War II united Finns, who still felt the wounds of their 1918 civil war. The post–World War II era was one of political instability and economic transformation, but it also gave rise to new social ideas and social policies—in particular the idea of equal educational opportunities. It is difficult to understand why education has become one of the trademarks of Finland without examining these post–World War II political and social developments.

History is often easier to understand when it is segmented into periods or phases of development, and the recent history of Finland is no exception. Although there are many ways to recount Finland's history, in this case it is helpful to illustrate congruencies between the development of Finland's education system, and three stages of economic development following World War II:

- Enhancing equal opportunities for education by way of transition from a northern agricultural nation to an industrialized society (1945–1970);
- Creating a public comprehensive school system by way of a Nordic welfare society with a growing service sector and increasing levels of technology and technological innovation (1965–1990);
- Improving the quality of basic education and expanding higher education in keeping with Finland's new identity as a high-tech knowledge-based economy (1985–present).[2]

School lunches, welfare services, and early support to those in need have been made available to all children in all Finnish schools—free of charge.

The end of World War II prompted such radical changes to Finnish political, social, and economic structures that immediate changes to education and other social institutions were required. Indeed, education soon became the main vehicle of social and economic transformation in the postwar era. In 1950, educational opportunities in Finland were unequal in the sense that only those living in towns or larger municipalities had access to grammar or middle schools. Most young people left school after six or seven years of formal basic education. Where private grammar schools were available, pupils could apply to enroll in them after four, five, or six years of state-run basic school, but such opportunities were limited. In 1950, for example, just 27 percent of 11-year-old Finns enrolled in grammar schools consisting of a five-year middle school and a three-year high school. An alternative educational path after the compulsory seven years of basic education was two or three years of study in one of the so-called "civic schools" (which had a vocational focus), offered by most Finnish municipalities. This basic education could be followed by vocational training and technical education, but only in larger municipalities and towns that housed these institutions.

In the early years after Finland's independence, teaching in primary schools was formal, teacher-centered, and more focused on moral than cognitive development. Three dominant themes

*To read more about the effects of income inequality, see the Spring 2011 issue of *American Educator* at www.aft.org/pdfs/americaneducator/spring2011/Wilkinson.pdf.

in Finnish national education policy between 1945 and 1970 would come to change this traditional model:

- The structure of the education system would be changed to establish a public, comprehensive school system that would provide access to better and more education for all;
- The form and content of curricula would focus on development of individual, holistic personalities of children; and
- Teacher education would be modernized to respond to needs arising from these developments. The future dream of Finland was built on knowledge and skills; thus, education was seen as a foundation for establishing the future.[3]

The first two decades after World War II were politically turbulent in Finland. It was difficult for many politicians to accept that the educational architecture of the day, which maintained and actually more deeply entrenched inequality in Finnish society, would be unable in the long run to ensure that Finland would achieve its goal of becoming a knowledge society. Some predicted a gloomy future for Finland if the new ideas related to common unified public school for all were approved: declining level of knowledge, waste of existing national talent, and Finland, as a nation, being left behind in the international economic race.

Nonetheless, in the 1960s, the social policy climate had consolidated the values of equality and social justice across the social classes of Finnish society. The expenditures incurred by the ideal of a welfare state were seen, as argued by a prominent Finnish political scientist, Professor Pekka Kuusi, as an investment in increasing productivity.[4] The new comprehensive school system—or *peruskoulu*—was poised for implementation in 1972. According to the plan, a wave of reform was to begin in the northern regions of Finland and reach the southern urban areas by 1978.

A fundamental belief from the old structure was that *everyone cannot learn everything*, that talent in society is not evenly distributed in terms of one's ability to be educated. It was important that the new peruskoulu shed these beliefs, and thus help to build a more socially just society with higher education levels for all.

The central idea of peruskoulu was to merge existing grammar schools, civic schools, and primary schools into a comprehensive nine-year municipal school. This meant that the placement of students after four years of primary education into grammar and civic streams would come to an end. All students, regardless of their domicile, socioeconomic background, or interests would enroll in the same nine-year basic schools governed by local education authorities. Critics of the new system maintained that it was not possible to have the same educational expectations of children coming from very different social and intellectual circumstances, and that overall education attainment would have to be adjusted downward to accommodate less-talented students. Fortunately, those critics did not prevail.

As planned, the wave of implementation began in the northern parts of Finland in 1972. The last of the southern municipalities shifted to the new comprehensive school system in 1979. The *National Curriculum for the Comprehensive School* steered the content, organization, and pace of teaching throughout the country. For the first several years, while the structure of the comprehensive school was similar for all students, the national curriculum provided schools with tools to differentiate instruction for different ability groups and personalities. Foreign languages and mathematics teaching, for example, were arranged in a way that offered students options for three levels of study in grades 7 to 9: basic, middle, and advanced. In 1985, ability grouping was abolished in all school subjects; since then, all students have studied according to the same curricula and syllabi.

Comprehensive school reform triggered the development of three particular aspects in the Finnish education system that would later prove to be instrumental in creating a well-performing education system. First, bringing together a wide variety of students, often with very different life circumstances and aspirations, to learn in the same schools and classes required a fundamentally new approach to teaching and learning. The equal opportunity principle insisted that all students be offered a fair chance to be successful and enjoy learning. From early on, it was understood that the education of pupils with special needs would only be successful if learning difficulties and other individual deficits were identified

early and promptly treated. Special education quickly became an integral part of school curricula, and all municipalities and schools soon housed experts trained to support special needs pupils.

Second, career guidance and counseling became a compulsory part of the comprehensive school curriculum in all schools. It was assumed at the time that if all pupils remained in the same school until the end of their compulsory education, they would need systematic counseling on their options after completing basic school. Career guidance was intended to minimize the possibility that students would make inappropriate choices regarding their futures. In principle, students had three options: continue general education in upper secondary general school (which about 51 percent of students do), go on to vocational upper secondary school (which about 42 percent of students do), or find employment. Both types of upper secondary education offered several internal options. Career guidance and counseling soon became a cornerstone of both lower and upper secondary education, and have been an important factor in explaining low grade repetition and dropout rates in Finland.[5] Career guidance has also served as a bridge between formal education and the world of work. As part of the overall career guidance curriculum, each student in peruskoulu spends at least two weeks in a selected workplace.

Third, the new peruskoulu required that teachers who were working in very different schools, namely the academic grammar schools and the work-oriented civic schools, had to begin to work in the same schools with students with diverse abilities. Compre-

hensive school reform was not just an organizational change, but a new philosophy of education for Finnish schools.[6] This philosophy included the beliefs that all pupils can learn if they are given proper opportunities and support, that understanding of and learning through human diversity is an important educational goal, and that schools should function as small-scale democracies, just as John Dewey had insisted decades before.[7] Peruskoulu therefore required that teachers employ alternative instructional methods, design learning environments that enable differentiated learning for different pupils, and perceive teaching as a high profession. These expectations led to wide-scale teacher education reform in 1979, including a new law on teacher education, with an emphasis on professional development and research-based teacher education.

It is noteworthy that in Finland, all education after the nine-year peruskoulu is noncompulsory. Rather than making upper secondary education compulsory, Finnish education policies have relied on developing equal opportunities for all to participate in upper secondary education as a matter of individual choice, while at the same time creating incentives (such as flexible study schedules and tuition-free higher education) for young people to stay on in the education system after completion of compulsory education. All students in upper secondary school have personalized learning plans that are not tied to age groups or classes, so some students take more time to complete their studies than others.

Education policies that have driven Finnish reforms since 1970 have prioritized creating equal opportunities, raising quality, and increasing participation within all educational levels across Finnish society. As a result, more than 99 percent of the age cohort successfully completes compulsory peruskoulu, about 95 percent continue their education in upper secondary schools, and an additional 3 percent enroll in a voluntary 10th grade of peruskoulu. Of those starting upper secondary school, 93 percent eventually receive their school leaving certification, providing access to higher education.[8]

Central to this effort to create equal opportunities are the principles of education and care that are typical of Finnish schools today. For example, schools are encouraged to maintain strong support systems for teaching and learning—nutritious, free school meals for all pupils, health services, psychological counseling, and student guidance are normal practices in every school. Another strong element of the education system in Finland is built-in networks of schools and communities of teachers in municipalities, and their seamless connection to other social services in society.

Unlike many other contemporary systems of education, the Finnish system has not been infected by market-based competition and high-stakes testing policies. The main reason is that the education community in Finland has remained unconvinced that competition and choice with more standardized testing than students evidently require would be good for schools. The ultimate success of a high-stakes testing policy is determined by whether it positively affects student learning, not whether it increases student scores on a particular test.[9] If student learning remains unaffected, or if testing leads to biased teaching, the validity of such high-stakes tests must be questioned. Finnish education authorities and especially teachers have not been convinced that frequent external census-based testing and stronger accountability would be beneficial to students and their learning.

Education policies are necessarily intertwined with other social policies, and with the overall political culture of a nation. The key success factor in Finland's development of a well-performing knowledge economy with good governance and a respected education system has been its ability to reach broad consensus on most major issues concerning future directions for Finland as a nation. Finland seems particularly successful in implementing and maintaining the policies and practices that constitute *sustainable leadership and change*.[10] Education in Finland is seen as a public good and therefore has a strong nation-building function.

The success of a high-stakes testing policy is determined by whether it positively affects student learning, not whether it increases student scores on a particular test.

Education policies designed to raise student achievement in Finland have put a strong accent on teaching and learning by encouraging schools to craft optimal learning environments and establish instructional content that will best help students to reach the general goals of schooling. It was assumed very early in Finland's reform process that instruction is the key element that makes a difference in what students learn in school, not standards, assessment, or alternative instructional programs. As the level of teacher professionalism gradually increased in schools during the 1990s, the prevalence of effective teaching methods and pedagogically focused school designs increased. A new flexibility within the Finnish education system enabled schools to learn from one another, and thus make best practices universal by adopting innovative approaches to organize schooling. It also encouraged teachers and schools to continue to expand their repertoires of teaching methods, and to individualize teaching in order to meet the needs of all students. As a result, Finnish education today offers a compelling model because of its high quality and equitable student learning. As the figure on page 25 shows, Finland, Canada, Japan, and Korea have education systems that rate highly in quality and equity; they produce consistent learning results regardless of students' socioeconomic status.

Intervening Early and Often

Equity in education is an important feature in Nordic welfare states. It means more than just opening access to an equal education for all. Equity in education is a principle that aims at guaranteeing high-quality education for all in different places and circumstances. In the Finnish context, equity is about having a socially fair and inclusive education system that is based on

equality of educational opportunities. As a result of the comprehensive school reform of the 1970s, education opportunities for good-quality learning have spread rather evenly across Finland. There was a visible achievement gap among young adults at the start of comprehensive school in the early 1970s due to very different educational orientations associated with the old system. This knowledge gap strongly corresponded with the socioeconomic divide within Finnish society at that time.

After abolishing streaming in the mid-1980s and making learning expectations the same for all students, the achievement gap between low and high achievers began to decrease. Clear evidence of more equitable learning outcomes came in 2000 from the first Programme for International Student Assessment (PISA) survey by the Organization for Economic Cooperation and Development (OECD). In that study, Finland had the smallest performance variations between schools in reading, mathematics, and science of all OECD nations. A similar trend continued in the 2003 PISA cycle and was even strengthened in the PISA surveys of 2006 and 2009.[11]

A consistent focus on equity and shared responsibility—not choice and competition—can lead to an education system where all children learn better.

An essential element of the Finnish comprehensive school is systematic attention to those students who have special educational needs. Special education is an important part of education and care in Finland. It refers to designed educational and psychological services within the education sector for those with special needs. The basic idea is that with early recognition of learning difficulties and social and behavioral problems, appropriate professional support can be provided to individuals as early as possible.

The aim of special education is to help and support students by giving them equal opportunities to complete school in accordance with their abilities and alongside their peers. There are two main pathways in special education in the Finnish comprehensive school. The first path sees the student included in a regular class and provided with *part-time special education* in small groups. These groups are led by a special education teacher if the difficulties in learning are not serious. The student may also have an individual learning plan that adjusts the learning goals according to his or her abilities. Students with special educational needs may complete their studies following a regular or an adjusted curriculum. Student assessment is then based on the individual learning plan.

The second pathway is to provide *permanent special education* in a special group or class in the student's own school or, in some cases, in a separate institution. Transfer to special education in this case requires an official decision that is based on a statement by a psychological, medical, or social welfare professional, with a mandatory parental hearing. In Finland, the transfer decision to special needs education is made by the school board of the pupil's municipality of residence, and can be processed rather quickly (within a few months in most cases). In order to promote success in learning, each student in special education has a personalized learning plan that is based on the school curriculum and adjusts educational expectations individually.

In the 2009–2010 school year, almost one-third of all students in peruskoulu were enrolled in one of the two alternative forms of special education described above. More than 23 percent of peruskoulu students were in part-time special education that focuses on curing minor dysfunctions in speaking, reading, and writing, or learning difficulties in mathematics or foreign languages. The remaining 8.5 percent of students were permanently transferred to a special education group, class, or institution. The number of students in permanent special education has doubled in the last 10 years; at the same time, the number of special education institutions has declined steadily since the early 1990s. Since those students who are in part-time special education normally vary from one year to another, up to half of those students who complete their compulsory education at the age of 16 have been in special education at some point in their schooling. In other words, it is nothing that special anymore for students. This fact significantly reduces the negative stigma that is often brought on by special education.

At the dawn of peruskoulu reform, Finland adopted a strategy of early intervention and prevention to help those individuals who have special educational needs of some kind. This means that possible learning and development deficits are diagnosed and addressed during early childhood development and care, before children enter school. In the early years of primary school, intensive special support, mostly in reading, writing, and arithmetic, is offered to all children who have major or minor special needs. Therefore, the proportion of students in special education in Finland in the early grades of primary school is relatively higher than in most other countries. The number of special needs students in Finland declines by the end of primary school and then slightly increases as students move to subject-based lower secondary school. The reason for the increased need for special support in lower secondary school is that the unified curriculum sets certain expectations for all students, regardless of their abilities or prior learning.*

High-equity education in Finland is not a result of educational factors alone. Basic structures of the Finnish welfare state play a crucial role in providing all children and their families with equitable conditions for starting a successful educational path at the age of 7. Early childhood care, voluntary free preschool that is attended by some 98 percent of the age cohort, comprehensive health services, and preventive measures to identify possible learning and development difficulties before children start schooling are accessible to all in Finland. Finnish schools also provide all pupils with free and healthy lunch every day regardless of their home socioeconomic situation. Child poverty is at a very low level, less than 4 percent of the child population (compared with over 20 percent in the United States). In order to prevent children from

(Continued on page 26)

*The common strategy internationally is to repair problems in primary and lower secondary education as they occur rather than try to prevent them from happening.[12] Countries that employ the strategy of repair have an increasing relative number of special needs students throughout primary and lower secondary education.

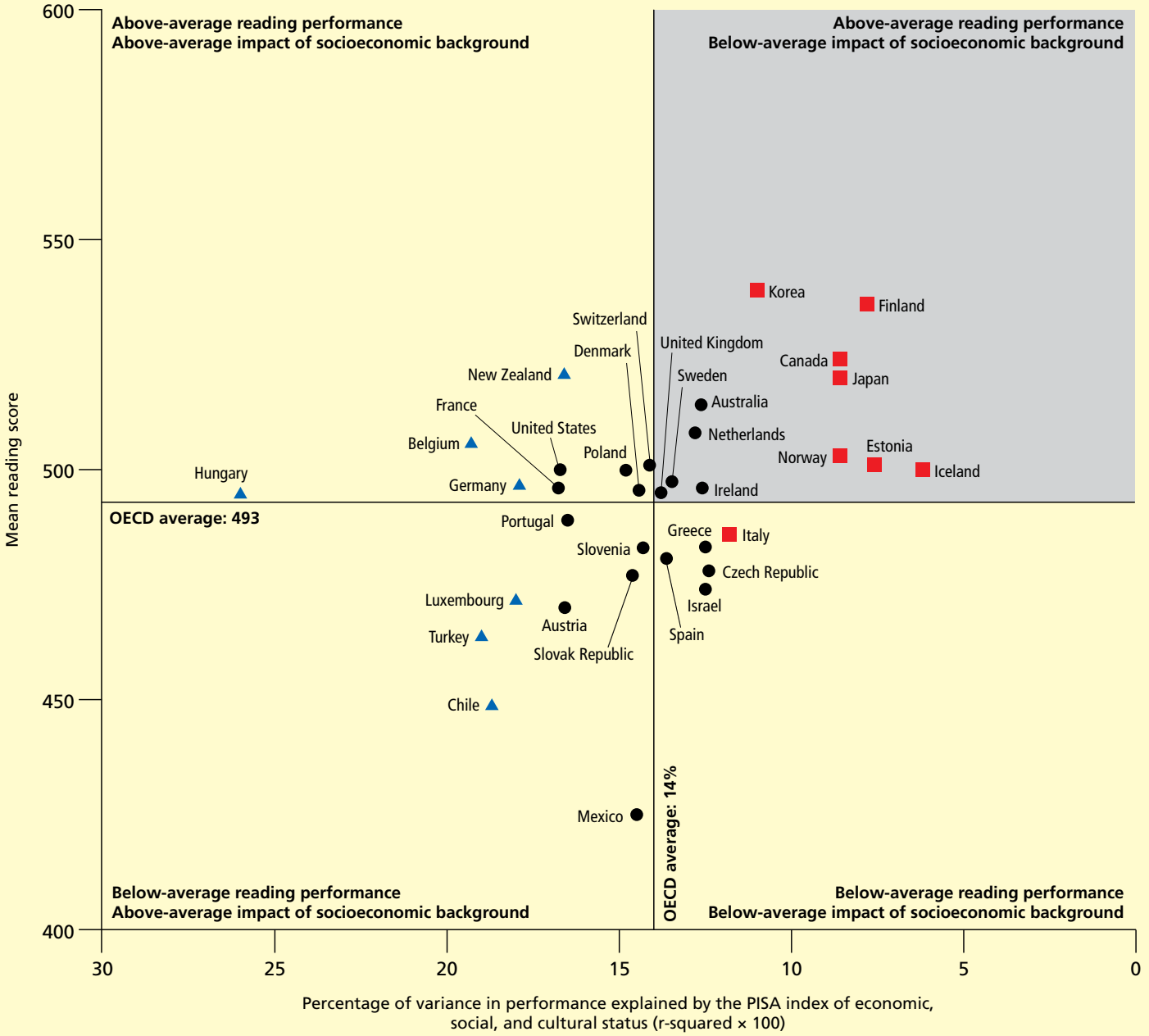
An International Look at Educational Equity

In Finland and a handful of other countries, reading performance is strong, but the impact of students' socioeconomic background is not. The figure below, which is drawn from the Programme for International Student Assessment (PISA) conducted by the Organization for Economic Cooperation and Development (OECD), shows each OECD country's (1) average reading score among 15 year olds and (2) average impact of students' socioeconomic backgrounds on their performance.

To provide a guide as to each country's relative standing, the figure is broken into quadrants using the OECD averages. Not surprisingly, many countries' averages are quite close to the OECD's averages. So, the figure also shows, as follows, which countries are statistically significantly more equitable, significantly less equitable, or no different than the OECD countries as a whole:

- ■ Countries in which the relationship between reading performance and socioeconomic background is weaker than the OECD's average (indicating greater educational equity).
- ▲ Countries in which the relationship between reading performance and socioeconomic background is stronger than the OECD's average (indicating less educational equity).
- ● Countries in which the relationship between reading performance and socioeconomic background is not statistically significantly different than the OECD's average.

–EDITORS



Note: In its report on the 2009 PISA results, the OECD included a version of this figure with 65 OECD and non-OECD countries and regions. The figure shown here draws from the same data, but only shows OECD countries. For the OECD's version of this figure, and the data it is based on, see Organization for Economic Cooperation and Development, *PISA 2009 Results: Overcoming Social Background—Equity in Learning Opportunities and Outcomes*, vol. 2 (Paris: OECD, 2010), Figure II.3.3 and Table II.3.2.

(Continued from page 24)

being ranked according to their educational performance in schools, grade-based assessments are not normally used during the first five years of peruskoulu. It has been an important principle in developing elementary education in Finland that structural elements that cause student failure in schools should be removed. That is why grade retention and overreliance on academic performance have gradually vanished in Finnish schools.

Preventing Grade Repetition

Grade repetition in the old Finnish school system was not rare in elementary schools, and it was an integral educational principle of grammar school. In some cases, a student repeated the third grade of elementary school in order to improve knowledge and skills required in the grammar school admission test at the end of the fourth grade. At the time of the introduction of the new nine-year school, approximately 12 percent of students in each grammar school grade did not progress from their grade. Up to half of those graduating from upper secondary grammar school repeated one or more grades at some point of their schooling.[13] Furthermore, significant numbers of students dropped out of school before completion—often after not being able to progress from one grade to the next.

In the old school system, grade repetition was a method of differentiation for teachers. Problems related to retention were well known; being sent back to the same grade with younger students was often demoralizing and rarely made way for the expected academic improvements among students.[14] After all, repeating an entire grade was an inefficient way of promoting learning because it did not focus on those parts of the curriculum in which a student needed targeted help. Studying for a second time those subjects that a student had already successfully completed was rarely

Finnish Lessons

What Can the World Learn from Educational Change in Finland?

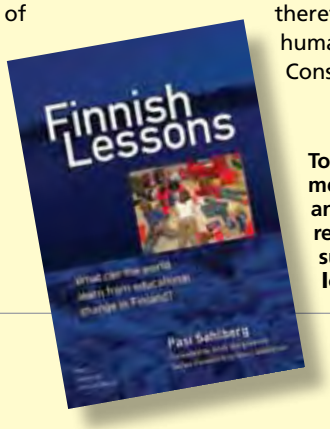
Reforming schools is a complex and slow process. This book is about how such a process evolved in Finland since World War II. It is the first book written for international readers that tells the story of how Finland created a system praised as much for its equity as for its high quality. Many of the world's great newspapers and broadcast services—the *New York Times*, the *Washington Post*, the *Times of London*, *Le Monde*, *El Pais*, National Public Radio, CNN, NBC, Deutsche Welle, and the BBC—have covered this Finnish educational miracle. Thousands of official delegations have visited Finnish authorities, schools, and communities to learn about what drives excellence in education. Until now, however, this story has not received the book-length treatment necessary for enumerating, linking, and explaining the many players, institutions, and impersonal forces involved.

My approach in this book is both personal and academic. It is personal because of my intimate relationship with education in Finland. I was born in northern Finland and raised in a village primary school, as both of my parents were teachers at that school. Most of my childhood memories are in one way or another linked to school. I had the privilege of looking beyond the secrets of the classroom after everybody else was gone, and I found that world rich. It was my home and an enchanted one. It is perhaps no surprise then that I went on to become a teacher. My first position was at a junior high school in Helsinki. I taught mathematics and physics there for seven years. Later, I spent enough time in educational administration and in university teacher education to understand the difference between education in school and out. As a policy analyst for the Organization for Economic Cooperation and Development, an education specialist for the World Bank, and an expert for the European Commission, I gained the global perspective necessary for a deeper appreciation of Finland's distinct place in education.

As this book illustrates, there is no single reason why any educational system succeeds or fails. Instead, there is a network of interrelated factors—educational, political, and cultural—that function differently in different situations. I would, however, like to cite an important element of Finnish educational policies since the early 1970s that appears to transcend cultures: an inspiring vision of what good public education should be. Finland has been particularly committed to building a good publicly financed and locally governed basic school for every child. This common educational goal became so deeply rooted in politics and public services in Finland that it survived opposing political governments and ministries unharmed and intact. Since the introduction of *peruskoulu* (the nine years of basic schooling with a common curriculum for all children) in the early 1970s, there have been 20 governments and nearly 30 different ministers of education in charge of educational reforms in Finland. So strong has this commitment to common basic school for all been that some call it the "Finnish Dream."

The size of Finland's population and relative homogeneity of its society obviously make many aspects of setting education policies and implementing reforms easier than in larger, more diverse jurisdictions. But these factors alone don't explain all the progress and achievements in education that are described in this book, and they should not stop us from learning from one another as we strive to improve education for all students. Finland is, however, very unique among nations in terms of its values, cultural determinants, and social cohesion within society. Fairness, honesty, and social justice are deeply rooted in the Finnish way of life. People have a strong sense of shared responsibility not only for their own lives, but also for those of others. Fostering the well-being of children starts before they are born and continues until they reach adulthood. Daycare is a right of all children before they start school at age 7, and public health services are easily accessible to all during childhood. Education in Finland is widely seen as a public good and is therefore protected as a basic human right to all in the Constitution.

–P.S.



To follow the latest developments in Finnish education and hear news about events related to *Finnish Lessons*, be sure to visit www.finnishlessons.com.

stimulating for students or their teachers. Students were sent to the same class without a plan to specify the areas of improvement, let alone the methods of achieving most effectively the required levels of knowledge and skills.

In the early days of comprehensive school reform, grade repetition was seen as an inadequate and wrong strategy for fixing individual learning or social deficiencies. In the elementary school, grade repeaters who had difficulties in one or two subjects were often labeled as "failing" students who also had behavioral and personality problems. This educational stigma normally had a dramatic negative impact on students and also lowered teachers' expectations regarding these students' abilities to learn. Grade repetition created a vicious circle that for many young people cast a negative shadow right into adulthood. Educational failure is linked to an individual's role in society and is characterized by unfavorable attitudes toward learning and further education. Grade repetition, in most cases, led to increased social inequality rather than helping students to overcome academic and social problems.

Peruskoulu quickly changed grade repetition policies and practices. The new comprehensive school did not completely remove the problem of repeating grades, but the number of students who repeated grades in the comprehensive school decreased significantly. Personalized learning and differentiation became basic principles in organizing schooling for students across society. The assumption that all students can achieve common educational goals if learning is organized according to each student's characteristics and needs became another foundation. Retention and ability grouping were clearly against these ideals. Different students have to learn to work and study together in the same class. Diversity of students' personalities, abilities, and orientations has to be taken into account in crafting learning environments and choosing pedagogical methods in schools. This turned out to be one of the most demanding professional challenges for teachers. Even today, schools are searching for an optimal educational and economic solution for Finland's rapidly increasing diversity.*

Minimizing grade repetition has been possible primarily because special education has become an integral part of each and every school in Finland. Every child has the right to get personalized support provided early on by trained professionals as part of normal schooling. This special support is arranged in many different ways today. As described earlier, special education in Finland is increasingly organized within general mainstream schooling.

Upper secondary schools—both general and vocational—operate using modular curriculum units rather than year-based grades. Thus, grade repetition in its conventional form has vanished from Finnish upper secondary schools. This nonclass structure has also abolished classes in which the same group of students move from one lesson to another and from one grade to the next. In the early 1980s, approximately 15 percent of students repeated a grade at least once. Today, students build their own personalized learning schedules from a menu of courses offered in their schools or by other education institutions. Studying in upper secondary school is therefore flexible, and selected courses can be completed at a different pace depending on the students' abilities and life situations. Rather than repeating an entire grade, a student only repeats those courses that were not passed satisfactorily. Most students complete upper secondary school in the prescribed time of three years, although some progress faster and some need more time than others.

Michael Fullan, a Canadian educational change scholar, speaks about "drivers of change," such as education policy or strategy levers, which have the best chances of driving intended change in education systems. "In the rush to move forward," writes Fullan, "leaders, especially from countries that have not been progressing, tend to choose the wrong drivers."[15] "Wrong drivers" include accountability (vs. professionalism), individual teacher quality (vs. collegiality), technology (vs. pedagogy), and fragmented strategies (vs. systems thinking). The Finnish experience shows that a consistent focus on equity and shared responsibility—not choice and competition—can lead to an education system where all children learn better than they did before.

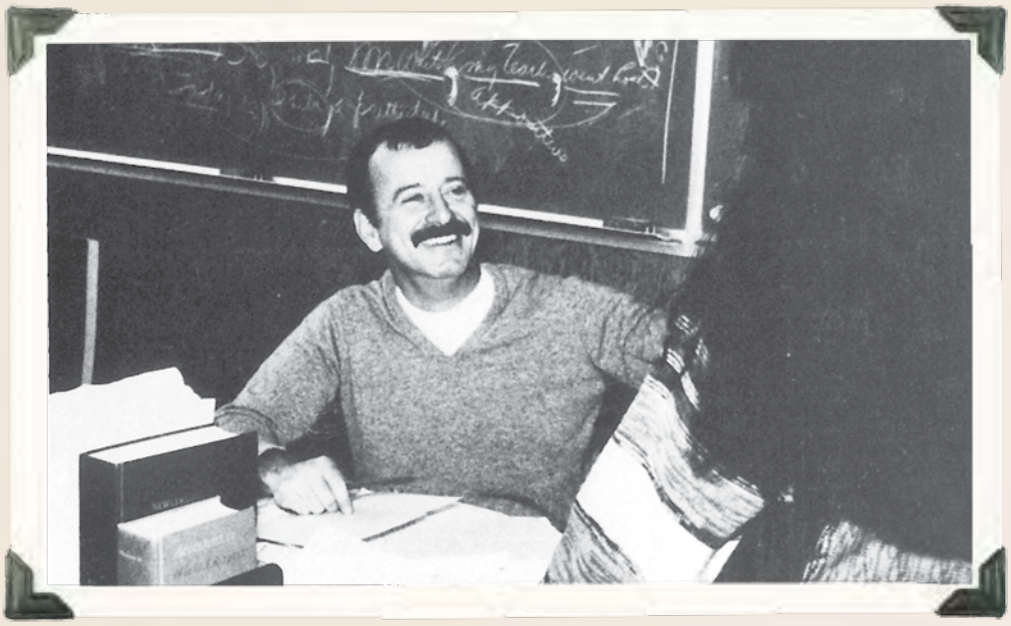
Understanding Finnish educational success needs to include an awareness of sociocultural, political, and economic factors. Indeed, there is more to the picture than meets the eye. An external OECD expert review team that visited Finland observed that "it is hard to imagine how Finland's educational success could be achieved or maintained without reference to the nation's broader and commonly accepted system of distinctive social values that more individualistic and inequitable societies may find it difficult to accept."[16] Another visiting OECD team confirmed that the Finnish approaches to equitable schooling rely on multiple and reinforcing forms of intervention with support that teachers can get from others, including special education teachers and classroom assistants.[17] Furthermore, Finland has shown that educational change should be systematic and coherent, in contrast with the current haphazard intervention efforts of many other countries.

(Continued on page 40)

*It is true that Finland long remained ethnically homogeneous. However, since it joined the European Union in 1995, cultural and ethnic diversification has been faster than in other European Union countries, especially in larger cities' districts and schools, where first- and second-generation immigrants account for one-quarter of the total population.

I'll Never Forget Mr. White

A Teacher's Legacy



By Andy Waddell

A man died last summer. At 78, he was neither old enough nor young enough for his passing to make news. His obituary was two paragraphs long. The *San Jose Mercury News* simply stated that Edward A. White was survived by "his brother Mike, his sister Mary and his many loving nieces and nephews." Like Willy Loman, he "never made a lot of money. His name was never in the paper." Only one short line from his obit showed the gap that separates Ed from the fictional salesman. "As a passionate High School English Teacher" the *Mercury* put it, he "leaves a far reaching legacy of kindness, love and the pursuit of life-long learning."

I am part of that legacy.

Ed was one of those legendary figures—it seems every school has one—who, sticking fast year after year like an axis of the earth, become almost synonymous with the institution itself, in this case San Jose High School. Every year, he sat with the graduates upon the platform, an honor voted by the students; every alumnus who returned to speak to the students called him out by name and devoted a few kind comments to "Mr. White." The words "I'll never forget" figured prominently in these tributes.

Lately, it feels like not only are public schools and teachers' unions under attack but so is the value of teaching itself, or at least teaching as a creative act, the way the old masters like Ed White did it. More and more emphasis is placed on standardized tests, "scripted lessons" are sold to districts as being "teacher-proof," and politicians rise to power by promising to fight teachers' interests. In this context (and just after battling a class of 39 freshmen seventh period and feeling once again like just hanging it up for good), I found myself reading the "guest book" on legacy.com, a tribute message board with comments like, "I am one of the countless former students whose life was forever changed by the wisdom, kindness and generosity of Mr. White" (Sylvia French Kennedy, class of 1986). Soon I began pondering a question I should have thought about 25 years ago when I entered this profession: What does it mean to be a great teacher?

I'm not alone in wondering about this. In 2009, headlines proclaimed that the Bill and Melinda Gates Foundation planned to spend $45 million to find out what makes a great teacher. In a pithy, withering piece in *Education Week*, retired teacher James D. Starkey offered to save them a lot of time and trouble (in exchange for the $45 mil) by answering the question right now, without the benefit of formal research. He said a great teacher: "(1) has a sense of humor; (2) is intuitive; (3) knows the subject matter; (4) listens well; (5) is articulate; (6) has an obsessive/compulsive side; (7) can

Andy Waddell teaches English at Santa Clara High School in Santa Clara, California. He has worked as a high school teacher and administrator for 25 years. Photo of Edward A. White (above) courtesy of the author.

be subversive; (8) is arrogant enough to be fearless; (9) has a performer's instincts; (10) is a real taskmaster."

Ed fit all 10 of these categories perfectly, but I would add "(11) likes kids." I suspect Mr. Starkey found this one too obvious to bother listing, but I think it's worth noting. I've never known a great teacher, or even a good one, who didn't get a charge out of the "kidness" of kids—the vibrancy of youth, the terrible, beautiful energy that frightens so many adults. The most pervasive, well-meaning platitude we in the teaching profession hear year after year from politicians, and even the public at large, is that "our children are our future." For us teachers, however, our children are our present. They are not adults-in-waiting but complete individuals with insights and idiosyncrasies all their own.

That is why the fourth item on Starkey's list, listening, is so important. When I was an 18-year-old community college student, one of my classmates was a middle-aged man who had dropped out of an engineering career and was starting over, studying poetry. I'll never forget the way he listened, staring straight at me with a Zen-like stillness that was almost scary. I commented on it, and he said, very slowly and deliberately, "Well, Andy, you know things that no one else knows." I was startled and, ironically, dumbstruck. The quality of his listening made me begin to listen to myself. No teacher can listen like that to 150 students a day, but the great ones find a way, from time to time, to give their undivided attention, to hear a kid the way we all want to be heard.

I repeat this story to my sophomores to introduce an essay assignment that requires them to use an incident from their lives to reflect on a universal idea. We read some authors who have managed to squeeze meaning from ordinary events, and I tell my classes, "The incident doesn't matter; it's what you make of it. Everyone in this room has enough experience to fill a book; it just depends on how you look at it." I stand on chairs and crouch in the back to demonstrate *perspective*. "You see things in a way that no one else sees them," I say. "You know things that no one else knows." And they nod; they know it's true.

The listening skill all great teachers share, no matter what their subject matter, is a finely tuned capacity for distinguishing differences in student voices. They can tell whether a student who asks to use the restroom should be given permission, told to wait, or taken out in the hall and quietly asked, "What's wrong?" They can hear the difference between teasing and banter. Most important, they sense the exact line between productive chatter and pointless noise, and (amazingly to me after 25 years of trying) are able to instantaneously draw the class back across the line to where they should be.

Even more difficult is teaching students to listen, not just to be quiet. I remember in third grade, dear old Mrs. Trolinger helping me with something while the rest of the class worked on. Suddenly, she stopped, finger to her lips, although for once I was successfully using my inside voice. "Shhh," she said, so intently and so quietly that I strained my ears, expecting something extraordinary. All I could hear was the creaking of desks, the scratching of pencils on three-lined paper, maybe a quick whisper for a borrowed eraser. I looked back at her, puzzled. "These are classroom sounds," she said simply, and we both kept quiet, sharing the moment. I had no idea why she did it, and even now can only guess. Was she feeling proud, pleased with the success of her own classroom management? Was she trying to demonstrate what quiet was for an awkward, loud boy who had very little control over his own voice? At the time, all I thought was "Boy, this lady really likes to hear kids work." Maybe I was right.

> Ed was my teacher, but I never sat in his class; I was down the hall scrubbing "INXS" off desks and girding my loins for another go at the Queen Mab speech.

Mr. Starkey predicts failure for the researchers from the Gates Foundation, concluding, "Great teaching is not quantifi-

able.... Great teaching happens by magic." True, perhaps, but not very helpful for those of us in the trenches trying to improve. To be fair, the Gates people never claimed to be after the lofty secret of great teaching. They are actually seeking the more likely and more helpful goal of "effective" teaching. In this pursuit, they have already videotaped more than 13,000 lessons, which they are analyzing, correlating effectiveness against a number of measures, including student feedback, to find a more rigorous, reliable measure of teacher effectiveness than looking only at student test scores. The preliminary results are really quite heartening for teachers. Most notably, they have found that good teachers tend to be effective no matter what classes they are assigned, they do very little "test prep," relying instead on "cognitively challenging tasks," and they tend to use writing instruction, even in math classes. They also score much higher on student surveys that ask students to rank their agreement with the statements "My teacher in this class makes me feel that s/he really cares about me" and "My teacher really tries to understand how students feel about things."

These two qualities, challenging and caring, are the two most basic aspects of teaching. The first is difficult to measure, the second nearly impossible. Researchers from the Consortium on Chicago School Research labeled these two strands "academic press" and "social support," and showed that both factors were vital for the success (measured by test scores) of middle schoolers in Chicago's poorer neighborhoods. In short, students do better when they are pushed, but also when they feel that adults care about them.

Elementary teachers are typically better at the latter. They hug and hold more often than they yell and scold, and they find ways even in large classes to make students feel special and, more important, competent (often by making chores seem like rewards). Many of us remember clapping erasers more vividly than we remember learning the state capitals.

The single most memorable event of my elementary career was the day, long after school hours had ended, when the custodian, Mr. Dalky, invested my friend Danny Larson and me with the awesome responsibility of helping him take down the flag. Even after explaining how terrible it would be if the Stars and Stripes should touch the unholy ground, he still trusted us to grab it as it descended the pole, and then showed us step by step the correct and only way to fold that sacred cloth into a neat triangle. And then he thanked us.

Mr. Dalky was my teacher that day, part of the village I didn't realize was raising me.

College, the other end of the academic road, can seem like all academic press and no support to those fresh from the safe confines of high school, and that is not a bad thing. My son, a student at San Francisco State University, reports back to me, "College is just like high school, except the teachers don't care. They don't care if you do the assignments; they don't care if you're there; they really don't care." All this he says happily, an amazed grin on his face. He knows he is being treated like an adult for the first time in his life, and he is loving it.

> "Yes," Ed would say, "I think that makes sense. I've never heard it put quite like that." Students thought Mr. White was brilliant because they felt brilliant in his class.

The great professor, unlike the great teacher of younger students, need not even know his students' names; in fact, anonymity might even come in handy. Dr. John Hospers, professor of philosophy at the University of Southern California and the first libertarian presidential candidate, once stopped a class discussion in its tracks, took off his horn-rimmed glasses, leaned across the podium, pointed directly at me, and said slowly, "That is slogan thinking, which is NO THINKING AT ALL!" Afterward, students I didn't even know came up to me and asked me how I was doing. True, I fumed a bit, searching my mind for a snappy comeback, but in a way I found it liberating. After being told for years that there are no wrong answers and gaining an inflated opinion of myself, it was strangely refreshing to be brought down a peg. Besides, the more I thought about it, the more I realized that the professor was completely right. I became known as "the guy Hospers hates" and friends were flummoxed by my good grade in the class. "He has no idea who I am," I explained.

Such a strategy would never work with high school students. It's been said that teenagers are only interested in one subject: themselves. Show an interest in that subject and they might walk a little way up the mountain of education. Still, this only goes so far. While we'd all like to make it to the top, it's very tempting to stay in the meadow with our feet in the stream. The "nice teacher" will let you stay there; the "cool teacher" will climb in with you; the great teacher has the force of will to say, "I know your feet hurt—let's climb together." As Salvador Benavides (class of 1981) put it, Mr. White "chal-

lenged us to work harder and aim higher than we ever imagined."

Ed was my teacher, but I never sat in his class; I was down the hall busily scrubbing "INXS" and "XTC" off desks between rounds of searching for pronoun antecedents and girding my loins for another go at the Queen Mab speech. I can't even call Ed my mentor, in the typical sense. We did not meet; we chatted. He seldom shared materials with me; in fact, he had few materials to share. Ed started teaching long before the Xerox machine, saw no hardship for students in copying lengthy examples from the blackboard, and loathed the fill-in dittos so ubiquitous in those days. His main method of instruction seemed to be the discussion, an activity he could stretch out for a 50-minute period if the kids were engaged, and they usually were.

In those days, as a young teacher, I hungered for help. I was as yet unused to the isolation of teaching. Older colleagues were nice, but there was no time built in for sharing resources and ideas. I remember creating a vocabulary list for *Julius Caesar* and pondering the absurdity that I was sitting in a 50-year-old building, in a 100-year-old school where a 400-year-old play had been taught thousands of times, and no one could just hand me a list of words. I kept thinking of a line from Brecht's play *Mother Courage*, in which the army recruiter says the commander is looking for some brave men to enlist. Mother Courage comments that he must be a very bad commander, saying, "If his plan of campaign was any good, why would he need *brave* soldiers, wouldn't plain, ordinary soldiers do? Whenever there are great virtues, it's a sure sign something's wrong." Already, I was giving up on my ambition to be a brave soldier in the fight against ignorance; I couldn't see great virtue in myself, but still I couldn't understand why an educated, reasonably intelligent person should be having such a difficult time becoming just a plain, ordinary soldier. I couldn't fathom why I had to have four different preps, why I was assigned most of the remedial students, why I was left to fend for myself as if I really were the competent, confident person I had pretended to be in my interview. It was clear to me that the system needed to change. I don't think I would have liked "scripted lessons," but I wanted something

to rely on, as opposed to the "sink or swim" attitude of the day, even though it was a crucible that occasionally forged the great teacher. Today, mentorship programs for new teachers are more common, thankfully, and materials are available at the click of a mouse, but still we devote precious little time to collaborating, to mining our greatest resource: the skilled professionals in our own buildings.

I don't believe Ed was keeping secrets from me. He wasn't one of those who want others to fail so their own success will seem even more miraculous. No, I think for him, teaching was neither science nor art—it was an extension of the self. Advising fellow teachers seemed to him to be not only intrusive but insulting, like telling someone how to love.

> Nothing could alter Ed's faith in young people, his blessed assurance of the potential inside the same kids who were being written off in the media as violent and lazy.

That is not to say he was without opinions—far from it; he could be smug, even sanctimonious, maddeningly self-assured as so many great teachers are. I distinctly remember an argument about the meaning of the Latin motto *de gustibus non est disputandum* and the definition of the word "taste." To Ed, "Taste" was a capital-letter distinction that denoted the accumulated appreciation of the best of culture. To dislike, say, Shakespeare did not mean that one had different taste; it meant that one had no taste at all. To Ed, matters of taste were beyond disputing because they were settled issues.

I've noticed that many great teachers have this quality of certainty. In the classroom, they can bend to coax ideas from callow minds, allowing arguments to flourish, ideas to be

challenged, all the while subtly leading the students along a winding but definite path. They can ask questions as if they've just thought of them, as if the subject under study had never before been understood, and when they get the answer they were looking for, they stand awestruck, eyes widening, and let the moment sink in. The class senses something has happened. "Yes," Ed would say, "I think that makes sense. I've never heard it put quite like that." Students thought Mr. White was brilliant because they felt brilliant in his class.

It wasn't easy to teach kids who had been in Ed's classes. One of the most dispiriting moments of my career came when I overheard two of my best students discussing the A papers I had just returned. They were talking about how measly and uninteresting their essays were and reminiscing about the lengthy, thought-provoking essays they had written as freshmen in Mr. White's class two years before. The same girls once told me that an assignment we were doing, a somewhat simplistic analysis of a piece of literature, "would have made Mr. White throw up." I learned early on that "But Mr. White said…" was the beginning of an argument I could not win. He had transferred his certainty onto them.

With adults this certainty could take on forms that were somewhat more abrupt. I saw Ed turn his back, literally, on a colleague who disagreed with him about a union issue. And God knows you didn't want to be his boss! He was a thorn in the side of dozens of principals and assistant principals, resisting wave after wave of "reform" with an almost pathological distrust of administrators, most of whom he considered to be just plain stupid. His attitude, and recurrent threat, when endless committees and planning meetings seemed to him to be wrongheaded, was to say, "I'm just going to close my door and teach."

And that is exactly what he did, year after year, in a community that transformed from the quiet downtown of an agricultural area to the blighted ghetto of a major metropolis. The world around him changed, but behind those closed doors, in the world he could control, nothing was different. The names might be Juan and Maria instead of John and Mary, but nothing could alter Ed's perfect faith in young people, his blessed assurance of the potential inside the same kids who were being written off in the media as violent and lazy—the blackboard jungle so feared at the time. He believed that the same writers who had spoken to him when he was a poor, working-class youth in Detroit could speak to the teased-hair, tight-skirted *cholas* and baggy-pants *vatos*, could transform them as he had been transformed.

Ed told me more than once a story about his own high school years. He was a ninth-grader working on an assignment about subordination in Sister Theonela's class. Words such as "Fleetwoods," "convertibles," "cars," and "Cadillacs" were supposed to be reordered from general to specific. Young Ed was having trouble and the teacher, trying to help, pointed at the word "cars" and asked, "Can you see that this group is bigger than the others?" Ed replied that he couldn't, and the teacher just placed a hand upon his shoulder and said, "You will," before moving on to the next kid.

Those two words, "You will," sum up Ed's philosophy, and really that of all great teachers. For many of us, the message we send is "You may." We present the material and if the students want to learn, it's up to them. On our better days, of course, we say "You can." It would be a poor teacher indeed who never sent that message. "You can do it!" we cheer them on, "You can do it!" And when they do, we feel vicarious triumph, which is sometimes a byproduct of surprise. Perhaps we weren't so sure they could do it after all.

"You will" takes it to another level. Said one way, with a pat on the back, it is an affirmation of faith, an absolute belief in the potential of the student. Said another way, accompanied by the famous teacher stare, "a gaze blank and pitiless as the sun," it's the order of an autocrat. It states, in the words of one of my fellow teachers, "I don't play." Every great teacher knows how to send both messages, sometimes simultaneously.

Ed had another story about Sister Theonela. He had written a little essay, a response to the reading. It was riddled with errors, according to Ed, but the teacher took him aside and said, "You have interesting insights. You should consider becoming an English teacher." It seemed an absurd thing to say to a boy growing up on the wrong side of Detroit whose mother sewed seats at the Ford factory. Ed thought she was crazy; everyone knew his future was down at the auto plant. He kept the paper anyway. Many times in his own teaching career, he told me, he reread that page, asking himself what his teacher saw, and whether he would be able to see it in his students' papers. "I don't think I would have seen it," he told me.

This was one of the few times I believe Ed was guilty of false modesty. He would have seen it; he saw it again and again in hundreds, thousands of students over the years. As former student Yolanda Guerra (class of 1986) posted, "He always had an open ear and heart. He instilled in me a desire and passion for learning and the capacity to ask tough questions.… He was a true teacher who saw that every student had the ability to succeed." Ms. Guerra is a teacher herself now at Downtown College Prep, a charter school a few miles from her old high school. She went on to say, "I honor him every day as I walk into my own classroom of high school students hoping that I have the same passion with my students that he had with us."

And the legacy continues. □

ASK THE COGNITIVE SCIENTIST

Why Does Family Wealth Affect Learning?

How does the mind work—and especially how does it learn? Teachers' instructional decisions are based on a mix of theories learned in teacher education, trial and error, craft knowledge, and gut instinct. Such knowledge often serves us well, but is there anything sturdier to rely on?

Cognitive science is an interdisciplinary field of researchers from psychology, neuroscience, linguistics, philosophy, computer science, and anthropology who seek to understand the mind. In this regular American Educator *column, we consider findings from this field that are strong and clear enough to merit classroom application.*

By Daniel T. Willingham

Question: Why do wealthy kids usually do better in school than poor kids?

Answer: Disadvantaged children face a host of challenges to academic success. These challenges fall into two broad categories. First, as one might expect, wealthier parents have the resources to provide more and better learning opportunities for their children. Second, children from poorer homes are subject to chronic stress, which research from the last 10 years has shown is more destructive to learning than was previously guessed. But research also shows it's not all about money.

"Common knowledge" does not always turn out to be true, especially in matters relating to schooling. But when it comes to wealth and educational outcomes, common knowledge has it right: on average, kids from wealthy families do significantly better than kids from poor families. Household wealth is associated with IQ[1] and school achievement,[2] and that phenomenon is observed to varying degrees throughout the world.[3] Household wealth is associated with the likelihood of a child graduating from high school[4] and attending college.[5] With a more fine-grained analysis, we see associations with wealth in more basic academic skills like reading achievement[6] and math achievement.[7] And the association with wealth is still observed if we examine even more basic cognitive processes such as phonological awareness,[8] or the amount of information the child can keep in working memory (which is the

ILLUSTRATIONS BY DANIEL BAXTER

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mental "space" in which thinking occurs),[9] or the extent to which the child can regulate his emotions and thought processes.[10]

But these effects are not due to household income alone. In fact, it's unlikely that they are *directly* due to income at all.[11] Imagine showering cash on a low-income family; there will not be a sudden boost to the children's cognition or academic achievement. The effects of wealth must be indirect and must accrue over time.

Indeed, researchers believe that a useful way to conceive of the impact of wealth is that it provides access to opportunities. Money is an obvious enabler of opportunities: cash buys books, and summer enrichment camps, and access to tutoring if it's needed. But in addition to financial capital, two other types of capital afford opportunities for children: *Human capital* refers to the skills or knowledge of individuals, usually based on their education and experience. Parents who have a good deal of human capital in the form of education will, in subtle and overt ways, impart their knowledge to their children. *Social capital* refers to beneficial connections in social networks, such as ties to people with financial or human capital. Parents with a lot of social capital might have friends or relatives who can provide helpful summer internships for their child, or they might be more likely to have well-placed friends who can advocate for their child if he has a problem at school.

Naturally, we'd expect financial, human, and social capital to be related. For example, someone who attends college is increasing her human capital through education, but she will also make friends in college and thus have connections (social capital) with other well-educated people.[12] That is why, rather than simply measuring family wealth, most researchers use a composite measure called *socioeconomic status* (SES) that includes measures of family income, parental education, and parental occupation.

How does SES affect educational outcomes? Most theories fall into one of two categories. *Family investment* models offer an intuitive mechanism: high-SES parents have more capital, and so can invest more in their children's development.[13] *Stress models* suggest that low SES is associated with long-term stress that has two consequences: it makes parents less effective, and it has direct, negative biological consequences for children's maturing brain systems.[14] These models are not mutually exclusive. Both could be right, and indeed, there is evidence that both factors contribute to the difficulty that low-SES students have in school. Indeed, much of the challenge in this research is separating the many factors that can have multiple effects and tend to occur together. For example, crowded housing conditions occur because of lack of financial capital and likely have direct effects on children's learning (it's hard to study in a crowded, noisy environment) as well as indirect effects (crowding makes health problems more likely and leads to greater stress). Despite these challenges, researchers have succeeded in identifying some of the many factors that contribute to the greater academic problems faced by students in low-SES families. Let's take a look at some of this evidence, bearing in mind that the studies cited here used methodologies that separate the effects of these co-occurring factors.

Family Investment Theories

Some factors associated with SES seem to be straightforward consequences of the amount of money available to the family. For example, low-income families cannot as readily afford books, computers, access to tutors, and other sources of academic support.[15] Indeed, these sources of intellectual stimulation are associated with better school outcomes,[16] and many poor families cannot afford them.[17]

There are subtle consequences of low socioeconomic status, such as greater risk for low birth weight, which is a risk for cognitive impairment.

There are other, more subtle consequences of SES, and these effects are present even before a child is born. Low-SES mothers tend to have less adequate access to health care, so their babies are at greater risk for low birth weight,[18] which is a risk factor for cognitive impairment[19] with consequences measurable at least into middle childhood.[20] There is also a high incidence of fetal alcohol syndrome in children born to low-SES mothers.[21] Fetal alcohol syndrome is caused by alcohol abuse by a woman when she's pregnant, and it results in a host of cognitive deficits for the infant. The greater incidence in low-SES pregnancies is thought to result not only from differences in mothers' drinking habits but, at least in part, from interactions with poor nutrition and possibly genetic factors.[22]

Once born, children in low-SES families have overall poorer health, which has a lasting impact on educational outcomes.[23] They are more likely to have a nutritionally inadequate diet[24] and poor access to health care,[25] which likely has wide-ranging health consequences. They are more likely to develop serious chronic health problems,[26] which make low-SES kids miss more days of school than their peers,[27] which in turn is associated with negative school outcomes.[28] Missing school is particularly destructive for low-SES kids; they benefit *more* from school than their wealthier counterparts,[29] presumably because their homes

and neighborhoods do not provide the same cognitive richness and challenge.

Poor children are also exposed to a number of risks in their physical environment.[30] They are more likely to live in substandard housing with greater exposure to lead, and subsequently show higher blood lead levels than wealthier children.[31] Even a trace amount of lead is known to have serious negative effects on cognition.[32] Kids in low-SES families are also more likely to share a room and generally to live in more crowded conditions,[33] which is known to affect academic performance.[34] This effect may be due to the simple fact that a more crowded home is noisier, making it more difficult to concentrate, but crowding also likely makes it harder for parents to maintain a calm, orderly home, which also impacts cognition.[35]

Perhaps the best-known effect of financial capital on schooling is that wealthier families often seek housing in what they believe to be superior school districts. But even before children start school, kids from higher-SES families are likely to have daycare providers who are less harsh and more sensitive than daycare providers of lower-SES kids; higher-quality daycare is associated with better math and reading scores through elementary school.[36] And once kids start school, poor children are more likely to have teachers who are less experienced or have marginal qualifications.[37] There is also evidence that, when teaching mathematics, teachers of poor children are more likely to emphasize basic computations rather than more advanced procedures and their conceptual underpinnings. The teachers of low-SES students also spend less classroom time on instruction. These data indicate that teachers are not emphasizing basic instruction because the kids are less capable; rather, low-SES kids are more likely to be assigned to teachers who emphasize basic instruction.[38]

All of the foregoing effects are consequences of reduced financial capital. Human capital—the knowledge and skills of the parents that can be imparted to their children—is also important. For example, a great deal of evidence shows that low-SES parents speak less often to their children, and with a more limited vocabulary and simpler syntax, than their high-SES counterparts,[39] a phenomenon that begins when children are still infants.[40] Mother's speech in particular is tightly linked to toddler vocabulary growth.[41] There is some evidence that this effect is partly due to differences in parents' knowledge about child development. Parents who know more about how children learn and grow talk to their children in more complex ways and more often solicit ideas from their children, and high-SES parents more often have this knowledge.[42] There is also evidence that the crowded homes of low-SES families contribute: when the home is crowded, parents are more likely to talk to children briefly and in directives.[43]

Children in low-SES families are read to by their parents less often,[44] and they watch more television than their high-SES counterparts.[45] Their parents are less likely to buy toys that teach shapes or colors or the names of letters.[46] All of these sources of cognitive stimulation that low-SES kids miss are known to have positive impacts on reading and math scores at school.[47]

Finally, more-educated parents are more concerned about imparting human capital to their children; or at least, they are more concerned about spending time with their children. Although one might suppose that parents who work more (either for extra income or out of necessity) will spend less time with their children, this effect is actually rather small.[48] Parents who work more hours tend to sacrifice other activities in order to spend time with their children. Income is also a weak predictor of time spent with children, but there is a robust effect of education, with better-educated parents spending more time with their children.[49]

Parents who know more about how children learn talk to their children in more complex ways.

What about social capital? There too, low-SES kids are at a disadvantage. Parental feeling of connectedness and involvement in their child's school is associated with student achievement,[50] and low-SES parents are less involved in their children's schools.[51] At least part of this effect seems to be due to race and class differences that contribute to a lack of trust between parents and teachers or administrators.[52] Low-SES kids also tend to befriend students who are themselves not engaged at school.[53]

Stress Theories

There appears to be ample evidence supporting family investment theories: families with more financial, human, or social capital invest more of it in their children, and their children benefit. Still, the support for family investment theories does not mean that other factors cannot contribute to the effect of SES on education, and indeed, there are also data supporting stress theories.

The basic idea behind stress theories was well captured by a policy statement from the American Academy of Pediatrics published in January of this year.[54] Low SES is associated with chronic stress that, if not buffered by supportive relationships, has long-term, negative consequences on brain development, which are expressed in cognitive performance. There are several steps, which I show in the figure on page 36, in the logic behind this theory, and there is at least some supporting evidence for each.

First, SES and stress are inversely correlated: that is, low-SES families suffer greater stress than mid- or high-SES families.[55] The reasons that stress is associated with SES likely seem self-evident. Among other factors, low-SES families more often go hungry (or are uncertain whether they'll have enough food in the coming month),[56] have greater worries about job insecurity and financial problems,[57] and are more likely to live in neighborhoods with high crime rates.[58] Indeed, levels of hormones associated with stress—cortisol and catecholamines—are inversely correlated with SES.[59]

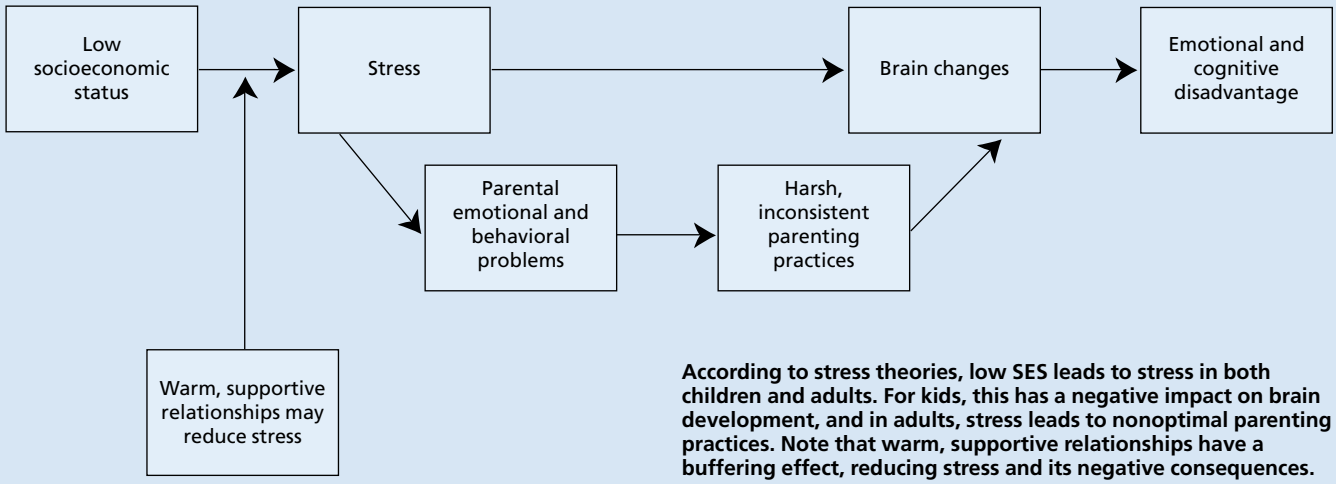
Second, there is evidence that these stressors affect parenting. Most parents know that they are not at their best with their kids when they feel under stress. Low-SES parents are more often harsh and inconsistent in parenting practices.[60] These practices are at least partly mediated by chronic stress; stress makes it more likely that parents will suffer behavioral and emotional problems,[61] and stress, along with some differences in beliefs about discipline, accounts for much of the differences between low-, mid-, and high-SES parenting practices.[62] Parental depression and stress have been linked with behavioral problems in children and with difficulties regulating emotions.[63]

Third, there is evidence of a direct effect of stress on children's brains.[64] Mothers under chronic stress during pregnancy have babies who develop more slowly during the first year, and who show lower mental development at 12 months.[65] As a child, chronic stress affects how the body responds to stress—the longer a child lives under stressful conditions (crowding, noise, substandard housing, exposure to violence, etc.), the higher his or her basal levels of cortisol (a stress hormone) and the more muted his or her reaction to a standard stressor such as being asked to work math problems in one's head.[66] In addition to changing the way the brain responds to stressful events, chronic stress changes the anatomy of the brain. For example, young adults who report high levels of verbal abuse as children show abnormalities in white matter tracts (which are like cables that connect different parts of the brain).[67] The effect of stress on the brain is most profound when children are young and the brain is still quite plastic.[68] All in all, the impact of stress on brain anatomy is wide-ranging, but not equivalent throughout. Five regions seem particularly vulnerable to its effects. These are parts of the brain that support working memory, long-term memory, spatial processing, and pattern recognition.[69] These findings showing brain changes associated with chronic stress are important because they suggest a possible mechanism by which stress may lead to differences in cognition. But they should not be interpreted as showing that kids subjected to chronic stress have brain damage or can't learn. They surely can learn, but these data give us some idea of the challenges they face.

Chronic stress, if not buffered by supportive relationships, has negative consequences, which are expressed in cognitive performance.

Fourth, there is evidence that stress directly affects children's cognitive abilities. A large research literature from laboratory studies shows that short-term stress interferes with the formation of new memories,[70] especially when the stress is unrelated to the event to be remembered and occurs at a different time.[71] For example, the child who is bullied on the bus on his way to school will remember the bullying episode well, but there will be a cost to everything he encounters at school that day. Remarkably, the same is true if he's bullied *on the bus ride home*. The stress exacts a cost to memories formed hours earlier. There is also direct evidence that the sort of stressors low-SES kids experience affect cognition. For example, when there has been

How Chronic Stress Affects Performance



According to stress theories, low SES leads to stress in both children and adults. For kids, this has a negative impact on brain development, and in adults, stress leads to nonoptimal parenting practices. Note that warm, supportive relationships have a buffering effect, reducing stress and its negative consequences.

a homicide in the neighborhood less than one week prior to testing, students score significantly lower on reading and vocabulary assessments.[72] In the longer term, there is evidence that suffering chronic stress as a child leads to reduced working-memory capacity in adulthood.[73]

Fifth, there is evidence of the buffering effect of warm parenting. Even in the face of life stress, nurturing parents make a child feel safe, and so the negative consequences of chronic stress will be lessened.[74] In one study, having nurturing parents at age 4 was related to the volume of the hippocampus (a crucial memory structure) at age 14.[75] In another study,[76] foster children aged 3 to 5 were shown to have atypical activity in the hypothalamic-pituitary-adrenal (HPA) axis, a set of structures that responds to stress. This atypical activity was associated with adverse events in the child's past. But the children responded well to an intervention in which adults were taught to better recognize signs of distress in the child, and to respond in a sensitive way. Nine months after the training, the atypical activity in the HPA axis was reduced for these children.

What Are the Implications?

What sort of intervention would help low-SES kids fulfill their educational potential? Reading the foregoing analysis of the broad impact of SES might lead one to conclude that an equally broad array of social services targeting home and family life, as well as school interventions, would be necessary—the sort of thing that the Harlem Children's Zone is famous for and the Coalition for Community Schools has long advocated. At the least, something like the Perry Preschool seems necessary. It emphasized high-quality preschool for children living in poverty, as well as weekly home visits to involve parents and encourage them to extend the preschool curriculum to the home.[77] But what can be done by an individual teacher?

We should keep in the forefront of our minds that the trends discussed here are exactly that—trends. There are harsh, inconsistent parents with stressed-out children in high-SES homes, and sensitive, consistent parents with well-prepared children in low-SES homes. Obviously, making assumptions about kids and their home lives based on parents' income or occupation is nothing more than stereotyping. Still, it is well to keep in the back of your mind that these trends exist: a child from a poor family is more likely to be under chronic stress than a child from a middle-class family, for example.

The difficult balance is to recognize the challenges each individual child faces, but not use them as a reason to lower expectations for achievement or appropriate behavior. High expectations need not be an additional source of stress—students thrive when high expectations are coupled with high levels of support.[78] Many low-SES kids are not getting the cognitive challenge they need from their homes and neighborhoods, but neither are they getting the support they need.

To compensate, teachers should offer in the classroom what these children are missing at home. Much of this is what we've called human capital—academic knowledge and skills—which is the teacher's bread and butter. It's also well to remember that some of this knowledge, though important for long-term success, is not academic knowledge. It's knowledge of how to interact with peers and adults, how to interact with large institutions like a school or a government agency, how to interact with authority figures, how to schedule one's time, strategies to regulate one's emotions, and so on. Some of this information is taught implicitly, by example, but much of it can be taught explicitly.

The difficult balance is to recognize the challenges each child faces, but not lower expectations.

The research reviewed here also highlights the importance of a calm atmosphere in the classroom and in the school. This is obviously a goal that virtually every teacher shares—no one wants a chaotic classroom—but knowing that a child's neighborhood and home might be noisy, crowded, and threatening makes the creation of a serene, joyful classroom all the more important. Kids in more chaotic classrooms show higher levels of stress hormones.[79] Knowing the consequences of stress for cognition, and the potential long-term consequences to the brain, makes the matter more urgent.

The research literature on the impact of SES on children's learning is sobering, and it's easy to see why an individual teacher might feel helpless in the face of these effects. Teachers should not be alone in confronting the impact of poverty on children's learning. One hopes that the advances in our understanding of the terrible consequences of poverty for the mind and brain will spur policymakers to serious action. But still, teachers should not despair. All children can learn, whatever their backgrounds, and whatever challenges they face. ☐

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Principles

(Continued from page 19)

helps them acquire the ability to recall past learning automatically.

The best way to become an expert is through practice—thousands of hours of practice. The more the practice, the better the performance.

In the classroom

Many successful programs, especially in the elementary grades, provided for extensive review. One way of achieving this goal is to review the previous week's work every Monday and the previous month's work every fourth Monday. Some effective teachers also gave tests after their reviews. Research has found that even at the secondary level, classes that had weekly quizzes scored better on final exams than did classes with only one or two quizzes during the term. These reviews and tests provided the additional practice students needed to become skilled, successful performers who could apply their knowledge and skills in new areas.

Teachers face a difficult problem when they need to cover a lot of material and don't feel they have the time for sufficient review. But the research states (and we all know from personal experience) that material that is not adequately practiced and reviewed is easily forgotten.

The 10 principles in this article come from three different sources: research on how the mind acquires and uses information, the instructional procedures that are used by the most successful teachers, and the procedures invented by researchers to help students learn difficult tasks. The research from each of these three sources has implications for classroom instruction, and these implications are described in each of these 10 principles.

Even though these principles come from three different sources, the instructional procedures that are taken from one source do not conflict with the instructional procedures that are taken from another source. Instead, the ideas from each of the sources overlap and add to each other. This overlap gives us faith that we are developing a valid and research-based understanding of the art of teaching. □

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Finland

(Continued from page 27)

The conclusion was that "developing the capacities of schools is much more important than testing the hell out of students, and that some nonschool policies associated with the welfare state are also necessary."[18] Scores of news articles on Finnish education have concluded that trust, teacher professionalism, and taking care of those with special needs are the factors that distinguish Finnish schools from most others.

Importing a specific aspect of Finland's education system, whether it is curricula, teacher training, special education, or school leadership, is probably of little value to those aiming to improve their own education systems. The Finnish welfare system guarantees all children the safety, health, nutrition, and moral support that they need to learn well in school. One lesson from Finland is, therefore, that successful change and good educational performance often require improvements in social, employment, and economic sectors. As described by theoretical biologist Stuart Kauffman,[19] separate elements of a complex system rarely function adequately in isolation from their original system in a new environment. □

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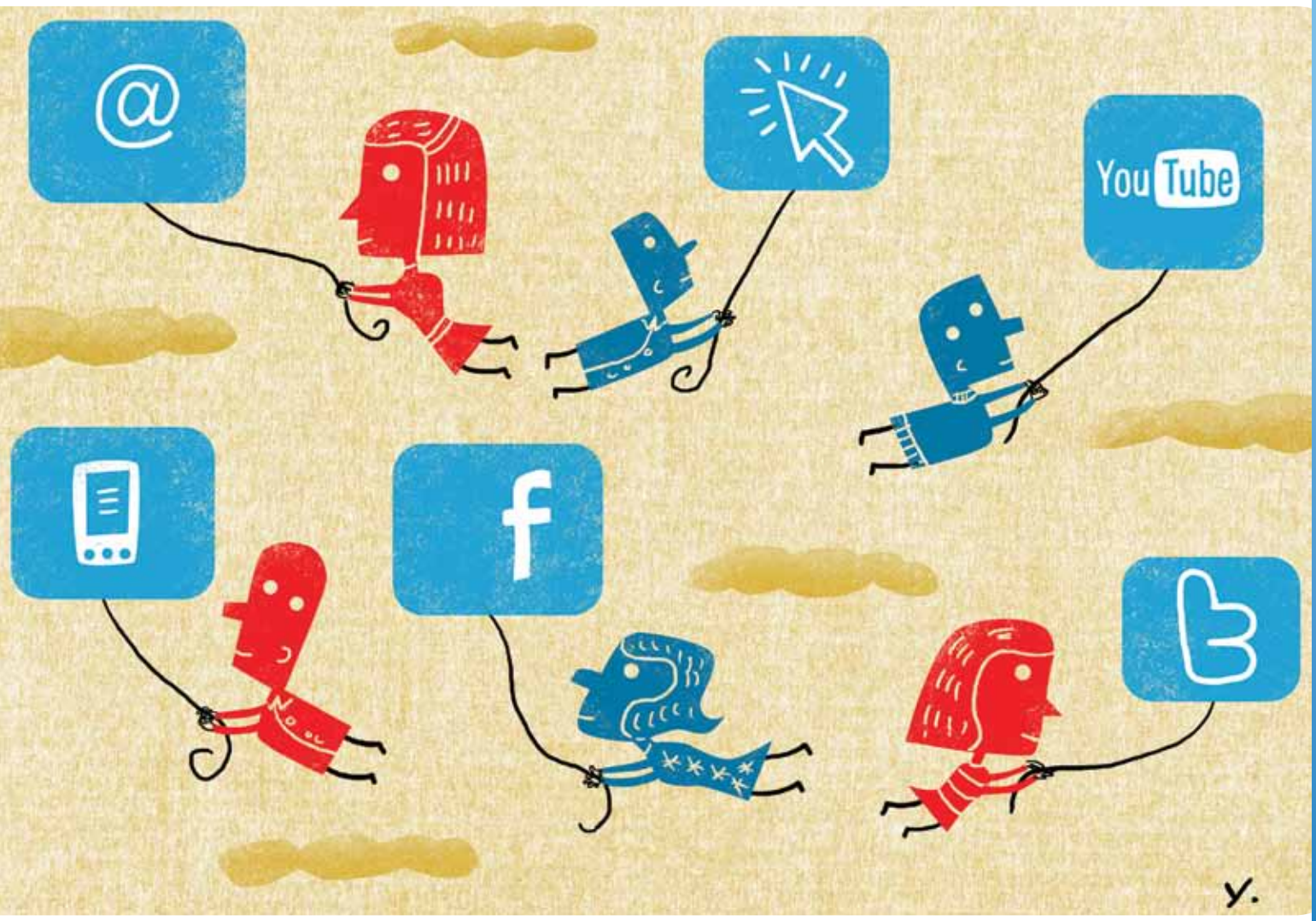

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