

AMERICAN  
**Educator**

AMERICAN FEDERATION OF TEACHERS  
FALL 1993

# Teaching for Understanding

To Memorize and Recite or  
To Think and Do?



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Bigger Than the Bargaining Table Can Solve



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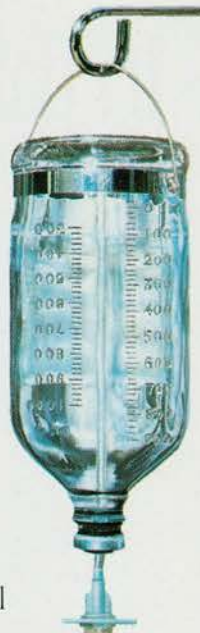

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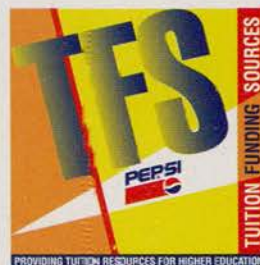
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*Suppose a student can remember Newtonian physics equations and apply them to three or four routine types of textbook problems. Does this mean he understands? No, says the author, and that's what lies at the heart of our students' performance problems.*

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*If spiraling health care costs continue, the annual bill will be about 20 percent of our gross domestic product by the turn of the century. And the more we spend on health care, the less is available for education.*

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A Special  
Pullout  
Section

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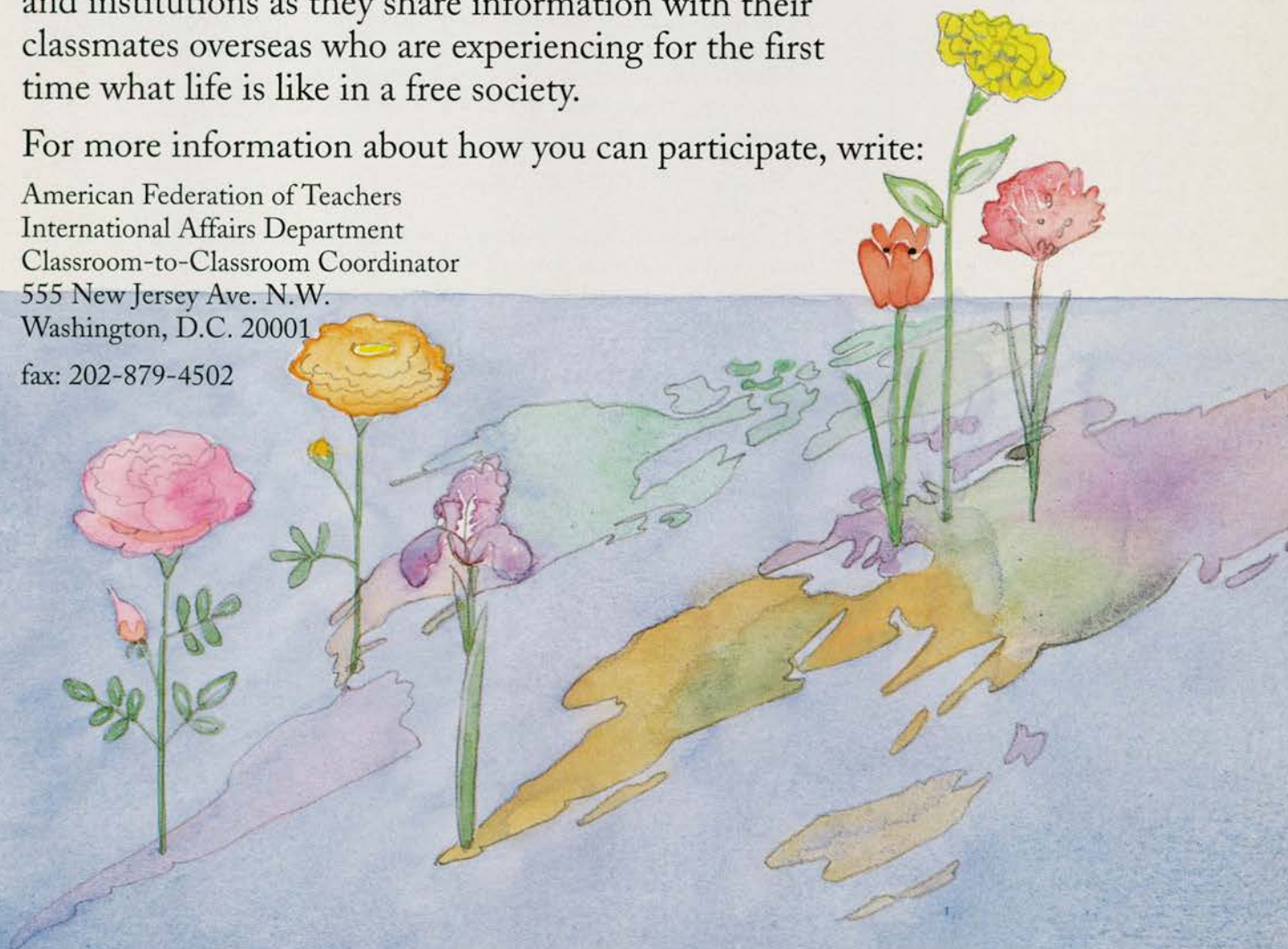
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# LETTERS

## COGNITIVE SCIENCE

Bravo to John Bruer's article on cognitive science. Seems there has always been more knowledge about the world than knowledge about the mind that discovers that knowledge. The article does an excellent job of providing insight into reciprocal teaching, cognitive research, and on how people think, learn and remember. My concern is if teaching methods based on research in cognitive science are the educational equivalents of polio vaccine and penicillin, why are so few outside the educational research community aware of this? Could it be that educators have naive facets of their own that make these important breakthroughs meaningless. Facets that should be changed are being used as anchors inhibiting the benefits of cognitive research to the very industry those benefits can serve. Are educators' long-term memory structures or production systems, as they are called in the article, so strong that magnificent new data will be ignored?

If one wants to use a computer, one has to know how to work it. It is the same with the most awesome computer ever designed, the mind. Knowing how it works can help structure education more logically and systematically toward a student's mind. Human beings are thinking animals. It's what sets us apart from all other species. Cognitive science and reciprocal teaching are the beginnings to a program that can fit the complexities of so awesome a thing as the mind. Taking steps now to find out more about cognitive science will result in our having more expert educational chunks.

The educational industry must have enough interest in moving from novice to expert in this field of study to sufficiently make a difference. As educators, the more we know about how the mind works, the more we can do to help it work in expert fashion. There are experts in every single

field of endeavor. To help our students become those experts we must become experts in knowing how the minds we teach operate.

—JOE SCIME

ATHOL SPRINGS, NEW YORK

"The Mind's Journey from Novice to Expert" (Summer 1993) was a wonderful article that reinforced what had already evolved in my 20+ years of teaching: Students learn best when they get to discover things for themselves. The teacher must play a significant role as facilitator and provide guidance in idea development, but students must take responsibility for their own learning.

I would like to see more attention given to research in the different ways people perceive and process information. While the four rules that were identified for the balance-scale problems seem very logical, I still wonder if the kinesthetic-tactile learner would approach the problem in a manner different from the analytical learner. For example, when confronted with the "train traveling from New York at 120 mph and the train coming from Los Angeles at 150 mph . . ." problem, I still prefer to draw a diagram of it, to help me visually understand the words, and then I can apply the correct algebraic equation to it. I visualized the balance problem too. Yet I know other people could directly figure the correct solution in their heads, without needing to write or draw anything.

It's been very obvious to me that children learn in different ways and that our educational system still focuses on the verbal and written word as the main instructional strategy. The current emphasis on "hands-on" learning activities in science is a direct acknowledgment of the weakness of words as the only teaching tool. I wish teachers in all of the other subject areas, and in our teacher training institutions, would recognize this as well.

—SANDY HILDRETH

MADRID, NEW YORK

The lead article (Summer 1993) by John Bruer likens teaching methods based on cognitive science to penicillin and polio vaccine. A few pages later, a review of the Stevenson and Stigler book cites their claim that elementary school students in the United States "were far below their Japanese and Chinese peers."

There's something funny going on here. The nations that have contributed the *least* to discovery of the new educational "penicillin" and "polio vaccine" and whose teachers have probably never heard of the "breakthroughs" in cognitive science reported by Mr. Bruer have the *highest* educational achievement.

There are two possibilities: Either Stevenson and Stigler are misrepresenting the comparative data, or Bruer's comparisons are wishful thinking — if not outright misrepresentation. The latter possibility is the more plausible. After all, it was only a generation ago that psychologists were peddling their then latest panacea under the label "behaviorism."

—FRANCIS SCHRAG

UNIVERSITY OF WISCONSIN-MADISON  
MADISON, WISCONSIN

## GOOD STORIES

What a welcome treat to read "The Moral Power of Good Stories." You put into words what I have felt so strongly as I watch my eight children grow.

The "modern" trend *has* been to not pass judgment—just be glad your kids are reading. While I believe in giving my children freedom in choosing what they want to read, my husband and I have also tried to buy and choose from the library good books in addition to whatever they may choose. As a result, I have some very good readers who are also developing a taste for the good.

In public education today, we have tried so hard to weed religion  
(Continued on page 36)

# TEACHING FOR UNDERSTANDING

BY DAVID PERKINS

**I**N A small town near Boston, a teacher of mathematics asks his students to design the floor plan of a community center, including dance areas, a place for a band, and other elements. Why? Because the floor plan involves several geometric shapes and a prescribed floor area. The students must use what they have studied about area to make a suitable plan.

In a city not far away, a teacher asks students to identify a time in their lives when they had been treated unjustly and a time when they had treated someone else unjustly. Why? Because the students will soon start reading works of literature, including *To Kill a Mockingbird*, that deal with issues of justice and who determines it. Making connections with students' own lives is to be a theme throughout. In a classroom in the Midwest, a student, using his own drawings, explains to a small group of peers how a certain predatory beetle mimics ants in order to invade their nests and eat their eggs. Why? Each student has an individual teaching responsibility for the group. Learning to teach one another develops secure comprehension of their topics (Brown, et al., in press). In an elementary school in Arizona, students studying ancient Egypt produce a *National Enquirer*-style, four-page tabloid call *King Tut's Chronicle*. Headlines tease "Cleo in Trouble Once Again?" Why? The format motivates the students and leads them to synthesize and represent what they are learning (Fiske, 1991, pp. 157-8).

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*David Perkins is co-director of Harvard Project Zero, a research center for cognitive development, and senior research associate at the Harvard Graduate School of Education. His most recent book is Smart Schools: From Training Memories to Educating Minds (The Free Press, 1992). This article is based on the Elam Lecture he delivered at the 1993 Conference of The Educational Press Association of America.*

Quirky, perhaps, by the measure of traditional educational practice, such episodes are not common in American classrooms. Neither are they rare. The first two examples happen to reflect the work of teachers collaborating with my colleagues and me in studies of teaching for understanding. The second two are drawn from an increasingly rich and varied literature. Anyone alert to current trends in teaching practice will not be surprised. These cases illustrate a growing effort to engage students more deeply and thoughtfully in subject-matter learning. Connections are sought between students' lives and the subject matter, between principles and practice, between the past and the present. Students are asked to think through concepts and situations, rather than memorize and give back on the quiz.

These days it seems old-fashioned to speak of bringing an apple to the teacher. But each of these teachers deserves an apple. They are stepping well beyond what most school boards, principals, and parents normally require of teachers. They are teaching for understanding. They want more from their students than remembering the formula for the area of a trapezoid, or three key kinds of camouflage, or the date of King Tut's reign, or the author of *To Kill a Mockingbird*. They want students to understand what they are learning, not just to know about it.

Wouldn't it be nice to offer the same apple to all teachers in all schools? . . . an apple for education altogether. However, teaching for understanding is not such an easy enterprise in many educational settings. Nor is it always welcome. Teaching for understanding? . . . the phrase has a nice sensible ring to it: Nice . . . but is it necessary?

Yes. It is absolutely necessary to achieve the most basic goal of education: preparing students for further learning and more effective functioning in their lives. In the paragraphs and pages to come, I argue that teaching for

(Continued on page 28)



# A RUSSIAN TEACHER IN AMERICA

BY ANDREI TOOM

Recipes  
and  
Routine  
Provide  
Shaky  
Foundation  
for Real  
Learning



I AM A Russian mathematician and teacher. For nearly 20 years I did research and taught students at Moscow University. Now I have moved to the United States, as have many other Russians. This article is about some of my experiences of teaching both in Russia and America.

Americans' ideas about Russia are as contradictory as Russia itself. For many years Soviet Russia was perceived as "The Evil Empire." On the other hand, there was a *Sputnik* movement in America, which claimed that the Russian educational system was much better than the American one. Obviously, these images did not fit together. A lot of effort is needed to give the real picture. I am just going to make a few comments to explain my background.

Communist rule in Russia emerged from the collapse of the obsolete Tzarist autocracy, under which most people were deprived of education. Early Communists enthusiastically sang the "International," which claimed: "Who was nothing will become everything." Nobody ever knew what it meant exactly, but many were excited. Many Russian revolutionaries sincerely believed that it was their mission to redress all the social injustices immediately, but ignorance crippled all their efforts. A telling example is described in the novel *Chapayev* by the Russian writer Furmanov. The hero Chapayev, a Red Army commander, insists on giving an official certificate of competence in medicine to a poorly educated man, naively thinking that having such a certificate really makes one a doctor.

Communists made promises that looked very democratic, particularly that children of "proletarians" would be given unlimited educational opportunities. Children of manual workers and poor peasants really were given privileges to enter all kinds of schools, and professors who gave them bad grades might be accused of anti-revolu-

*Andrei Toom is assistant professor of mathematics at Incarnate Word College in San Antonio, Texas. This article is adapted, with permission, from "A Russian Teacher in America," which appeared in the Journal of Mathematical Behavior (No. 12, June 1993).*

ILLUSTRATED BY BRU ASSOCIATES

tionary activity. Only a generation later, Russia had thousands of hastily coached engineers and scientists of proletarian descent. One of these "proletarian scientists," an academician named Lysenko, gave fantastic agricultural promises that he never kept. However, Lysenko impressed Soviet rulers from Stalin to Khrushchev because they also were pseudo-educated. A major branch of biology, namely genetics, was declared a "bourgeois pseudo-science" because Lysenko was against it.

The ambitions of pseudo-educated "proletarian scientists," their haughtiness toward bourgeois science, their pretensions of superiority because of having had poor parents and being led by "the world's truest teaching" (that is, Marxism) caused a lot of industrial and ecological disasters. However, Communists never admitted the true causes of these disasters; all of them were attributed to some "enemies" sabotage. A number of alleged "enemies" were arrested and reportedly confessed. Masses of people, although declared "educated" by that time, believed these reports. But disasters continued, and to explain them away the authorities needed more and more "enemies." Meanwhile, Russia became the world leader in wasted resources and polluted environment: *Chernobyl* is just one (but not unique) example.

I was 11 when Stalin died. For many years all Soviet people, especially youngsters, had been indoctrinated that they should never doubt the Communist tenets. All media had been filled with verbose praises to Stalin who was called "the greatest genius of all times and all peoples."

However, much of Russian and foreign literature was available, including American authors. Foreign authors were published under the pretext that they "criticized bourgeois society." Mark Twain, Jack London, Ernest Seton, O. Henry, Edgar Allan Poe, Paul de Kruif, Ernest Hemingway, Ray Bradbury were among my favorite authors.

I vividly remember reading a book about a scientist who proved that insects have no reason; they only have instinct. What he actually proved was that the behavior of insects was effective only in situations usual for them. When the experimenter artificially arranged unusual situations, the insects did the same standard movements although they evidently could not be of any use in that new situation, because it was different from those to which the insects had become accommodated through evolution. I was impressed: I understood that propaganda tried to turn us into some kind of insects. I thought then and think now that it is a most important duty of a teacher of humans to teach them to be humans; that is, to behave reasonably in unusual situations. When I taught in Russia, I was thanked most explicitly for this. But I met a lot of resistance from some of my American undergraduate students especially when I tried to give them something unexpected. On tests, they wanted to do practically the same as what they had done before—only with different numerical data. This is why I decided to write this article.

I always believed that really good education is the most valuable contribution that intellectuals of a country can make toward its democratization. Remember that the great French Revolution was prepared by the Age of Enlightenment. It was evident that the worst features of Soviet rule were connected with the power of the pseu-

do-educated who got their certificates for being "proletarians," but cared only for their career. Understandably, Soviet authorities always were suspicious about independent thought and real intellectuals.

In return, good teaching, intended to develop real competence of students, always had a flavor of resistance to Soviet authorities, as it involved realism, openmindedness and critical thinking. When a good mathematics teacher tried to move his students to think independently, he was aware that his real influence went far beyond mathematics: He tried and succeeded to keep alive the critical spirit. Learning recipes without thinking was associated with the Communist tyranny; learning to solve nontrivial problems was associated with independence and criticism. For this reason, for example, George Pólya's writings on teaching were perceived in Russia as books on openmindedness and critical thinking rather than just on the teaching of mathematics. We knew that Pólya was not alone: He referred to other scientists, for example to Max Wertheimer's notion of "productive thinking."

In the years of Khrushchev's liberalism, some new foreign books also became available in Russia. Russian thinkers read very attentively all the foreign authors they could find. Many valuable ideas came from Americans: authoritarian personality (Theodor Adorno); group pressure (Solomon Asch); obedience to authority (Stanley Milgram). Eric Berne's *Games People Play* moved us to see which dirty games our rulers played with us. Thomas Kuhn's book about scientific revolutions was about ideological revolutions for us. Milton Rokeach's idea of open and closed minds opened our minds. John Holt's criticism of American schools made us understand that our schools deserved much harsher criticism.

**M**Y PARENTS belonged to artistic circles, and pressure of censure was a constant theme of conversations. If trimming a tree went too far, they would say with regret: "Look, how we have edited this tree!" Exact sciences provided the greatest available degree of independence from authorities, and my parents spoke with envy about mathematicians who could afford to say the exact truth and even be paid for it rather than punished. They could not guide my study of sciences, but they expected intellectual efforts of me, and it was important.

Later, my school teacher of mathematics, Alexander Shershevsky, helped me a lot. He strived to become a mathematician, but could not obtain a research position because in his student years he had gotten into some political trouble. (The trouble must have been minor, otherwise we would never have seen him again.) I was especially impressed by his responsible attitude to his mission. He urged me to attend informal classes in mathematics at Moscow University. The main business of these classes was solving nonstandard problems. Students were free to drop in and out; using this, I changed several groups until I found a teacher, Alexander Olevsky, whom I liked most. Every year students at Moscow University arranged a competition for high school students in solving problems. Every problem was new and unlike others and demanded a nontrivial idea and a rigorous proof to solve. There were five problems and five hours to solve them. Typically, everyone who solved at least one problem was rewarded. In this way I got several

prizes. This convinced me that I could succeed as a mathematician. When I moved from high school to the mathematics department of Moscow University, solving problems naturally led me to research.

From my first year in the university I took it for granted that a competent mathematician should participate in the teaching of mathematics because I had excellent examples to follow. The famous Kolmogorov organized a mathematical college affiliated with Moscow University, and I taught there. Academician Gelfand organized a School by Correspondence, and I instructed its teachers. In the computer club I headed the teaching program.<sup>1</sup> Aleksandrov, Arnold, Boltyansky, Dobrushin, Dynkin, Efimov, Kirillov, Postnikov, Sinai, Tzetlin, Uspensky, the Yaglom brothers, and other first-class mathematicians were willing to lecture and to communicate with students. A lot of new and original problems from all branches of mathematics and at various levels of difficulty were invented for all kinds of students from young children to graduate students and young professionals. Now, I was among those who invented problems. When I advised Ph.D. and other students, I gave them problems that interested me, and we solved them together.

The main pressure that students put upon teachers was to tell them something new. A vivid example was Leonid Vaserstein (then a student) who would declare in the middle of a talk: "All this is trivial." Taken out of situational context this may seem impolite, but actually this was quite *productive*. He pressed lecturers for more competence. Soon he had to emigrate. (Now he is a professor at Penn State University.) His fate is typical: Top officials of Moscow University, very poor scientists but bombastic Communists, used all pretexts (notably anti-Semitism) to get rid of competent young scientists to ensure their own positions. Now, they do the same without Communist paraphernalia; they recently elected a notorious hardliner, Sadovnichy, president of Moscow University.

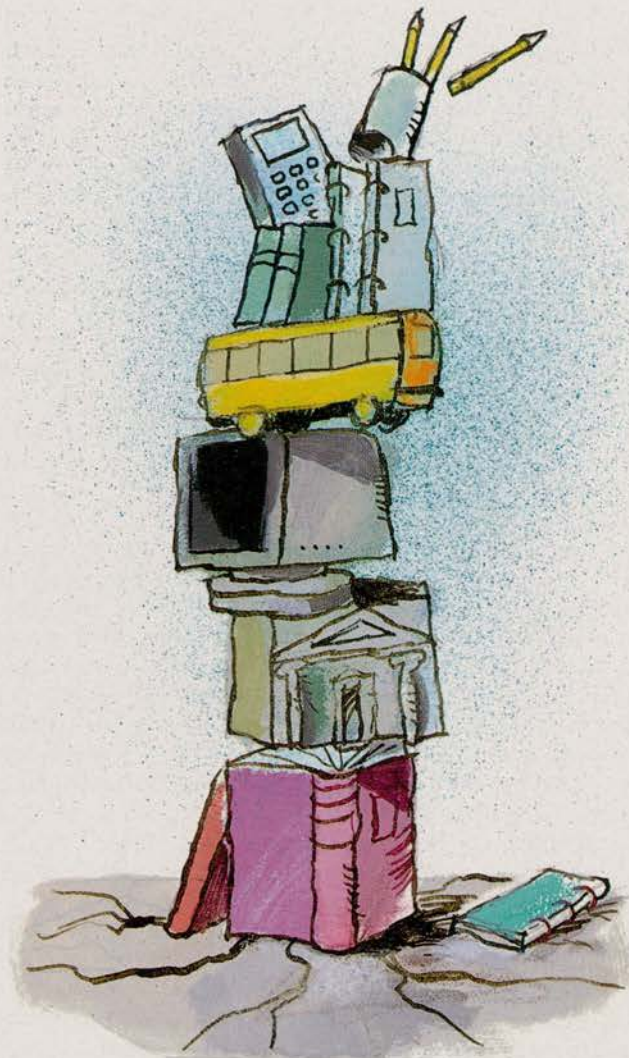
Whenever the purpose of learning was real competence, it had nothing to do with good standing with the authorities, who were feared and despised by intellectuals. Grades were just a nuisance, like any extraneous control. For example, when I taught in the college organized by Kolmogorov, I simply gave an A to every student because all of them deserved A according to average Russian standards, and I wanted to save them the trouble of dealing with the authorities. But they knew perfectly well that we expected much more of them than of the average student, and they worked very hard.

Every advanced school, where independent and creative thought was cultivated, became a breeding ground for political dissent. The mathematics department of Moscow University was no exception. From time to time there were political clashes there and I took part in them. This caused me problems with the Soviet authorities and eventually led to my emigration.

Most of my 60 publications are in mathematics, the others pertain to education and humanities. Not one article of the latter part was published as I wanted it, because of censorship restrictions. Most of them would never have

<sup>1</sup> Many thinkers were read with interest in our club. Reading Seymour Papert's *Mindstorms*, we thought: "If small children are taught to think with such care in America, they must develop into tremendously competent university students."

***Learning recipes without thinking was associated with the Communist tyranny; learning to solve nontrivial problems was associated with independence and criticism.***



been published without the willingness of a particular editor to take a certain, well-calculated risk. Whenever I brought an article to the newspaper *Izvestia*, my cautiously courageous editor, Irina Ovchinnikova, exclaimed: "Oh, Andrei, do you really think that this is publishable?" And she had to cross out the most critical statements to save the others.

My research in mathematics could not improve my position in the university because Communist bureaucrats always (and correctly) understood that I would never *solidarize* with them. The adviser of my Ph.D., Ilya Piatetski-Shapiro, emigrated to Israel, and thereby became *persona non grata* for the Soviet establishment: Even referring to his papers was not easy. My papers were known abroad, but were not recognized as anything valu-

able by my supervisor, because I gave him too few chances to appropriate my work. I received several invitations from foreign universities, but the authorities never allowed me to go abroad. Only by chance, I got to Italy in 1989 and decided to accept all the invitations I had, without going back and subjecting myself to the same arbitrariness. From Rome I went to Rutgers University, then to other American universities. Finally I got a regular position at Incarnate Word College, where I am now, but it would be premature to write about my experiences here.

IT IS a common opinion that the United States of America supports democracy. Democracy always was connected in my mind with good education for all people, and I knew that American thinkers also believed in this connection. Thus, when I came to this country, I expected to have rich opportunities to teach students to think critically, independently, and creatively and to solve non-standard problems without hindrance from authorities.

My first experience in teaching in this country did not contradict this expectation. It was proposed that I give a course called "Analysis of Algorithms" to graduate students of the computer science department of Boston University (BU). The textbook *Introduction to Algorithms* by Cormen, Leiserson, and Rivest was excellent. The department applied to me a wise rule—to give full freedom to the lecturer—and I used it to the benefit of my students as I understood it. In one semester I covered most of that rich book. I believe that the mathematical introduction was especially useful: I filled many gaps in my students' former education. My 19 students came from all over the globe, and most of them collaborated with each other in an excellent way. After every lecture they came to one room, discussed the problems that I gave them, and solved them together. Some problems I gave them were from the book, some were invented by me. I tried to miss no opportunity to make my students think, and they accepted it. Also there was no problem with grades. The department gave me *carte blanche* and I used it benevolently: Almost all of my students learned a great deal, and I rewarded them with good grades.

But in the next year, when I came to a huge state university and started to teach the so-called business calculus<sup>2</sup> to undergraduates, I got into an absolutely new situation. All my ideas about teaching students to think became completely out of place. Never before had I seen so many young people in one place who were so reluctant to meet challenges and to solve original problems. All they wanted were high grades, and they wanted to get them with a conveyor belt regularity. Suppose that a worker at a conveyor belt gets inspired by some interesting idea and tries to implement it into his work. You can guess that he will get into trouble. This is what happened to me when I started to teach American undergraduates.

In my student years, I hated teachers who simply repeated textbooks: It seemed to me that they wasted my time. Naturally, as a teacher, I avoided that practice. This worked well until the last year when I started to teach business calculus. Then I found quite a different attitude among my students: Many of them would be

most satisfied if the teacher simply repeated and explained what was written in the textbook. It seems that some of them have problems in reading by themselves what is written there, although most textbooks are quite elementary (but verbose). At first I failed to understand this, and one student wrote about me: "He should teach from the text and give exams based on the text or similar problems."

The voluminous book I had to use in teaching the business-calculus course may impress nonprofessionals, for example parents of students. Its chapters are named after really important mathematical theories. But everything nontrivial is carefully eliminated. In fact, every chapter contains a recipe, as in a cookbook, and problems do not go beyond straightforward applications of the recipe. The book carefully avoids connecting the material of different chapters, presenting the subject from different sides, giving problems in which a student should choose which method to apply. And this book was chosen among others, some of which were quite usable. Why? I see one explanation: Because this book perfectly fits the *max-min* principle of the market: maximal pretensions with minimal content. All the other textbooks are not so perfect in this respect.

I was astonished by the fact that I could find absolutely no nonstandard problems in the textbook. But I said to myself: This is a good case for me to show what I can do! *I can* invent nonstandard problems! and so *I did!* And my first test was a total failure. It turned out to be so difficult for the students that most of them got very low grades. I had to learn that every technical calculation, which I was used to ignoring, was a considerable obstacle for my students. It took a considerable amount of time for me to understand how poor they were in basic algebraic calculations. Every time I prepared another test, I tried to make it as easy as possible, and still several times I failed: The tests turned out to be too difficult. As time went on, I came to the following rule: As long as a problem was interesting for me, it was too difficult for the students; only when a problem became trivial, might it be given in the test.

It was good luck for me that one of the students auditing my precalculus course, Robert Tufts, was a retired engineer who had lived much in Europe and Japan and had an extensive experience of learning and teaching. For him my style of teaching was not unusual; in fact, he liked it and told other students about it. Thus, they chose the label, "European teacher," for me, and this softened their shock. Still, another student wrote:

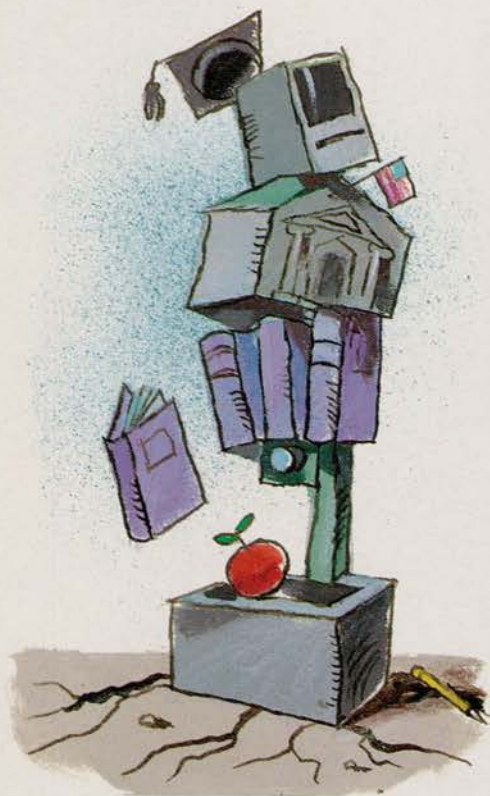
Please inform Mr. Toom about the grading system and instruction methods of THIS country. Mr. Toom assumes that his students were taught as he was. I earned a grade of A in my college algebra and trigonometry courses so it makes no sense for me to be doing so poorly in this course. Please straighten this man out.

In the next semester I straightened myself out: At every lecture I took the textbook into my hand and explained some examples from it. And nobody complained.

As I had often done before, I gave out to students lists of additional problems arranged by me, and as before, these problems were useful as they moved many students to think. But I had not got used to caring about grades, and this time grades—not math problems—were

<sup>2</sup> Full title: *Calculus II for Business and Economics*.

**Suppose you fly in a plane. What is more important for you: the pilot's real competence or his papers that certify he is competent?**



the center of attention. My carelessness created a lot of trouble for myself and for the department. Those students who solved my problems wanted extra credit, while those who did not solve them wanted full credit also. Several times I was called to the official in charge to clarify my grading system. In the next semester I decided not to give any extra-credit problems, and no trouble arose. The less I teach, the less trouble I have. In Russia we used to joke: No initiative will remain unpunished. Now I saw this rule working in American education.

I had to learn by trial and error how much of elementary mathematics was taboo in the business-calculus course. It took a while before I realized that I was lecturing about exponential functions to students who were not required to know about geometrical progressions. Also I confused my business-calculus students by

trying to explain errors in the textbook. Many of them would prefer to accept every word of it without criticism.

Another mistake made by me was to include a trigonometrical function in a test problem. I could not imagine that students who take "calculus" were not supposed to know trigonometry, but it was the case. Of course, I was called to the official in charge and rebuked. Thus, I could discuss the equation  $y'' - y = 0$ , but not  $y'' + y = 0$ . In addition, I received a telephone call from someone who had graduated from the school of law; referring to a decision made by the authorities, he accused me of wasting taxpayers' money by teaching students what they did not need to know (trigonometry). After several lapses of this sort, the department decided not to invite me for the next year, although they knew that I was a competent scholar, that I was interested in teaching, and that I needed a position. All they wanted was not to have problems with the students.

I noticed that research mathematicians treat the business-calculus courses like Russians treated Communist meetings: Nobody dares to criticize openly, but everybody tries to sneak away. That is why foreign lecturers such as myself are needed to do this dirty job. But foreigners adjust to the system pretty soon, so that American students have almost no chances of becoming aware of their ignorance. For me, a few months were sufficient: The pressure from those students who wanted good grades with minimal learning, which was supported by university officials, made me care more about my safety from complaints and less about the real competence of my students.

One foreigner, experienced in teaching Americans, advised me in a friendly manner: "Listen, don't ask for trouble. Education in this country is not our concern. Nobody will care if you fall short of the syllabus, but never go beyond."<sup>3</sup> And he went home with dollars earned honestly; that is, by doing to Americans just what they—both students and officials—wanted him to do. Of course, he teaches in a much more productive way in his own country.

**SUPPOSE YOU** fly in a plane. What is more important for you: the pilot's real competence or his papers that certify he is competent? Or suppose you get sick and need medical treatment. What is more important for you: your doctor's real competence or his diploma? Of course, in every case the real competence is more important. But last year I met a large group of people whose priorities were exactly the opposite: my students. Not all, but many. Their first priority was to get papers that certify that they are competent rather than to develop real competence. As soon as I started to explain to them something that was a little bit beyond the standard courses, they asked suspiciously: "Will this be on the test?" If I said, "no," they did not listen any more and showed clearly that I was doing something inappropriate.

I had to learn also that American students want to be told exactly from the very beginning of the course what  
*(Continued on page 20)*

<sup>3</sup> Remember that throughout my business-calculus course, I never went beyond into something more advanced; I simply tried to cover up gaps in my students' basic knowledge. And exactly this caused all the trouble.

# BITING THE HEALTH CARE BULLET

BY ALBERT SHANKER

WHEN I was president of the United Federation of Teachers in New York City, the cost of health care always played a big part in our contract negotiations. An excellent program we had in the 1960s became poorer with each contract because of increases in health care costs. Also, because of these increases, the amount of money available to improve pay and working conditions decreased year by year. My experience in New York City is the experience of school systems all across the country. Teachers and other educators have a vital concern about the increased costs of health care because the more we spend on health care, the less is available for education.

Now that changes are proposed, union members, like others, are worried about whether the new health care plan will be better or worse than the one they have. Those of us who have very good plans would like to hold on to them. But we must realize that rapidly rising costs mean we won't be able to—unless there is a radical change in the system. Health care now takes up 14 percent of the country's gross domestic product (GDP), and the cost is increasing at a rate that is much greater than inflation. Also, given the rapid and unexpected rise of unemployment in some sectors, many people who are used to having a good employer-paid plan may suddenly find that they have to pay their own way for a less desirable plan—if they can get any coverage at all.

Our situation with respect to health care costs reminds me of a story about a mythical but nonetheless very instructive experiment with a frog. We know that frogs move very quickly. If a frog jumped into a pot of boiling water, it would jump right

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ILLUSTRATED BY ROBERT BARKIN



out. It might get some blisters, but they would heal and the frog would be fine. But if you put the frog in a pot of cool water and lit the flame under it, the frog would slowly get adjusted. It would think, "Gee, the water's getting warm," but it would not realize what was happening until, eventually, the water would boil—and you'd have frog soup.

That's what is happening to health care costs. They've gone from 6 percent of our GDP in 1963 to a projected 14 percent in 1993. Somewhere around the turn of the century, the annual bill will rise to 20 percent of our GDP. In other words, 20 percent of all the goods and services we produce in the U.S. will be used to pay for health care. And there is no reason to think that costs will stop increasing.

If health care had risen from 6 to 14 percent of our GDP in one year, you could be sure that we'd be out there saying, "Do something about this!" "It's absolutely untenable—an outrage!" But we haven't noticed that the water has been slowly moving up to the boiling point. Many people are concerned with the costs of the national health program President Clinton has proposed, but they ought to be more concerned with the costs of our current system. President Clinton's plan is designed to control these runaway costs, but with the current system, we're going to end up paying in many ways. We'll have to raise taxes and cut programs to pay for increases in Medicare and Medicaid. Union members will get poorer contracts. We'll be unable to compete in selling our products, which will be more expensive because of higher health care costs—and that means a loss of jobs. We are paying 35 to 40 percent more for health care than other industrialized countries. That might be all right if we were healthier and living longer, but we're just paying more.

The president has shown great

courage and leadership in taking on an issue that most people think is impossible to deal with because he knows it is absolutely central to solving many of our other problems. His presidential campaign and his activities and those of the first lady since he became president have helped to establish a consensus that the problem must be solved and a set of basic principles to guide the reform. There are many loose ends and all sorts of legitimate concerns on the part of doctors, health care workers, senior citizens and others. But President

Clinton says he wants to listen. And when all is said and done, the need to have a national system is overriding.

You often hear, "If it ain't broke, don't fix it." Well, our health care system *is* broken, and we have to do something about it. President Clinton has initiated a national discussion to create a system that will give Americans health security without bankrupting us. He needs everyone's help in doing this. He also deserves our respect and gratitude for biting the bullet on a change that is absolutely essential. □

## OR PAYING THE PRICE ON THE PICKET LINE

While President Clinton was preparing to formally announce his national health care reform proposal, the 450 members of the Butte Teachers Union in Butte, Montana, were ending an eight-day strike. The issue that had driven them to the picket line is the same one that affects school districts across the country: escalating health care costs that leave little or no money for wage increases or anything else.

"It's gotten to the point," says Jim Rosa, an English teacher at Butte High School and negotiating chairman for the last 17 years, "where I feel almost like I'm negotiating on behalf of the insurance company. They announce their increase—it was 11 percent this year—and our committee goes to the school board to try to get the money. We've done our job well; the district has absorbed most of the increases, but the money hasn't gone to us; it's gone to the insurance companies. They get theirs first. We have no choice, because this is a benefit we need and must keep; it's not a luxury. But then what's left for salaries?"

"Last year, we had no salary increase at all; whatever money was available went toward higher insurance costs. It was the same thing the year before. For the two-thirds of our staff who are at the top of the salary schedule, that has meant a wage freeze. Actually, it has meant a wage *decrease*, because inflation keeps eating away at the edges. We couldn't go a third year with a wage freeze, so we did have a strike this year—and we were able to improve the board's offer. But next year, we'll probably be facing the same problem all over again.

"It's not as though we haven't tried to reduce costs," Rosa adds. "We've accepted a deductible and a co-payment, and we've introduced cost-containment measures such as managed care. But there's only so far you can go. You start adding up the co-payments and the front-end deductibles and the loss in wages, and pretty soon you have to ask whether you have a benefit at all. This problem," he concludes, "is bigger than we can solve at this bargaining table or any bargaining table."

—E.M.

# PROFILE IN COURAGE

*In 1981, the AFL-CIO inaugurated the George Meany Human Rights Award, named in honor of its late president. Meany, who died in 1979, had dedicated his career of more than four decades to the pursuit of worker rights and individual freedom, both here and abroad. Each year, the AFL-CIO bestows this award on those individuals and organizations that carry out Meany's work in the world. Its recipients have included Soviet dissident and scientist Andre Sakharov, Filipino trade union leader and democracy activist Ernesto Herrera, Zambian trade union leader Frederick Chiluba, who led his nation's movement for free elections and is now the president of the country, and Poland's Solidarnosc trade union movement, the first free labor organization in a nation of the former Soviet bloc.*

*The following is a portrait of this year's winner, Han Dongfang, by Charles D. Gray, director of the AFL-CIO's International Affairs Department.*

HAN DONGFANG, now only 30 years old, has seen more of life, and faced it with more courage, than almost any other living human.

A railway mechanic, Han first entered the world stage in the spring of 1989, the season of hope for China. As students and other democracy activists swelled the spaces around Beijing's Tiananmen Square, Han began organizing the first democratic labor organization in the People's Republic of China. Under the banner of the Beijing Workers Autonomous Federation, factory workers joined students in the square, proclaiming that in the "workers' state," workers should have a voice in their own destiny. Word spread, and similar organizations began to form around the nation. Han Dongfang was their acknowledged leader.

More than most, China's dictators must have understood the significance of these events. They had followed the events of Eastern Europe closely, and were leery of the fate of Eastern Europe's dictatorships following the advent of the free union, Solidarnosc. Some China watchers have speculated that the growing possibility of free unions in China was a major factor in the decision to use force in suppressing the democracy movement. But whatever the case, Han survived the Tiananmen Square massacre in June 1989, only to find that he was one of China's most wanted dissidents.

Rather than hide or flee, Han Dongfang walked to the central police station and presented himself. Since Chinese law grants workers the right to join unions and to speak freely, Han declared that he had committed no crime, and he was never convicted of one.

Nevertheless, Han languished in prison for the next 22 months, where he was subjected to daily brutality, torture, and abuse. Perhaps the most bizarre form of mistreatment was also the most life threatening. As a pun-

ishment, Han was deliberately confined in an infectious tuberculosis ward. As intended, he caught the disease. Denied proper medical care, he soon hovered near death.

On the outside, the AFL-CIO and other trade union and human rights groups launched an intensive international campaign on Han's behalf. Rather than suffer the bad press of having another Tiananmen hero die in prison, in April 1991, the authorities let Han go and allowed him to receive treatment. But in the summer of 1992, Han was still gravely ill. After two serious relapses, it was discovered that the medication the authorities were giving him had expired, and so, was meant to be ineffective.

In late 1991, at the behest of the American labor movement, Secretary of State James Baker included Han Dongfang on the list of individuals, presented to the Chinese authorities, for whom the U.S. government wished to intervene. The regime assured Baker that it would allow Han to leave China for medical treatment in the United States.

This promise went unfulfilled for nearly a year, during which Han was subject to continuous harassment, including official proceedings to have his family evicted from their work-unit apartment on grounds that Han had not worked at the railway yard for more than three years. That he had not worked because the authorities had kept him in prison and had tried to kill him with TB was not considered an adequate defense.

Despite everything, Han refused to give up.

His public opposition to a new law, which effectively banned free trade unions, provoked the Chinese government to bring additional frivolous charges against him in an administrative court. While standing outside the court, he was roughed up by police, and subsequently charged with assaulting the police officers who attacked him. One month after his beating, Han sought permission to ride a bicycle around Tiananmen Square on the anniversary of the massacre. The request was denied. When Han questioned the denial, on the grounds that all Chinese citizens had the right to free expression, he was told he could express himself freely as long as he could guarantee that no one would listen to him. That June 4, Han and three others were placed under house arrest to make sure that no one could.

After several additional appeals by the U.S. government, in September 1992, Han and his pregnant wife were given visas and passports to travel to the United States. Han vowed he would not abandon the cause of freedom for Chinese workers and would return to his homeland as soon as his TB had been brought under control.

Doctors found that, with indifferent treatment, Han had developed a treatment-resistant form of the disease. In April 1993, after intensive drug therapy had proved useless, part of an infected lung was surgically removed.

When strength permitted, Han used his free time in the West to continue his advocacy for the workers of China. He accepted speaking invitations from union and human rights groups, attended the U.N. Conference on Human Rights and the International Labor Conference, accepted awards, and met with the media and labor and political leaders, including President Clinton and AFL-CIO President Lane Kirkland—all to gain support for the idea that the economic liberalization for which China is now being praised ought to include some freedom for working men and women.

**O**N AUGUST 13, 1993, when Han Dongfang stepped into China at a border post in the southern province of Guangdong, he was honoring a pledge to his fellow labor activists that he would not abandon them.

Within 24 hours, Beijing reacted. Early the next morning, security police burst into Han's hotel room. They seized his money, handcuffed him, forcibly transported him to the Hong Kong border, then pushed and punched him across to the other side. He was left on the road, stunned and bruised.

There had been no charges, no arrest warrant, no judicial proceedings—just the exercise of raw power. Han was a stateless citizen, expelled by his own country.

Han had understood the risks of return—arrest, prosecution, perhaps death—and was prepared for them. But, somehow, he had not really expected this.

After all, he had gone out of his way to do everything legally. From the beginning, he made known his intention to return home. His valid visa and passport should have made this possible. While in the West, he told the truth—to President Clinton and anyone else who asked—but always emphasized that those advocating democracy and free labor unions in China were not seeking political power or to overthrow the state. They were seeking only a means for workers to protect their own interests. The regime, which had always lectured the people on the dangers of capitalism, should understand this necessity in China's new socialist market economy. Working within the law, he and others would try to popularize worker knowledge of the international labor standards that China itself had ratified and of the labor rights that China had inscribed in its constitution.

Han appealed, going to the Hong Kong office of the Xinhua News Agency (whose officials represent China in the British colony) to seek an explanation. He got none, not even the name of which governmental department was responsible for the cancellation of his visa or the law upon which the decision to expel him was based.

On August 21, Beijing responded again. They declared Han's passport invalid.

The international reaction was swift. Within days of the August 14 expulsion, the U.S. State Department and the government of Great Britain both had issued state-

AP/WIDE WORLD PHOTOS



## AN INJURY TO ONE . . .

**I**N DRAMATIC demonstration of the labor tenet, "an injury to one is an injury to all," unions around the globe have been rallying to Han Dongfang's defense.

Pressure from American trade union members has been vital to Han's survival, helping to obtain his 1991 release from prison and his 1992 permission to obtain medical treatment in the United States. Without this support, it is likely that Han would already have become another faceless victim of China's gulags.

After Han's August expulsion from China, AFL-CIO President Lane Kirkland sent a letter to Chinese Premier Li Peng condemning his government's actions. Kirkland stated: "Since your government claims to support both human rights and the dignity of workers, [Han's] advocacy of these causes could not possibly be against the 'national interest.' And contrary to your government's assertion that he acted 'against the Chinese constitution,' Mr. Han never wavered in his support of this document . . . we are forced to conclude that it is your government's actions, not Mr. Han's, which are in violation of both Chinese and international law."

In a companion letter to Secre-

tary of State Warren Christopher, the AFL-CIO set out specific measures for the U.S. government to take in response to Han's case: intervene with Beijing to help restore Han's full rights of citizenship; make clear to the PRC that such human rights infringements will result in the revocation of China's most favored nation trading privileges; and oppose the selection of Beijing as the site for the 2000 Summer Olympic Games. The Clinton administration has complied with the first two requests and has stated publicly that all U.S.-obtained information on China's human rights abuses has been given to the Olympic Committee, for use in its deliberations on a site selection.

In addition, the international labor community has rallied to Han's cause. The International Confederation of Free Trade Unions (ICFTU), representing 113 million workers worldwide, and which includes the AFL-CIO, has asked that the U.N.'s International Labor Organization intervene in the case, lodged a protest with Beijing, and called on all affiliates and International Trade Secretariats (ITSS) to join the solidarity campaign. Among the ITSS actively campaigning for Han are the International

Textile, Garment & Leather Workers' Federation; the International Federation of Chemical, Energy and General Workers' Unions; and the Public Services International (which hosted Han at its World Congress in Finland less than two weeks before his expulsion).

Poland's Solidarnosc and the Federation of Trade Unions of Burma (FTUB), two national labor movements with much in common with the Chinese free trade union movement, have been particularly moved by Han's plight. Like the Beijing Workers Autonomous Federation, both had been declared illegal by dictatorial governments and were forced to operate underground. While Polish workers have now acquired the right to speak on their own behalf (see box on the next page), the FTUB is still banned by Burma's brutal military junta. Its leaders wrote to Han, "As a trade union that has been declared illegal by the present regime of Burma, we cannot help you very much. But what we can say from our hearts is that all the members of the FTUB fully support you and stand with you on your rightful insistence to return to China. . . ."

The Hong Kong Confederation of Trade Unions is assisting Han while he is in the colony and is diligently keeping the international labor community apprised of breaking developments.

ments deploring the banishment as a violation of the Universal Declaration of Human Rights. The United States also warned that, unless Han's case had been satisfactorily resolved, it would be a factor the next year, when the Clinton administration reviewed China's progress on human rights and decided whether to extend Most Favored Nation (MFN) trade privileges to the country.

In an ironic case of fortunate timing, Han's expulsion had occurred during the U.S. Congress' traditional August recess. Waiting in Hong Kong for China's response to his appeals for re-entry, Han met with members of Congress traveling through Asia, including Sen. Max Baucus (D-Mont.), a member of the Senate Select Committee on Intelligence; Rep. Nancy Pelosi (D-Calif.), a leading proponent of the linkage between human rights and trade in U.S. relations with China; Rep. Gary Ackerman (D-N.Y.), chairman of the House Asia and Pacific Affairs Subcommittee; and Rep. Sam Gibbons (D-Fla.), chairman of the House Ways and Means Trade Subcommittee. All rallied to Han's cause.

In Hong Kong, the people feared to see Han in their own mirrors; they saw in Han's fate their own predica-

ment. With concern running high over the colony's future under Chinese rule scheduled to begin in 1997, Han became the symbol of a dismal future. Television newscasts made Han a lead story, and newspapers carried daily accounts of his travails. Protest signs declared: "Han Dongfang Today, the People of Hong Kong Tomorrow."

While support from Hong Kong's democracy movement was expected, even the usually timid Hong Kong government called Beijing's actions into question. Acting Governor David Ford bluntly told the press, "Part of the confidence of the Hong Kong people in choosing their future is that they will be able to leave Hong Kong and come back. The foundation of government here is the rule of law. Our future will only be protected by the continuation of the protection of the law and the freedom of individual action." A few days later, Governor Chris Patten echoed Ford's words.

As pressure on the Chinese government mounted, the Beijing-controlled press in Hong Kong began to offer rationalizations. It labeled Han a subversive for having participated in open and free forums in the West where

the subject of international labor and human rights standards were discussed. It claimed Han had harmed China's national interests by raising these issues in meetings with foreign leaders and that Han had violated a promise "not to undertake any activities against the Chinese constitution or that will damage the national interest."

Belatedly realizing the power of a single man of principle to endanger their economic interests, and fearing for their bid to become the site of the 2000 Summer Olympic Games, China's rulers moderated their stance. Within a month of the expulsion, they declared that if Han "repented," the regime might allow him to return at some time in the future. But first, he must promise not to continue to advocate the formation of free unions. [On September 23, Sydney, Australia was chosen over Beijing to be the host city for the 2000 Summer Olympics. Some international affairs experts believe this to be a direct response to China's poor record on human rights.]

As we go to press, Han Dongfang remains a stateless person, stranded in Hong Kong. He is pursuing every legal recourse available that might enable him to return to Beijing and continue work on behalf of a free Chinese labor movement. Han has even challenged the Chinese government to pursue their "charges" against him. If they have evidence of any wrongdoing on his part, Han asks that they let him stand trial for it in his own country. For a man who almost died in China's jails, it is a dangerous challenge. But for a man who faced death on behalf of his principles, it was not unexpected.

It is still uncertain whether Han will be able to travel to San Francisco in October to receive the George Meany Human Rights Award at the AFL-CIO's biennial convention. If Han is unable to make it, George Meany would have understood: In the struggle for worker rights, the trappings of honor are less important than a life lived in determination and courage. □

## SOLIDARNOSC!

**I**N 1981, the first George Meany Human Rights Award was given to Poland's Solidarnosc trade union. At the time, Solidarnosc had recently won legal recognition as the first truly independent labor organization in a communist country. But before its president, Lech Walesa, could travel to the United States to attend the AFL-CIO's 1981 Convention to receive the award, Poland's dictatorship had declared martial law, banning the union and forcing its leaders underground.

The AFL-CIO quickly marshaled its resources to help—raising funds from American workers, providing moral and material support, and keeping the plight of Polish workers at the forefront of American diplomatic action.

In 1989, with the Soviet empire beginning to crumble, a victorious Lech Walesa arrived in Washington, D.C., to receive the award.

"I am honored," he declared, "at long last, to accept on behalf of my trade union the George Meany Human Rights Award, which I had planned to pick up exactly eight years ago. . . ."

"Now the time has come to thank you, to thank you for your solidarity with 'Solidarity,' with the cause so many people considered lost and which now, thanks to the stubbornness of the Poles and the perseverance of our friends, has put us on the road to victory.

"One easily finds friends when one is successful. But when you are in trouble, there is suddenly hardly anybody to be seen. At least you can know for sure that the ones that stayed with you are the ones that you can really rely on. . . ."

"Many considered Solidarnosc a

lost cause. . . . We were presented as Don Quixotes pursuing unrealistic goals. . . . It was stated straightforwardly that our activities might threaten international stability, thus posing a threat to peace. . . . We couldn't agree to such a way of thinking. The reason is not that we lack realism. We have decided to pursue the goal of peace in a different way, because it was precisely our realism which was telling us that building peace on the foundation of injustice and lack of freedom is impossible. . . ."

"It is realism that made us claim that it is impossible to reform the country when people's mouths are gagged and their hands tied. . . . This is the lesson we have learned from our Polish experience. This formula applies to all totalitarian and dictatorial systems, regardless of the ideology they profess or the catchphrases they hide behind. Peace has to be the work of free people who speak for themselves with their own voices. . . ."

Given this background, it is no surprise that Poland's Solidarnosc trade union has joined the AFL-CIO in offering support to Han Dongfang, the winner of the 1993 George Meany Human Rights Award, a man whom the press calls "China's Lech Walesa." Solidarnosc is now legal, Poland is now a democracy, and Lech Walesa is its president. But remembering the years in the underground, when the support of foreign labor movements helped to keep hope alive, Solidarnosc denounced Han's treatment and the suppression of the Workers Autonomous Federation. It has declared that Han's expulsion is "another glaring example of human rights violations by the Chinese authorities," and noted that the freedom of association and freedom of speech—denied to Han—"constitute the foundations of real democracy."



AP/WIDE WORLD PHOTOS

## A RUSSIAN TEACHER IN AMERICA

(Continued from page 13)

percentages of the total score comes from homework, from tests, and from quizzes. First I thought that it was some nonsense, as if I were requested to predict how many commas and colons I would use in a paper I was going to write. But later I understood that these percentages make sense for those students who do not care about the subject and take a course just to get a grade with minimal learning.

Of course, students are different. Many really want to learn, because curiosity is inherent in human nature. But selfless curiosity is illegal (at least in the business-calculus course) in the sense that it is neither expected nor supported officially. On the contrary, officials cater to those who want to learn as little as possible, and percentages are a telling example of this.

It seems that some parents urge their offspring to get high grades by any means, but fail to add that they care about actual competence, too. I understand that some students are the first in their families to get a higher education. Their parents did monotonous work all their lives, tried to make more money for less work and were right, of course. Now, their offspring do monotonous exercises at universities, try to make more grades for less work, and nobody in the family sees anything wrong with it. Indeed, parents may perceive this as a great achievement when their offspring graduates, and they may think that they now have an "intellectual" in the family, while this is simply someone who bought a discounted degree at a university sale! Discounted not in the sense of money, but in the sense of intellectual effort and development.

The grade looks like the ultimate value, and neither students, nor parents, nor university officials see anything wrong with this. In fact, all officials completely support the top priority of official records. It seems to be generally taken for granted that students normally learn as little as possible for a certain grade. Only by a misunderstanding may they learn more, and when this happens due to undetailed syllabus, they blame the teacher like people who blame an official whose neglect caused them a loss.

It is the basic principle of the market that everybody tries to get as much as possible and to pay as little as possible. There is nothing wrong with this: When I buy something, I try to save money, and everybody does the same. What is wrong is that some students apply the same rule to learning: They seem to think that they *buy* grades and *pay* for them by learning. And they try to *pay* as little as possible! In other words, some students seem to think that it is a loss whenever they learn something. This looks crazy when put in such straightforward terms, but there are students who behave as if they think this way. (I do not know what they really think.) And there are officials who take this behavior as normal and arrange the learning environment according to it.

The attitude "learn as little as possible" is not totally wrong, however, because a good deal of the stuff students are taught indeed deserves minimization (business calculus, for example). A good deal, but not all—there are excellent books and teachers—but many students are not sophisticated enough to discriminate.

***I have examined the American Constitution and found no statement that guarantees the right of ignorance for students.***



After every test, I explained correct solutions: Many a student said: "Now I understand." I was glad: the purpose of my teaching was achieved. But some said it with regret, which meant: "This understanding is useless because it came too late to provide me a good grade." To me, tests were just a means to promote understanding; to them understanding was just a means to get a good grade. To some students it made no sense to understand anything after the test.

Some students are so busy and anxious counting points on tests and predicting grades that they have no "mental room" left to think about mathematics. It seems even irrelevant both for them and for the university whether they have learned anything at all: What matters for both sides is that the students overcame another barrier on their obstacle-race toward graduation (and wast-

ed some more months of their young and productive years).

At one lecture I wrote a theorem on the blackboard and said to the students: "Look what a beautiful theorem it is!" Some laughed. I asked what was the matter. Then one explained: "Professor, it is nonsense, a theorem cannot be beautiful!" And I understood that these poor devils, who had always learned under the lash of grades, never from natural curiosity, really could not imagine that an abstraction might be beautiful.

Any creative activity (including learning) needs at least temporal independence from external rewards and pressures. Peaks of creativity (which are essential in learning and solving nontrivial problems) need so much concentration on the subject that any sticks and carrots can only disturb them. Only when the intimate work of creative faculties is over and has produced a finished result, may one think how to sell this result most profitably. Pushkin, a Russian poet said: "Inspiration is not for sale, but a manuscript may be sold." The same applies to learning: Those who lack intrinsic motivation and are guided only by external rewards, learn poorly. They are never carried away by the subject's charm for its own sake, as they believe that they must be "practical"; that is, never forget their points and grades. As a result they never use the powerful potential of creativity given to them by nature. Everybody's natural abilities are rich, but their use depends on individual priorities.

It seems that some students just cannot imagine that learning might be of intrinsic value, besides official graduation. And they might go through many years of schooling, communicate with teachers and officials, graduate from an elementary school, middle school, high school, and a university, and never have a chance to question this! Unless they meet some irritating foreigner!

Foreigners, however, soon understand that to survive in this country they have to adjust to the system rather than to criticize it. At various levels and in various ways, newcomers are shown clearly that this country wants intellectuals, but not those who are too independent. This may be one reason why so many immigrants who were excellent mathematics teachers in Russia have done much less than their best to reform American education.

In my case, pretty soon the pressure from students made me deviate from my principle to do my best: I was forced to care about my safety from students' complaints at the expense of their own best interests. Although my personal experience is limited. I think that this situation is typical. In another state, students complained about their mathematics teacher, another newcomer from Russia: "We pay as much as others, but have to know more than they for the same grade." Still in another state, another newcomer from Russia found an effective way to calm his students; when they asked how he would give them grades, he answered that he would do it "on the curve." I asked him what he meant, and he answered that he did not know: What mattered for him was that the students got relaxed and became willing to listen to lectures and solve problems.

Well, I can imagine a situation in which learning for a grade makes sense. If students are ultimately disappointed with the teacher, if they have given up any hope of learning anything valuable from him, if they not only disrespect, but actually despise him—then, and only

then, it makes sense to learn for a grade—to get at least this if there is nothing better to get. In the final analysis, learning for a grade is the deepest offense to the teacher, because it implies the thought: "I know in advance that nothing valuable will come from real contact with the teacher; so let me at least get a grade." But, according to my experience, students who learn for grades do it in all courses. They seem not to be aware that they offend teachers; they simply take this mode of behavior for granted. (And most American teachers and officials also take it for granted.)

At one of my lectures on business calculus, when asked why I gave problems unlike those in the book, I answered: "Because I want you to know elementary mathematics." I expected to convince students by this answer. In Moscow, a university student who was told that he or she did not know elementary mathematics, got confused and checked into the matter immediately. Elementary mathematics was normally taught to children who looked like children. Now imagine my astonishment when right after my answer, an imposing train of well-grown adults stood up and tramped out. They decided (correctly) that they could graduate from the university without knowing elementary mathematics. And they knew that they would easily find a lecturer who would teach them from the text.

And the one who had to change was me. In the next semester, I never scared students away by checking into basics. I understood perfectly that teaching an advanced subject like calculus without filling gaps in basics was like building on sand. But I could not afford to care about my students because I had to care about my safety from their complaints.

I have examined the American Constitution and found no statement that guarantees the right of ignorance for students. Nevertheless, some students behave as if such a statement existed. And some officials behave as if they had no other choice than to comply with them. Why? One official explained to me that some students had sued universities for better grades and won. (I have never heard of a student who sued a university for better or more knowledge.) Now the main concern of officials is not to have this trouble again. One evident result of this is that bright students lose a lot of opportunities to learn more, but they never complain (regretfully), and officials do not need to care about them.

I do not propose to put all the blame on students. In fact, their priorities reflect the cynicism of educators who design courses not for the sake of students' best interests, but for other aims: for example, to put another artificial obstacle in their way, to keep teachers busy, etc. The business-calculus course seems to be deliberately designed just as an obstacle for those who want to graduate in the business school.

I understand that I have very little experience with the bulk of the Russian population. Most of my students in Moscow were children of intellectuals, because in Russia (as in most countries) a much smaller percentage of youngsters than in the United States go into higher education. In fact, what is going on in America is an experiment: to give higher education to those strata of society which remain deprived of it in most other countries. My concern is that this should be really an education, not an imitation.

I WAS astonished to find that many of my American colleagues, although very competent as scientists and quite decent as persons, had absolutely different ideas about education and teaching that I had. When I spoke to them about education, they answered something like: "This is not my concern. There are special people to care about all that," as if I spoke about some important but remote activity. According to my experience, the prevailing attitude among American mathematicians is to avoid teaching. When these American mathematicians say that they have a "good position," this typically means that *they do not have to teach*. And if a mathematician with (substantiated or not) research ambitions has to teach, he often tries to do it as mechanically as possible. And students take this for granted, and they try to learn as mechanically as possible. The result is a tit-for-tat between teachers and students, which may reduce mathematical education to wasteful bureaucratic mirages. And the system (as any system) is robust: If a recent immigrant, inexperienced in American ways, happens to be different (for example, to love teaching), he or she does not fit into the system, and only causes troubles.<sup>4</sup>

The attitudes of some mathematicians toward teaching form a perfect counterpart to the attitudes of some students toward learning. Some, but not all. It certainly is not exciting to teach those who invest more efforts into pushing for grades than for understanding. But, on the other hand, students as a whole are not nearly as hopeless as some smug teachers pretend.<sup>5</sup> It is true that there are a few nasty students who can put anybody off teaching, and it is true that some indifferent bureaucrats prefer to yield to their pressures (at the expense of those who want to learn). But in every course there are students who are really interested, and I think that these students are the most valuable. In every one of my courses there were students who were excited by those very non-trivial problems that moved others to complain. My former students came to my office to thank me. They said that after my course the next courses were easy for them. Some asked if I was expected to teach something in the next year and advised me to publish the problems I had invented. But bright students never complain (regretfully), and officials do not care about them. More than once I had to say to one student or another: "You did very well in my course, and I give you an A. But this does not mean much, because what I teach you is not really mathematics."

Some people excuse bad teaching by saying: Since students buy it, it is OK to sell it. But pushers of drugs say the same. It is the responsibility of specialists to do the right things even if laymen cannot discriminate between right and wrong. It is the responsibility of teachers to teach in a way that really develops students' intellect. Imagine that a non-educated person is sick. Is it fair to prescribe him a fake medicine just because he cannot tell it from a good one? Of course not: This is not only inhu-

man, but also dangerous for the reputation of the medical profession. The same about teaching: Fake teaching is unfair and breeds anti-intellectualism. The moral status of those who designed the business-calculus course is like that of colonial-time hucksters who sold cheap beads, mirrors, and "fire-water" to ignorants, whose role is now played by students. (I do not blame rank-and-file teachers, because many have no choice.)

For many years, the Soviet authorities tried in vain to reduce scientists' concerns to their job and were irritated when someone interfered with public affairs. Sakharov is the most well-known example of a Russian scientist directly involved with politics, but I am sure that educational efforts of many others were equally important. In this respect, the free American job market seems to intimidate dissenters more effectively than Soviet despots ever could: Most American mathematicians try to deal with education as little as possible, because of the existing system of rewards.

Most students are young people. They are not yet quite mature, and their priorities are in the process of formation. Every school not only teaches particular subjects, but also suggests certain ideas of what learning and mental activity should be. In the present situation, the idea most often promoted by authorities is that official records are the most important results of learning. Many students are not independent enough to defend themselves against this bad influence and get phony education at the expense of real time and money. Their motivation shrinks to external sticks and carrots, and they fail to develop independence from external rewards of the social system.

I LOVE to start my courses at the precalculus level by asking students to vote on the following question:

*Take the infinite decimal fraction 0.999 . . . that is zero, then decimal point, then an infinite row of nines. Is this fraction less than or equal to one?*

Often the majority votes that the fraction is less than one. Then I ask, how much less, and students give different answers according to which calculators they use. This starts a useful discussion in which all the students participate because they feel that this really pertains to them. Every student tries to prove that his answer is correct, which allows me to convince them that all are wrong: This fraction equals one.

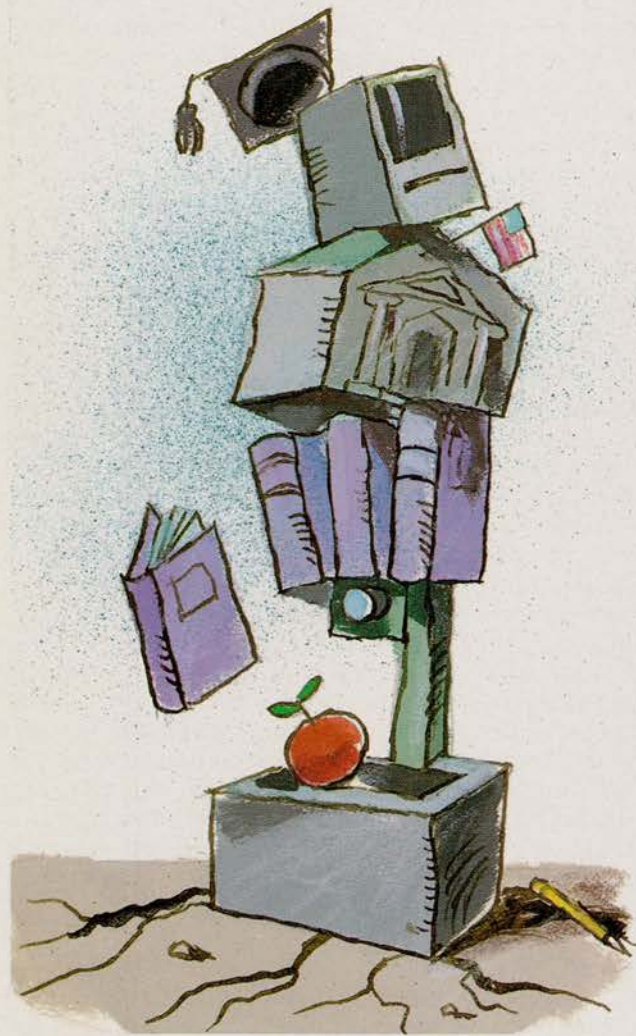
You may ask me: Why do I start my courses by provoking students in making a wrong decision in such a dramatic form? Because it is absolutely necessary for a teacher to keep his or her students alert and critical of themselves. If I simply informed my students that this fraction equals one, they would easily agree, but forget it by the next lecture. This is just one example. In fact, when I teach as I want, I try systematically to show that something that seems evident may be wrong. Experience of this sort, I believe, is essential as a psychological prerequisite for studying rigorous mathematics. In Russia, students were delighted whenever I succeeded to bamboozle them. Even children understood that it was a pedagogical device to make their knowledge and thinking more robust. My graduate students at BU also were excited when I proved that no algorithm can solve the sorting problem in linear time and right after that presented an algorithm that seemed to do this.

<sup>4</sup> Most advertisements about positions request what they call "commitment to excellence in teaching," especially teaching undergraduates. But what does it mean: commitment to teach thinking or commitment to waste one's time for pseudo-teaching? And according to my experience, if an applicant claims that he or she loves teaching, he or she only moves others to think that he or she is failing in his or her efforts to do research.

<sup>5</sup> A typical game (in Berne's sense): "It is profanity to make such a genius as I am, waste my precious time on teaching."



***The students grabbed their calculators, but seemed not to know what to calculate.***



This is understandable: Wise nature has made people, especially young people, in such a way that they love challenges. That is why people (especially children) enjoy performances of magicians whose job is to cheat. Many love mysteries and detective stories whose authors intentionally mislead the reader. Why shouldn't the teacher use the same device? Creative students are happy to meet something puzzling or misleading, because it gives them a chance to become tougher as thinkers.

But many undergraduate students are oversensitive to everything that they perceive as a failure, even a small one. Whenever intonations of my voice led them in a wrong direction, students took it as a violation of some gentlemen's rules. It looks like some American students

cannot afford the natural human love for intellectual challenges because of the pressures of grades and formal records. If the teacher's recommendations do not lead them straight to the right answer, they perceive it as the teacher's fault, not as a pedagogical device. But with this attitude, one cannot develop intellectual independence.

Some seem to think that they should be perfect from the very beginning, and if they are not, this is a fatal failure—like an incurable disease. They seem to feel obliged to give the right answer as quickly as cowboys shoot in Westerns, and if they miss, they just feel themselves to be losers and have no ways to deliberately and systematically develop themselves.

Officially, certain prerequisites are requested for every course. I wanted to check students' actual prerequisites and found that many of them could not solve simple, almost arithmetical, problems.

I included in my courses a problem that I had solved in middle school:

*Tom and Dick can do a job in two hours. Tom and Harry can do the same job in three hours. Dick and Harry can do the same job in four hours. How long will it take for all three of them to do this job?*

This problem can be solved by elementary algebra and a few arithmetical calculations. Most of my students could not solve it. One of them wrote the following system of equations:

$$T + D = 2, T + H = 3, D + H = 4$$

The student got a bad grade and asked me why. I asked in return, which parameters she meant by *T*, *D* and *H*—time or something else. She said that she meant no parameters, just Tom, Dick and Harry. I replied: "This is illiterate." A Russian student would grasp the chance to learn something new, but the American took this as a fatal failure, left the room with tears in her eyes, and dropped from my course. I regret this even now, but what else could I say?

This case is typical in the sense that many students avoid discussing their mistakes; it looks like a useless pain for them. If you learn for competence, which is valuable for you as such, you can benefit from your mistakes. But if you learn for grades, and your self-esteem completely depends on external evaluations, it is plain masochism to keep in mind lost opportunities.

At the last lecture of my business-calculus course, I gave a problem:

*When 1,000 pounds of cucumbers were brought to the shop they contained 99 percent water. But while they were kept unsold, some water evaporated, and the percentage of water dropped to 98 percent. How many pounds do they weigh now?*

The students grabbed their calculators, but seemed not to know what to calculate. After a while, one produced a complicated and wrong answer. And it was pretended that these students had learned to solve differential equations! Of course, they had not! All they had learned was to follow a few recipes without thinking—a bright start for their careers!

Well, let us admit that most people can manage without being able to solve differential equations. But why did the students waste their time? The syllabus, the textbook, all the course design aped those for future professionals, but with one *small* change: applying recipes

instead of solving problems. But this change annihilated the whole enterprise.

Thus, students lost several months, but had not learned to solve any problems at all, because to solve problems means to think productively, that is to produce ideas that are not given in advance. And this is what they were completely deprived of.

The problems given above should be solved in high school or even middle school. Solving problems like these and writing down the solutions are a valuable experience of productive formal thinking that is hardly avoidable for every man or woman in modern civilization. All normal teenagers have brains mature enough to solve such problems, and those who solve them at 14 really can learn calculus at 18. But most of my students seemed to have no such experience. What had they done throughout their many years of schooling?

It seems that to a great extent they had filled in boxes, that is to say, chosen the right answer among several ready-made ones. Multiple-choice tests are convenient because their results are easy to process. This seems to be the main reason why such tests are so often used. Perhaps such tests give valuable information to educators, but they grossly limit students' initiative, fragment their activity and deprive them of self-organizational experience.

Suppose that you are an average student. If you write solutions, even wrong ones, you can analyze them and learn something from your mistakes. But if you just put tallies into boxes, you don't remember why you made the choice; so you cannot analyze your mistakes and cannot benefit from them. All you hope is that your conditional reflexes will gradually improve, but you cannot control this process, like an animal in a problem box.

Well, better late than never, that is why I gave the problems mentioned above to my students. But I could not give more than just a few problems of this sort, because I had to follow the syllabus.

Nowadays, throughout the world, every youngster is assigned to learn some mathematics, but most of those who are in charge of this huge enterprise cannot explain in reasonable terms what all this is for and what is meant by "mathematics" in this context. What is the purpose of mathematical education for those many who will not become professional mathematicians? This is an enormously important question, but too comprehensive to discuss here in detail. Let us at least understand that it has no straightforward utilitarian answer. Very little of mathematics is used by most people in their work or other activities. Managers and lawyers, social workers and police officers, drivers and farmers, politicians and officials, doctors and nurses, cooks and barbers, writers and artists, sportspeople, businesspeople, salespeople and showpeople, do not solve quadratic equations, do not use set theory, the theory of numbers, functions or algorithms, analytical or projective geometry, and do not differentiate or integrate.

Please, do not think that I am *against* teaching mathematics. I am *for* it. What I want to emphasize is that a teacher should never expect that students will have a chance to apply recipes literally. If you teach nothing but recipes, you teach nothing. This is especially true when teaching such an abstract subject as mathematics: It makes sense only when it is teaching one to think, to

learn, and to solve problems. When this takes place, teaching mathematics may be enormously useful for everybody.<sup>6</sup> Here (as elsewhere in this paper) I do not pretend that my opinions are original. A lot has been said in the same vein, for example: "In mathematics 'know-how' is the ability to solve problems, and it is much more important than mere possession of information."<sup>7</sup>

But thinking and solving nontrivial problems are conspicuous by their absence in many developmental courses. (Nobody knows what these courses actually develop.) Many courses of mathematics in liberal arts settings are made up by the following simple rule: Take the professional course, keep the shell, and eliminate the kernel. That is, keep the pretensions, terms, even some formulations, but eliminate everything that needs thinking. At first sight, it may seem easy to avoid this, because there are lots of problems in various textbooks; solving these problems would certainly benefit students much more than business calculus, which is neither business nor calculus. But this won't do because of the market pressures. Suppose that some author writes a textbook with problems that need thinking for their solution, and some college gives a course using this book. Instead of learning recipes with bombastic labels, students who take this course will have to adopt the modesty that is required for concentrating on the real difficulties of a subject. The college will have to admit that its students simply learn to solve some mathematical problems and thereby just become more intelligent. Which parents will send their offspring to it? Which firm will hire the students? What will they boast of?

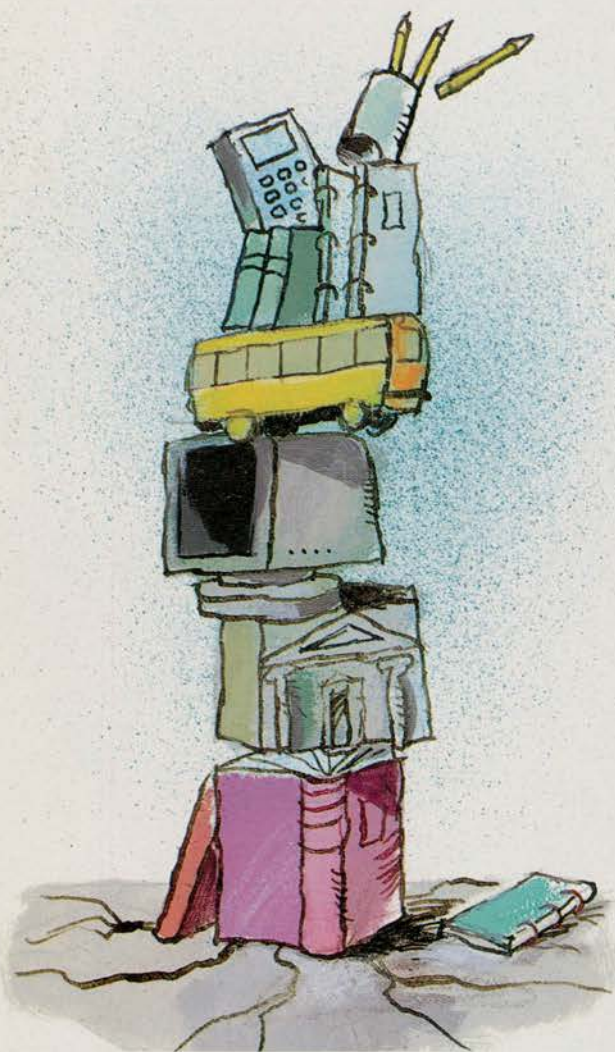
To survive against competition, every university and every college has to pretend that it gives something modern, advanced, and immediately marketable. But is it possible to give advanced courses to students who are ignorant in elementary mathematics? Of course not. What to do? Very simple! Emasculate the course by excluding everything nontrivial, reduce the students' task to applying ready-made recipes without understanding—and you will survive and succeed. Your pretensions that you teach something advanced will allow the students to pretend that they are educated, and this will allow the firms and departments that hire them to pretend that they hired educated people. But at some point, this chain of pretensions will have to break.

**T**HE AMERICAN ability to get things done has become proverbial. The question is what should be done. I have no panacea, but I invite Americans to at least see the problem. Many seem not to see any problem at all. I tried to figure out what political leaders of this country think about the quality of education and concluded that

<sup>6</sup> One small example of a successful solution of a practical problem: Once my daughter (who was 12) needed a dictionary, and we went to a bookstore. She chose one but could not find any printed indication of the number of words it contained. Then she chose a page that looked typical, counted the number of words in it, looked at the number of the last page, rounded both numbers to the first digit and mentally multiplied them. Thus in a few seconds, she obtained an adequate estimate of what she needed. I was delighted. This may be called "mathematical common sense." What a contrast with most of my business-calculus students who were helpless without their calculators and without a detailed instruction of what to do and in which order!

<sup>7</sup> George Pólya, *On the Curriculum for Prospective High School Teachers*.

***Someday, ignorant people with degrees and diplomas may want power according to their papers rather than their real competence.***



they think nothing about it. They speak of giving everyone an opportunity to obtain an education, but they say nothing about the quality of that education.

Now many Americans say: "We have won the Cold War." This is wrong. The Soviet rulers certainly lost the Cold War, but this does not yet mean that Americans won. The Soviet bureaucrats lost because they lived in the lunatic world of "advantages of the Soviet system," "Soviet type of democracy," "building of Communism,"

"enthusiasm of the Soviet people," and other slogans of their own propaganda. Lack of realism, fear of any independent opinion, enormous discrepancy between reality and official versions undermined the Soviet rule. Much can and will be said about the collapse of the Soviet Union, but I am sure that the dominance of bureaucratic fictions at the expense of reality certainly played a major role.

Regretfully, all the same can be said about some part of American education. There are people among students, their parents, teachers, and officials who do not understand what education is about. They anchor their aspirations and priorities to the bureaucratic form rather than to the substance of culture. Let me repeat that there is nothing special about Americans in this respect. There are lots of countries where the average education is worse than in America (in Russia, for example).

There is rule *by* the people in America, but not always *for* the people. People command to the intellectuals, in a sovereign way, something like the following: "Give certificates of competence to our offspring without any delay! And don't waste taxpayers' money by teaching students too much! And don't you dare to discriminate against ignorant ones." Intellectuals obey implicitly and give out bombastic graduation papers with an open hand. Everybody is glad: Scientists return to their research having paid as little effort and attention to teaching as possible. Bunches of youngsters get impressive certificates that are the most marketable results of their studies. Parents have realized their dream to "educate" their children. Some of the richest and smartest parents are also glad: They find special ways for their children to get *real* education, so their future is ensured. But what about the future of others? Is it ensured as well?

Those who learn for grades expect to succeed in their business. *Today* they are right insofar as almost every American who has a degree, however ignorant, can live better than even competent people in much poorer countries around the world. A person with a diploma should not fail to find a job in his or her field of competence: This is a common belief in this country. But this cannot last long in the situation when "competence" and a diploma tautologically mean each other. The advantages enjoyed by Americans are the results of real competence and real efforts of previous generations, whose heritage is now getting devaluated as a result of the bureaucratic character of the educational system. And someday, ignorant people with degrees and diplomas may want power according to their papers rather than their real competence. We Russians have some experience of this sort, and it is not unique. In all countries (including America) activists of ignorance try to dictate their will to universities, and sometimes they succeed—at the expense of those who really want to learn.

How much of American education really develops students' competence and how much—like business calculus—comes to pretentious trivialities? I don't yet know. And I don't know who knows. I am learning about it by experience, and it will take a long time to learn. But it is clear to me right now that the winners in the modern world will be those countries that will really teach their students to think and to solve problems. I sincerely wish America to be among these. □

*Special  
American  
Educator  
Pullout Section  
on Private  
School Choice*



# Myths & Facts

## About Private School Choice

**N**UMEROUS STUDIES and test results have shown us that the academic performance of American students is very poor. Most citizens, be they elected officials or teachers, parents or retirees, agree that this crisis in education affects us all because it threatens our capacity to sustain our democracy and to meet the challenges of a global economy. The question is how to overcome that crisis.

For the past few years—with increasing intensity—Americans have been told that private school choice is the solution to our problems in education. Private school choice (also commonly known as vouchers) means allowing parents to use public dollars to send their children to private and religious schools. Proponents say private school choice will break up the public school “monopoly” and force schools to improve as they compete to attract customers. The result, they say, will be good schools and high student achievement.

This is an attractive argument, but one based more on myth than on fact. The American Federation of Teachers believes that educators have a special responsibility to help the public distinguish between myth and fact and that informed debate is essential to the democratic process. In publishing *Myths and Facts about Private School Choice*, we hope to advance citizens’ understanding of this important and controversial public policy issue.

Some may ask, “Why should we take the AFT’s word about private school choice? Doesn’t the AFT have a vested interest in

public education?” Sure we do, and so do all Americans. And we are not asking anyone to take our word—or anyone else’s, for that matter—on private school choice. We have documented all our facts, as well as the claims made by private school choice supporters. Check out the evidence and ask further questions—of both sides in this debate.

The AFT is proud of its role in and support of public education, but that has not blinded us to the reality that the American education system must do a much better job. Teachers were the first to blow the whistle on declining academic standards and poor student performance, and when the studies came out that confirmed what teachers already knew, the AFT did not whitewash the findings. Just as we are uncovering here the myths about private school choice, we publicized the sad facts about American student achievement.

If private school choice is not the answer, what is? We believe the keys to turning around both our public and private schools are: clear and challenging academic standards; student assessments based on these standards; and accountability for students and schools based on performance. We also advocate rigorous standards for teachers; firm and fair discipline in schools, and the removal of chronically disruptive and violent youngsters to alternative schools; and restoring parents’ involvement in helping their children succeed in school.

These are commonsense solutions favored by most Americans. These solutions are within our reach. We hope you will work with us to achieve them and at the same time strengthen and preserve the vital role of public education in our democracy.



**MYTH:** Private school choice lets parents pick the best school for a child by giving them a voucher to use at a public or private school.

**FACT:** Parents may choose a private school, but that doesn't mean the school will choose their child. Public schools have to take all children. Private schools don't.

Private schools pick children on the basis of grades, recommendations, scores on entrance exams, and personal interviews. For example, 71 percent of Catholic high schools require an entrance exam, as do 43 percent of other religious schools and 66 percent of independent private schools.<sup>1</sup>

Unless a child is well-behaved, belongs to the "right" social class or religion, or has the right mix of intellectual, creative, and athletic abilities, he or she may not get into a private school. And since private schools are private, the public—the taxpayers who would foot the bill for vouchers—have no say in private schools' admission and other policies.

The term "private school choice" is therefore misleading, because money isn't the only barrier to choosing a private school, especially one with a good reputation. Ask any wealthy family if money alone can get a child into a private school of choice. The answer is No.

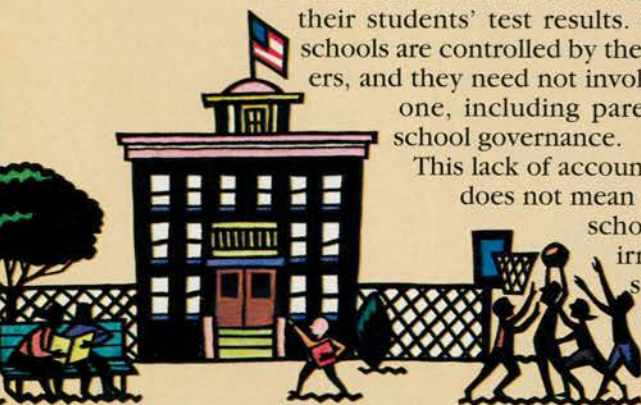
Disadvantaged children would have even less choice of private schools. For example, very few private schools serve children with disabilities.<sup>2</sup> In Milwaukee, where poor families can get vouchers for private schools, 40 percent of the children who sought to participate could not find a school that would take them.<sup>3</sup>

**MYTH:** Private school choice would increase accountability in education by breaking up the public school monopoly and making schools more responsive to parents.

**FACT:** Private school choice would *reduce* accountability in education. The reason is simple: Private schools are exempt from almost all public regulations.

Most private schools don't have to account to the public for their admission, discipline, or expulsion policies; curriculum; teacher qualifications; the source of their funds or how they spend those funds; the needs of children with disabilities; or their students' test results. Private schools are controlled by their owners, and they need not involve anyone, including parents, in school governance.

This lack of accountability does not mean private schools are irresponsible. Private



schools are free from regulation because what they teach and how they teach are not supposed to be the public's business and *can't* be the public's business—unless private schools are willing to give up their autonomy and religious schools are willing to have the wall between church and state broken down.

Advocates of private school choice say that parents will hold the schools accountable. But vouchers create incentives for schools to attract customers and not necessarily to improve achievement, so there's no assurance that what schools would sell—or what parents would buy—would be a better education. Where would busy parents get the information they need to choose among schools? Should we just assume that all private schools would be honest? Moreover, is parental satisfaction an adequate standard of accountability when all taxpayers—not just parents with school-age children—bear the cost of education?

Public schools should be more accountable for their performance. But at least they show how they spend taxpayers' money; follow regulations about discipline, safety, equal opportunity, curriculum, and teacher credentials; and publish information about student performance, good or bad. And they are governed by the people's elected representatives.

If we want stricter accountability in education, that's what we should demand—rather than giving public dollars to schools that don't have to answer to the public.

**MYTH:** Private school choice would promote healthy competition between public and private schools and make all schools better.

**FACT:** Competition *is* healthy—when everyone has to play by the same rules. But the playing field for public and private schools is far from level.

As noted earlier, public schools must serve all children; private schools don't have to. Public schools must obey state and local regulations concerning discipline; health and safety; civil rights; special education; curriculum; student testing; teacher qualifications—the list goes on. Private schools are exempt from most of these rules.

In the name of fair competition, are proponents of choice ready to subject private and religious schools to the rules now governing public schools? Not a chance. Are they proposing to ask Congress, state legislatures, school boards, and the courts to roll back the laws and regulations governing public schools and allow them to behave like private schools? No. Can a competition be fair if competitors play by different rules? And can its results prove anything of value? No on both counts.

At any rate, it would be a riverboat gamble to entrust education to the chance of the market. Markets develop products to satisfy people's tastes or needs, according to their ability to pay. But satisfying consumers is not the goal of education: Learning is. Education is a vital *public* good that cannot be guaranteed through markets (that's why we developed public schools in the first place).

Supporters of private school choice glamorize the market and ignore its failures and abuses. If markets only penalize poor performance and encourage quality goods, why are junk food and violent movies so common? Why have so many private trade schools pocketed millions of dollars in federal aid for higher education without giving students the training they were promised?<sup>4</sup> Why are taxpayers shelling out \$200 billion to rescue banks that failed when their owners speculated recklessly with other people's money?

In a market system, some parents might choose topnotch schools, but others might choose cult schools or football factories. When a referendum on private school choice was called in California, a group of avowed witches announced plans to open a "pagan" school that would combine reading, writing, and arithmetic with magic. Indeed, vouchers would create a lot of chances for hocus-focus.

**MYTH:** Private schools are as nonselective, open, and diverse as public schools.

**FACT:** Private schools serve a hand-picked and more advantaged group

of students than public schools do because of the purposes, admission policies, and tuition costs of private schools.

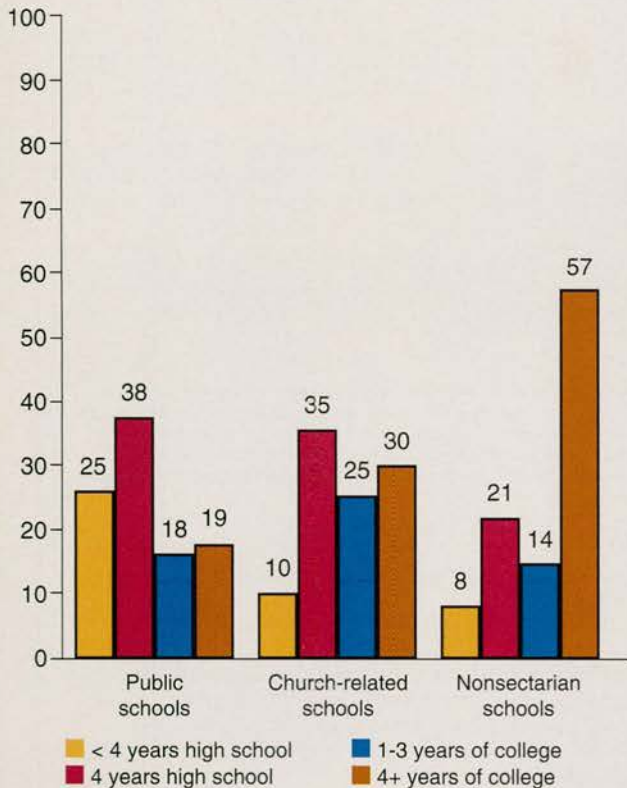
Religious schools dominate the private sector in education: 81 percent of private elementary and secondary schools are religious schools, and 84 percent of private school students attend religious schools.<sup>5</sup>

Also, most private schools educate students from families having greater resources than those of public school students. Private school students are much more likely to have college-educated parents than public school students (see Chart 1). Likewise, private school students are much more likely to be well-off than public school students (see Chart 2). Private schools are also less racially diverse: The share of white students attending private school (11 percent) is double that of Hispanic and black students (5 percent and 6 percent, respectively).<sup>6</sup>

What about the claims that Catholic schools are a special case—that they are as open and diverse as public schools? The facts show otherwise. For example, only 2 percent of Catholic schools fall into the lowest quartile of student socioeconomic status (SES), compared with 28 percent of public schools. Even in urban areas, only 18 percent of Catholic

**CHART 1**

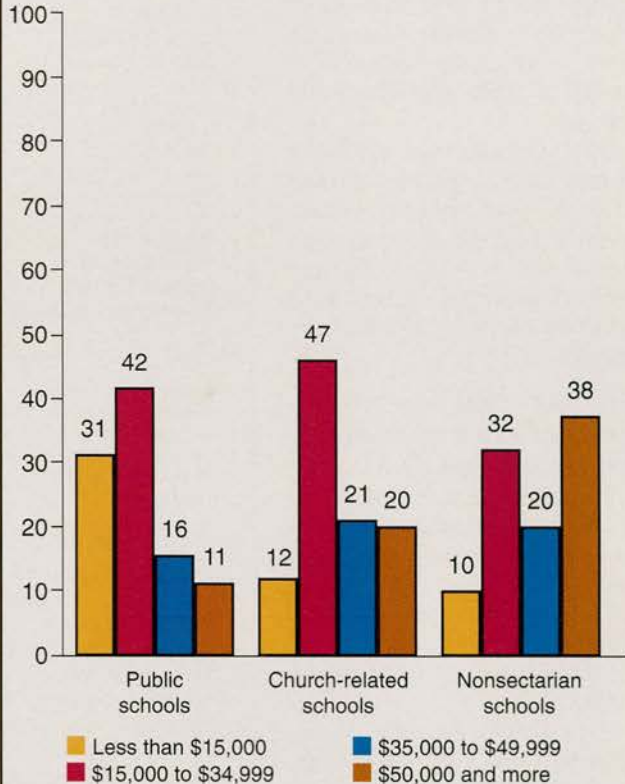
**PARENTAL EDUCATION LEVELS OF ELEMENTARY AND SECONDARY STUDENTS IN PUBLIC, PAROCHIAL, AND OTHER PRIVATE SCHOOLS**



Source: Private Schools in the United States: A Statistical Profile, With Comparisons to Public Schools, Figure 3-6, p. 47, U.S. Department of Education, National Center for Education Statistics, February 1991.

**CHART 2**

**FAMILY INCOME OF ELEMENTARY AND SECONDARY STUDENTS IN PUBLIC, PAROCHIAL, AND OTHER PRIVATE SCHOOLS**



Source: Private Schools in the United States: A Statistical Profile, With Comparisons to Public Schools, Figure 3-5, p. 46, U.S. Department of Education, National Center for Education Statistics, February 1991.

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schools fall into the lowest SES quartile, compared with 42 percent of public schools.<sup>7</sup>

Catholic schools do perform an important service by educating some poor children, many of whom are not Catholic. But even in such cases, Catholic schools handpick these students and can always expel their mistakes. Public schools must accept all comers.

None of these differences between public and private schools should be surprising, because private schools cater to particular needs and wants—"market niches." This undercuts the claim that private school choice will benefit a wide range of children, not because private schools are irresponsible, but because the nature of private schools—and private businesses—is to carve out market niches. Public and private schools serve very different groups of children—and would continue doing so under a voucher plan.

**MYTH:** The evidence shows that private schools outperform public schools.

**FACT:** The evidence shows no such thing. Because private schools are able to handpick students, many of whom have highly educated parents and high family incomes, you'd expect private schools to substantially outperform public schools. The surprise is they don't. Private schools do only slightly better, and their edge disappears when one compares public and private school students from similar backgrounds.

Let's examine the evidence from three sources: (1) the National Assessment of Educational Progress, (2) the High School and Beyond study, and (3) Milwaukee's experiment with vouchers for low-income families.

### The National Assessment of Educational Progress (NAEP)

The NAEP is a national survey that has tracked student achievement in major subjects since 1969. The 1990 NAEP math assessment was the first to report results separately for public and private school students.

Overall, private school students had only a slim advantage on the NAEP math test (see Table 1). In grades 4 and 8, private school students averaged 10 to 17 more points on NAEP's

500-point scale. This margin dropped to between 6 and 7 points by grade 12. Even more surprising is the fact that, compared with private school seniors, a slightly higher percentage of public school seniors attained the top level of achievement on the 1990 math exam.<sup>8</sup>

Research has shown again and again that parent education and family income have powerful effects on educational achievement. So, given the much higher levels of parent education and family income enjoyed by private school students, one would expect them to achieve much more. But they don't.

If one compares the 1990 NAEP math scores of private and public school students with the same level of parent education or the same math coursework, *the achievement gap vanishes completely* (see Charts 3, 4, and 5).<sup>9</sup> The 1990 NAEP exam in science and the 1992 math results show the same pattern.<sup>10</sup>

Chester Finn, Jr., an Assistant Secretary of Education under President Reagan and a fervent backer of private

**TABLE 1**  
**AVERAGE PROFICIENCY AND PERCENTAGE OF STUDENTS AT OR ABOVE FOUR ANCHOR LEVELS ON THE NAEP MATHEMATICS SCALE BY TYPE OF SCHOOL**

	Percent of Students	Average Proficiency	Percentage of Students at or Above			
			Level 200	Level 250	Level 300	Level 350
<b>GRADE 4</b>						
Public Schools	88 (1.2)	214 (0.9)	70 (1.3)	10 (0.8)	0 (0.0)	0 (0.0)
Catholic Schools	8 (1.1)	224 (2.0)	83 (2.6)	16 (2.2)	0 (0.0)	0 (0.0)
Other Private Schools	4 (0.8)	231 (2.8)	89 (3.8)	22 (3.4)	0 (0.0)	0 (0.0)
<b>GRADE 8</b>						
Public Schools	89 (1.3)	264 (1.2)	97 (0.5)	66 (1.3)	13 (1.3)	0 (0.1)
Catholic Schools	7 (1.1)	278 (2.6)	100 (0.2)	84 (2.6)	22 (3.4)	0 (0.2)
Other Private Schools	4 (0.7)	274 (2.4)	100 (0.5)	80 (3.8)	18 (2.9)	0 (0.0)
<b>GRADE 12</b>						
Public Schools	90 (1.3)	295 (1.1)	100 (0.1)	90 (0.7)	45 (1.4)	5 (0.6)
Catholic Schools	6 (1.1)	302 (3.0)	100 (0.0)	96 (1.2)	54 (4.5)	4 (1.0)
Other Private Schools	4 (0.8)	301 (3.1)	100 (0.0)	97 (1.1)	51 (4.8)	4 (1.8)

The standard errors of the estimated percentages and proficiencies appear in parentheses. It can be said with 95 percent certainty that for each population of interest, the value for the whole population is within plus or minus two standard errors of the estimate for the sample. When the proportion of students is 0 percent, the standard error is inestimable. Although percentages less than 0.5 percent are rounded to 0 percent, a few eighth-grade public school students (0.2 percent) and Catholic school students (0.1 percent) reached Level 350.

#### DESCRIPTION OF NAEP LEVELS:

**Level 200:** Simple additive reasoning and problem solving with whole numbers; content typically covered by 3rd grade.

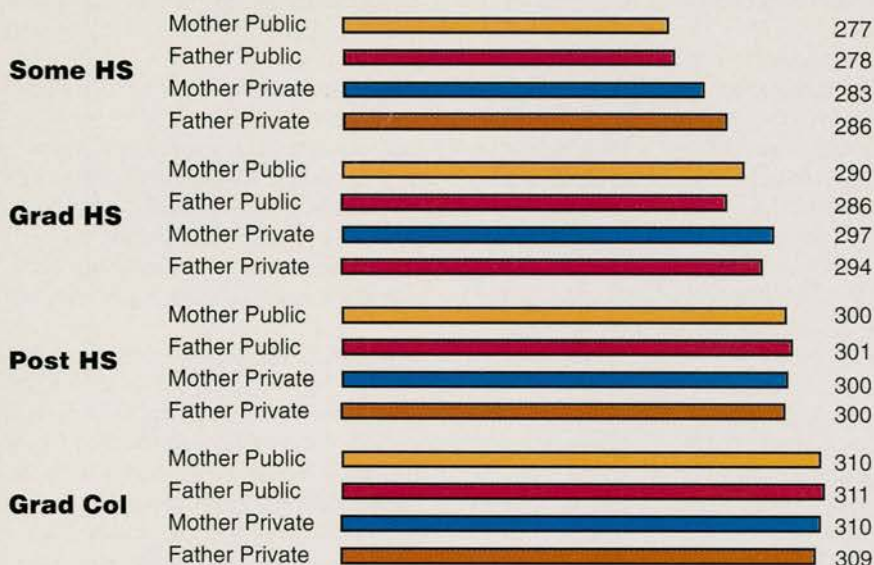
**Level 250:** Simple multiplicative reasoning and two-step problem solving; content typically covered by 5th grade.

**Level 300:** Reasoning and problem solving involving fractions, decimals, percents, elementary geometry, and simple algebra; content introduced by 7th grade.

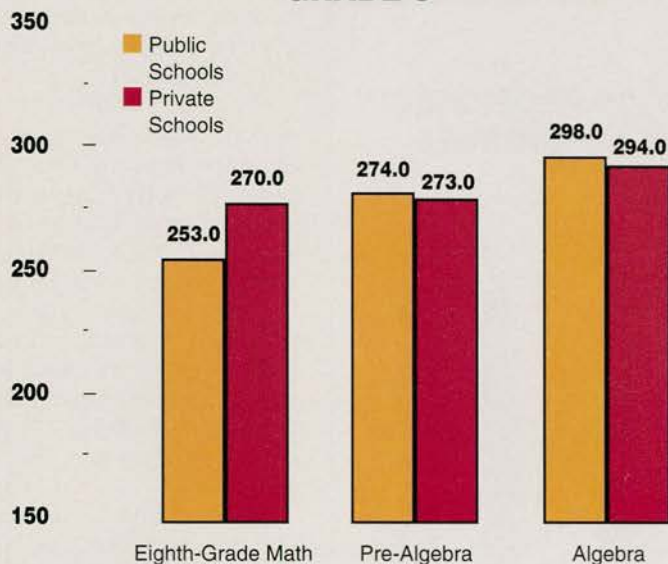
**Level 350:** Reasoning and problem solving involving geometry, algebra, and beginning statistics and probability; content generally covered in high school math courses in preparation for the study of advanced math.

Source: The State of Mathematics Achievement: NAEP's 1990 Assessment of the Nation and the Trial Assessment of the States, U.S. Department of Education, National Center for Education Statistics, June 1991, Table 2.6 and Executive Summary, pp. 6-7.



**CHART 3****MATHEMATICS ACHIEVEMENT AT GRADE 12  
BY LEVEL OF PARENTAL EDUCATION  
PUBLIC AND PRIVATE SCHOOLS**

Data source: National Assessment of Educational Progress 1990, Student Data.  
Chart prepared by American Federation of Teachers.

**CHART 4****AVERAGE OVERALL MATHEMATICS PROFICIENCY  
BY STUDENTS TAKING SIMILAR COURSES  
GRADE 8**

Data source: National Assessment of Educational Progress 1990, Student Data.  
Chart prepared by American Federation of Teachers.

school choice, found similar results in an analysis of unpublished NAEP test results for history and literature.

Finn concluded that, "With differences that large in parent education, it is conceivable that there is no

iversity of Wisconsin at Madison: "The size of the differences in achievement between sectors is simply so small that we can draw almost no conclusions from them."<sup>13</sup>

Professor Christopher Jencks, Northwestern Uni-

(private) school effect showing up here at all."<sup>11</sup>

None of this is anything for public schools to crow about. Neither public nor private school students are performing well. For example, only about half of high school seniors—in either school sector—can solve problems involving decimals, fractions, percents, basic geometry, and simple algebra. These topics typically are taught in junior high math.

But the fact that private schools, despite their considerable advantages, do not perform much better than public schools indicates that private school choice is not a panacea. Even if all public school students entered private schools tomorrow, we'd still have an educational crisis on our hands.

**High School and Beyond (HS&B)**

HS&B is a federal survey of student achievement in 1,000 public and private high schools. The research findings based on HS&B mirror the NAEP results: The private school advantage is very small and almost disappears when similar students are compared.

A 1982 analysis of HS&B data by James Coleman reported that Catholic high school students scored one grade level higher on achievement tests than their public school counterparts.<sup>12</sup> This finding fueled the popular impression that private schools are better than public schools. Unfortunately, Coleman failed to control for student ability or learning prior to high school. Once those errors were corrected, the private school edge in achievement was tiny.

Leading researchers who have studied the HS&B data echo that point. For example:

Professor John Witte, University of Wisconsin at Madison: "The size of the differences in achievement between sectors is simply so small that we can draw almost no conclusions from them."<sup>13</sup>

Professor Christopher Jencks, Northwestern Uni-

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versity: "The annual increment attributable to Catholic schooling . . . averages .03 or .04 standard deviations per year. By conventional standards, this is a tiny effect."<sup>14</sup>

But what about the latest book using HS&B, *Politics, Markets, and America's Schools*, by John Chubb and Terry Moe? Doesn't the book prove that private schools outdo public schools because of market control?

It's true that Chubb and Moe received a lot of media attention for their conclusion that private schools perform better than public schools. However, when experts looked at the book, they found it was highly flawed, based more on ideology than on evidence. In fact, Chubb and Moe never directly compared the performance of public and private schools. Instead, they simply assumed that the qualities of effective schools are associated with free markets and private schools. Can we afford to make decisions about the future of public schools on the basis of faith instead of evidence?

The flaws in Chubb and Moe's research are well-documented, but too numerous to describe here. However, two leading education scholars, Valerie Lee of the University of Michigan and Anthony Bryk of the University of Chicago, summed it up when they wrote: "*Politics, Markets, and America's Schools* comes up short as a piece of disciplined policy research" and goes "substantially beyond what the empirical evidence can support."<sup>15</sup>

### Milwaukee's voucher experiment

Milwaukee's voucher experiment reinforces the conclusion that private schools don't outperform public schools and that private school choice won't

improve student achievement. Moreover, this program vividly shows the risks of giving tax dollars to schools not accountable to the public.

The Milwaukee program offers vouchers for up to 950 low-income, public school students to use at non-religious private schools. Yet the private schools have been unable or unwilling to serve even such a small number of children. In the most recent year, only 613 students participated, while almost 400 could not find a school that would take them. Only 11 of 21 eligible private schools were willing to take voucher students.

Parents whose children participated in the voucher program report satisfaction with their choice. Yet the annual student attrition from Milwaukee's voucher schools has been 35 percent; and, teaching methods in Milwaukee do not differ much in the public and private schools. In addition, the voucher schools are characterized by low teacher salaries and high teacher turnover.

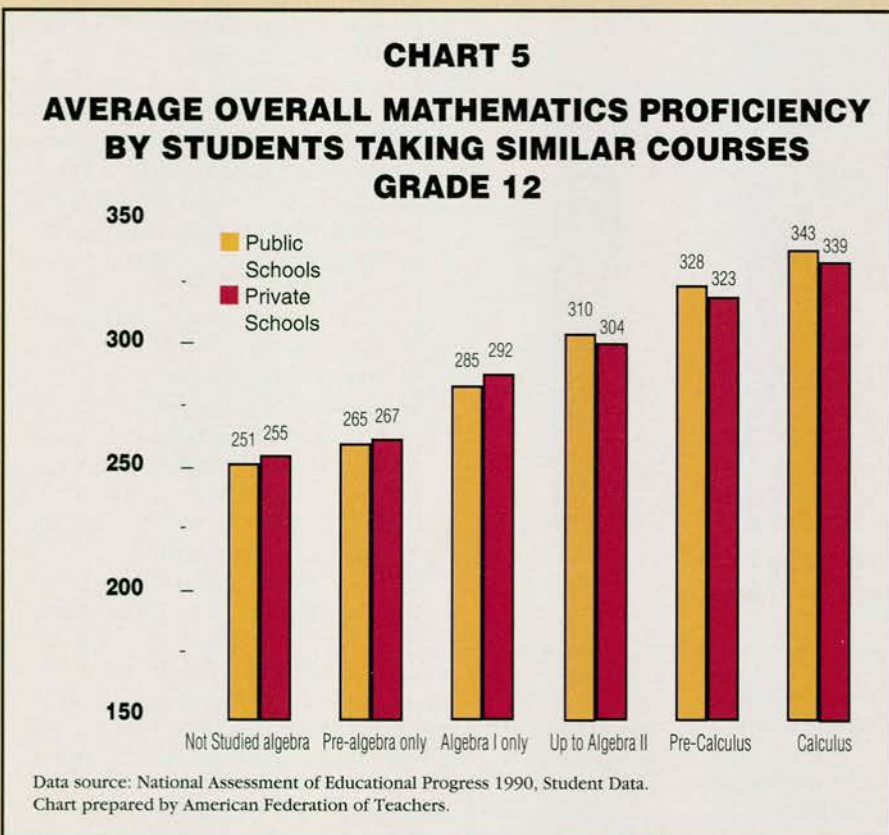
Accountability is almost completely absent in the Milwaukee program. During the first year, one of the voucher schools withdrew from the program when it reintroduced religious instruction, sending 63 students back to the public schools. Several weeks later, the school went bankrupt amid claims of theft and financial mismanagement. Parents also complained about food, transportation, a lack of books and materials, and discipline problems. The school lacked formal bylaws or a governing board with open meetings and did not submit to an external financial audit. Because private schools are exempt from almost all regulations, there are no safeguards to prevent similar abuses. Advocates of private school choice say that parents will hold the schools accountable, but how

many parents have the time or expertise to check a school's budget, review its curriculum, or even make sure that the bus driver has a license?

Of course, the bottom line is whether the choice program increases learning. In the second year, voucher students lost ground in reading and held steady in math, while public school students stayed constant in both reading and math scores. Although it is still too early for firm conclusions about Milwaukee's voucher experiment, the voucher schools are, if anything, doing worse than the public schools.<sup>16</sup>

The evidence is overwhelming: Private schools do not educate the same kinds of students as public schools, and private schools do not outperform public schools.

**MYTH:** American colleges and universities, which are forced to compete, are the best in the



world. If our elementary and secondary schools had to compete, they would also reach the same level of excellence.

**FACT:** American colleges and universities vary widely: Some are outstanding, some are mediocre, and some are abysmal. The competition for customers does nothing to promote academic excellence. Indeed, some colleges will take any warm body, regardless of whether the student learned anything in high school, just to keep enrollments up.

A recent ranking of admission standards at American colleges reflects this sorry state of affairs. Only 39 colleges qualified as “most difficult”—most of their students are in the top 10 percent of their high school class and have SAT scores above 1250. By contrast, 188 colleges—almost five times as many—were “non-competitive,” accepting almost all applicants regardless of high school record and SAT scores.<sup>17</sup>

Why are college admission standards so low? The answer is easy: Colleges are competing for customers to keep the flow of tuition and federal aid dollars coming in. A former college professor recently told the *Wall Street Journal*, “When the institution needs to recruit and retain students to survive . . . intellectual standards are at risk of being compromised.”<sup>18</sup>

With such powerful pressure for colleges to attract customers, it comes as no surprise that many students don’t do well or learn much in college. The dropout rate is enormous: Only half of full-time entrants to four-year colleges have earned a college degree six years later.<sup>19</sup> That’s much worse than high school dropout rates. Studies have also shown that many college graduates can’t make sense of bus schedules, contrast two opposing editorial views, or calculate the tip for a restaurant bill.<sup>20</sup>

Other nations’ universities show that high standards, not competition, are vital to education. To attend college in Australia, Great Britain, France, Germany, and Japan, students must pass demanding national or provincial exams based on high school curriculum. The United States lacks such standards. Many or most American college students could not get into European universities.

Competition does force schools to seek out customers, but that doesn’t necessarily mean the schools are selling anything of value.

**MYTH:** Giving parents the right to choose a private school would not cost taxpayers anything. In fact, it would save money.

**FACT:** Private school choice would be very expensive, even before a single child changed from public to private schools. Why? Taxpayers would provide vouchers for children *already* attending private school. The total cost would exceed \$30 billion annually if each of the nation’s 5.4 million children in private school got a voucher worth the average expenditure (\$5,900) for each public school student.<sup>21</sup> In effect, people would be subject to double taxation for public and private schools.

This would represent a large transfer of income from the public to the mostly high-income families

with children in private schools. Even if half of these families refused the voucher, the cost still would exceed the \$12 billion in federal spending on elementary and secondary education in 1992.<sup>22</sup>

It’s true that most voucher plans offer less than the average cost of educating a student. For example, California’s voucher proposal (subject to a voter referendum in November 1993) offers \$2,600 per student; Milwaukee’s voucher program offered \$2,745 per student in 1992-93. But smaller vouchers mean that more families—particularly poor families—won’t be able to pay for good private schools (top private schools cost as much as \$6,000 to \$12,000 per year).

Advocates of private school choice say their plan would pare down the public school bureaucracy. But they neglect to tell us that choice would require a huge new bureaucracy—and hence, more money—to give parents information about the array of schools and to transport children to schools outside their neighborhoods.

With federal, state, and local budgets already severely strained, can taxpayers afford to subsidize high-income families who already can afford to send their children to private school?

**MYTH:** Public education in the United States is beyond repair. Years of reform efforts have achieved nothing, so we have no alternative but to try private school choice.

**FACT:** Public schools must do a much better job. But the doomsayers mislead us when they claim public schools are getting worse and worse. The fact is that public schools have been doing a better job recently, even as child poverty and family breakup increased. Instead of rolling the dice with private school choice, we need to continue to improve the public schools.

Education reform during the 1970s and 1980s was mostly an effort to shore up basic skills. Remedial programs expanded; student testing (mostly low-level) increased; and graduation requirements were toughened. What happened? Test scores in science, math, and reading for students in grades 4, 8, and 12 have risen slowly but steadily. The gains were sizable in basic skills, but absent in more advanced skills.<sup>23</sup>

Is this good enough? No. We need to insist on higher standards. The main reason American children don’t learn much—in public *or* private schools—is that our educational standards are so low. Most college-bound students know they can find a school that will accept them, no matter how poor their grades are or how little they know. Job-bound students know that employers don’t check high school transcripts. The solution is an education system driven by clear and challenging curriculum standards, student assessments tied to those standards, and direct accountability for student and school performance—the same formula used by other industrialized democracies whose students outperform our own.

By contrast, private school choice offers no benefits and entails enormous risks. We’ve seen that private schools are not doing better than public schools. What are the risks? Private school choice would reduce

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accountability and risk further separating us by class, race, ethnicity, and religion. Markets are inherently unstable. Businesses constantly open and close, merge and restructure. What would happen if a child's school closed in the middle of the school year? Would the child wait until next year if other schools are filled to capacity? Would public schools be used as dumping grounds? What if public school buildings were sold, closed, or privatized? Many neighborhood schools would disappear. Private school choice might seem like a harmless experiment, but—like Humpty Dumpty—if public schools fall, they will be hard to put back together again.

Should we sacrifice public schools for a perilous and untested market fantasy? We think the answer is No. □

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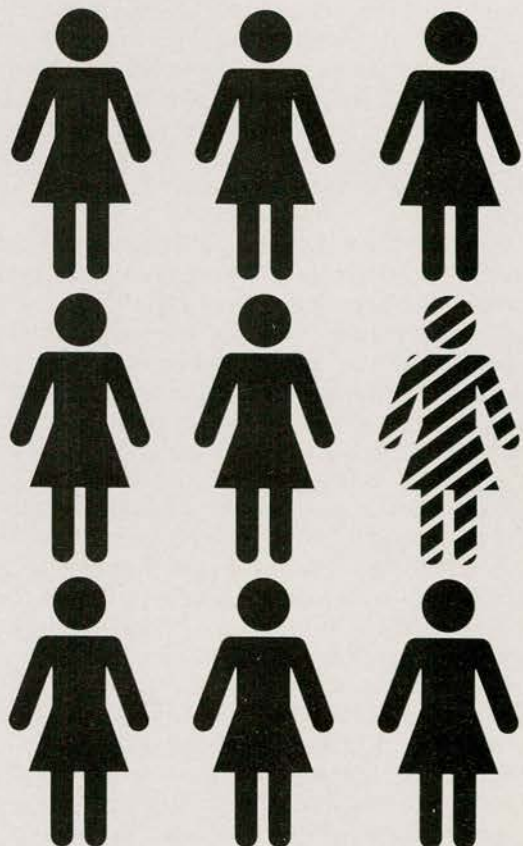
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## TEACHING FOR UNDERSTANDING

(Continued from page 8)

understanding amounts to a central element of any reasonable program of education. Moreover, once we pool insights from the worlds of research and from educational practice, we understand enough about both the nature of understanding and how people learn for understanding to support a concerted and committed effort to teach for understanding.

### WHY EDUCATE FOR UNDERSTANDING?

Knowledge and skill have traditionally been the mainstays of American education. We want students to be knowledgeable about history, science, geography, and so on. We want students to be skillful in the routines of arithmetic, the craft of writing, the use of foreign languages. Achieving this is not easy, but we work hard at it.

So with knowledge and skill deserving plenty of concern and getting plenty of attention, why pursue understanding? While there are several reasons, one stands out: Knowledge and skill in themselves do not guarantee understanding. People can acquire knowledge and routine skills without understanding their basis or when to use them. And, by and large, knowledge and skills that are not understood do students little good! What use can students make of the history or mathematics they have learned unless they have understood it?

In the long term, education must aim for active use of knowledge and skill (Perkins, 1992). Students garner knowledge and skill in schools so that they can put them to work—in professional roles—scientist, engineer, designer, doctor, businessperson, writer, artist, musician—and in lay roles—citizen, voter, parent—that require appreciation, understanding, and judgment. Yet rote knowledge generally defies active use, and routine skills often serve poorly because students do not understand when to use them. In short, we must teach for understanding in order to realize the long-term payoffs of education.

But maybe there is nothing that needs to be done. “If it ain’t broke, don’t fix it.” Perhaps students understand quite well the knowledge and skills they are acquiring.

Unfortunately, research says otherwise. For instance, studies of students’ understanding of science and mathematics reveal numerous and persistent shortfalls. Misconceptions in science range from youngsters’ confusions about whether the Earth is flat or in just what way it is round, to college students’ misconceptions about Newton’s laws (e.g., Clement, 1982, 1983; McCloskey, 1983; Nussbaum, 1985). Misunderstandings in mathematics include diverse “malrules,” where students overgeneralize rules for one operation and carry them over inappropriately to another; difficulties in the use of ratios and proportions; confusion about what algebraic equations really mean, and more (e.g., Behr, Lesh, Post, and Silver, 1983; Clement, Lochhead and Monk, 1981; Lochhead and Mestre, 1988; Resnick, 1987, 1992).

Although the humanistic subject matters might appear on the surface less subject to misunderstanding than the technically challenging science and mathematics, again research reveals that this is not true. For instance, studies of students’ reading abilities show that, while they

can read the words, they have difficulty interpreting and making inferences from what they have read. Studies of writing show that most students experience little success with formulating cogent viewpoints well-supported by arguments (National Assessment of Educational Progress, 1981). Indeed, students tend to write essays in a mode Bereiter and Scardamalia (1985) call “knowledge telling,” simply writing out paragraph by paragraph what they know about a topic rather than finding and expressing a viewpoint.

Examinations of students’ understanding of history reveal that they suffer from problems such as “presentism” and “localism” (Carretero, Pozo, and Asensio, 1989; Shelmit, 1980). For instance, students pondering Truman’s decision to drop the atomic bomb on Hiroshima often are severely critical because of more recent history. Suffering from “presentism,” they have difficulty projecting themselves into the era and pondering the issue in terms of what Truman knew at the time. Yet such shifts of perspective are essential for understanding history—and indeed for understanding other nations, cultures, and ethnic groups today. Moreover, Gardner (1991) argues that students’ understanding of the humanistic subject matters is plagued by a number of stereotypes—for instance those concerning racial, sexual, and ethnic identity—that amount to misunderstandings of the human condition in its variety.

So understanding is “broke” far more often than we can reasonably tolerate. Moreover, we can do something about it. The time is ripe. Cognitive science, educational psychology, and practical experience with teachers and students put us in a position to teach for understanding—and to teach teachers to teach for understanding (Gardner, 1991; Perkins, 1986, 1992). As the following sections argue, today, more than ever before, teaching for understanding is an approachable agenda for education.

### WHAT IS UNDERSTANDING?

At the heart of teaching for understanding lies a very basic question: What is understanding? Ponder this query for a moment and you will realize that good answers are not obvious. To draw a comparison, we all have a reasonable conception of what knowing is. When a student knows something, the student can bring it forth upon call—tell us the knowledge or demonstrate the skill. But understanding something is a more subtle matter. A student might be able to regurgitate reams of facts and demonstrate routine skills with very little understanding. Somehow, understanding goes beyond knowing. But how?

Clues can be found in this fantasy: Imagine a snowball fight in space. Half a dozen astronauts in free fall arrange themselves in a circle. Each has in hand a net bag full of snowballs. At the word “go” over their radios, each starts to fire snowballs at the other astronauts. What will happen? What is your prediction?

If you have some understanding of Newton’s theory of motion, you may predict that this snowball fight will not go very well. As the astronauts fire the snowballs, they will begin to move away from one another: Firing a snowball forward pushes an astronaut backward. Moreover,

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Ponder this query for a moment  
and you will realize that good  
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each astronaut who fires a snowball will start to spin with the very motion of firing, because the astronaut's arm that hurls the snowball is well away from the astronaut's center of gravity. It's unlikely that anyone would hit anyone else even on the first shot, because of starting to spin, and the astronauts would soon be too far from one another to have any chance at all. So much for snowball fights in space.

If making such predictions is a sign of understanding Newton's theory, what is understanding in general? My colleagues and I at the Harvard Graduate School of Education have analyzed the meaning of understanding as a concept. We have examined views of understanding in contemporary research and looked to the practices of teachers with a knack for teaching for understanding. We have formulated a conception of understanding consonant with these several sources. We call it a "performance perspective" on understanding. This perspective reflects the general spirit of "constructivism" prominent in contemporary theories of learning (Duffy and Jonassen, 1992) and offers a specific view of what learning for understanding involves. This perspective helps to clarify what understanding is and how to teach for understanding by making explicit what has been implicit and making general what has been phrased in more restricted ways (Gardner, 1991; Perkins, 1992).

In brief, this performance perspective says that understanding a topic of study is a matter of being able to perform in a variety of thought-demanding ways with the topic, for instance to: explain, muster evidence, find examples, generalize, apply concepts, analogize, represent in a new way, and so on. Suppose a student "knows" Newtonian physics: The student can write down equations and apply them to three or four routine types of textbook problems. In itself, this is not convincing evidence that the student really understands the theory. The student might simply be parroting the text and following memorized routines for stock problems. But suppose the student can make appropriate predictions about the snowball fight in space. This goes beyond just "knowing." Moreover, suppose the student can find new examples of Newton's theory at work in everyday experience (Why do football linemen need to be so big? So they will have high inertia.) and make other extrapolations. The more thought-demanding performances the student can display, the more confident we would be that the student understands.

In summary, understanding something is a matter of being able to carry out a variety of "performances" concerning the topic—performances like making predictions about the snowball fight in space that show one's understanding and, at the same time, advance it by encompassing new situations. We call such performances "understanding performances" or "performances of understanding."

Understanding performances contrast with what students spend most of their time doing. While understanding performances can be immensely varied, by definition they must be thought-demanding; they must take students beyond what they already know. Most classroom activities are too routine to be understanding performances—spelling drills, true-and-false quizzes, arithmetic exercises, many conventional essay questions, and so on. Such performances have their importance too, of

course. But they are not performances of understanding; hence they do not do much to build understanding.

## HOW CAN STUDENTS LEARN WITH UNDERSTANDING?

Given this performance perspective on understanding, how can students learn with understanding? An important step toward an answer comes from asking a related but different question: How do you learn to roller skate? Certainly not just by reading instructions and watching others, although these may help. Most centrally, you learn by skating. And, if you are a good learner, not just by idle skating, but by thoughtful skating where you pay attention to what you are doing—capitalize on your strengths, figure out (perhaps with the help of a coach) your weaknesses, and work on them.

It's the same with understanding. If understanding a topic means building up performances of understanding around that topic, the mainstay of learning for understanding must be actual engagement in those performances. The learners must spend the larger part of their time with activities that ask them to generalize, find new examples, carry out applications, and work through other understanding performances. And they must do so in a thoughtful way, with appropriate feedback to help them perform better.

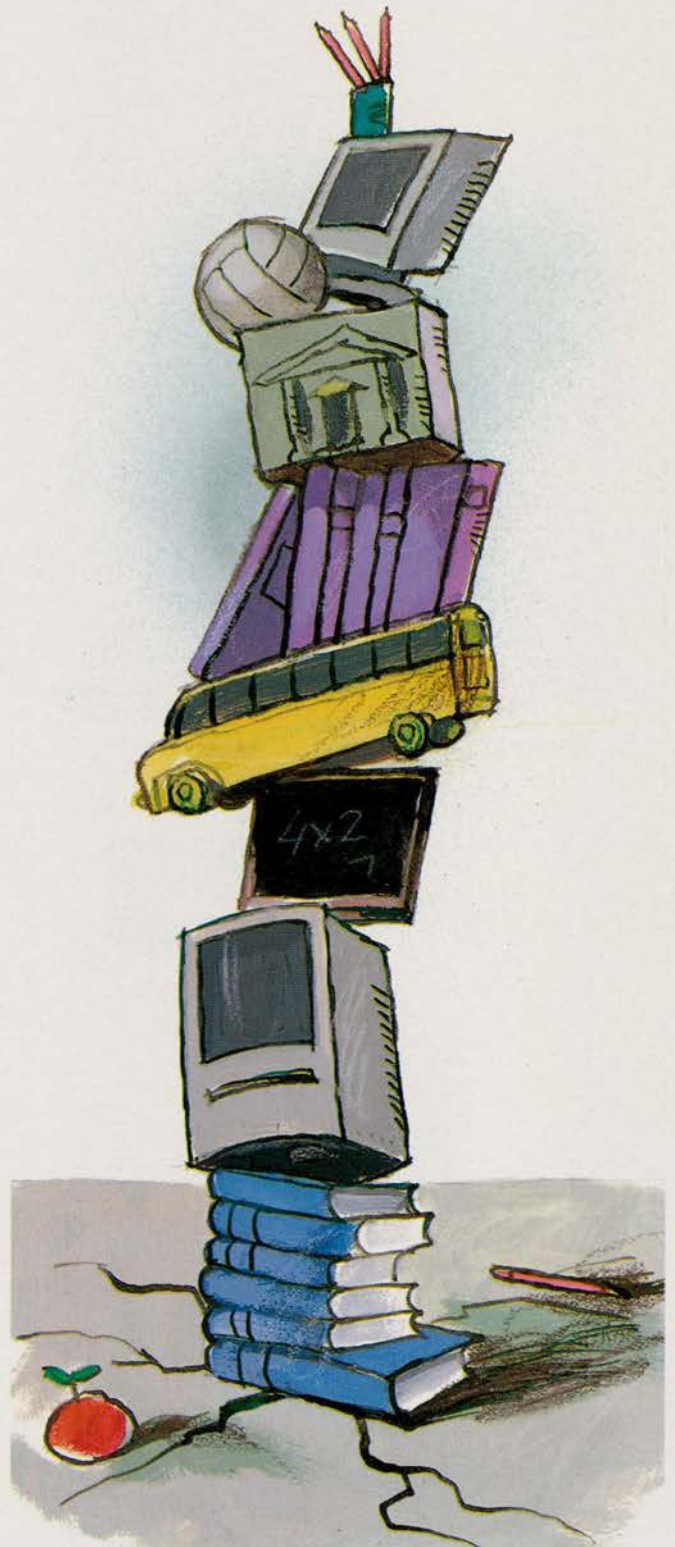
Notice how this performance view of learning for understanding contrasts with another view one might have. It's all too easy to conceive of learning with understanding as a matter of taking in information with clarity. If only one listens carefully enough, then one understands. But this idea of understanding as a matter of clarity simply will not work. Recall the example of Newton's theory of motion; you may listen carefully to the teacher and understand in the limited sense of following what the teacher says as the teacher says it. But this does not mean that you really understand in the more genuine sense of appreciating these implications for situations the teacher did not talk about. Learning for understanding requires not just taking in what you hear; it requires thinking in a number of ways with what you heard—practicing and debugging your thinking until you can make the right connections flexibly.

This becomes an especially urgent agenda when we think about how youngsters typically spend most of their school time and homework time. As noted earlier, most school activities are not understanding performances: They are one or another kind of knowledge building or routine skill building. Knowledge building and routine skill building are important. But, as argued earlier, if knowledge and skills are not understood, the student cannot make good use of them.

Moreover, when students do tackle understanding performances—interpreting a poem, designing an experiment, or tracking a theme through an historical period—there is often little guidance as to criteria, little feedback before the final product to help them make it better, or few occasions to stand back and reflect on their progress.

In summary, typical classrooms do not give a sufficient presence to thoughtful engagement in understanding performances. To get the understanding we want, we

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need to put understanding up front. And that means putting thoughtful engagement in performances of understanding up front!

## HOW CAN WE TEACH FOR UNDERSTANDING?

We've looked at learning for understanding from the standpoint of the learner. But what does learning for understanding mean from the standpoint of the teacher? What does teaching for understanding involve? While teaching for understanding is not terribly hard, it is not terribly easy, either. Teaching for understanding is not simply another way of teaching, just as manageable as the usual lecture-exercise-test method. It involves genuinely more intricate classroom choreography. To elaborate, here are six priorities for teachers who teach for understanding:

### 1. Make learning a long-term, thinking-centered process.

From the standpoint of the teacher, the message about performances of understanding boils down to this: Teaching is less about what the teacher does than about what the teacher gets the students to do. The teacher must arrange for the students to think with and about the ideas they are learning for an extended period of time, so that they learn their way around a topic. Unless students are thinking with and about the ideas they are learning for a while, they are not likely to build up a flexible repertoire of performances of understanding.

Imagine, if you will, a period of weeks or even months committed to some rich theme—the nature of life, the origin of revolutions, the art of mathematical modeling. Imagine a group of students engaged over time in a variety of understanding performances focused on that topic and a few chosen goals. The students face progressively more subtle but still accessible challenges. At the end there may be some culminating understanding performance such as an essay or an exhibition as in Theodore Sizer's (1984) concept of "essential schools." Such a long-term, thinking-centered process seems central to building students' understanding.

### 2. Provide for rich ongoing assessment.

I emphasized earlier that students need criteria, feedback, and opportunities for reflection in order to learn performances of understanding well. Traditionally, assessment comes at the end of a topic and focuses on grading and accountability. These are important functions that need to be honored in many contexts. But they do not serve students' immediate learning needs very well. To learn effectively, students need criteria, feedback, and opportunities for reflection from the beginning of any sequence of instruction (cf. Baron, 1990; Gifford and O'Connor, 1991; Perrone, 1991b).

This means that occasions of assessment should occur throughout the learning process from beginning to end. Sometimes they may involve feedback from the teacher, sometimes from peers, sometimes from students' self evaluation. Sometimes the teacher may give criteria, sometimes engage students in defining their own criteria. While there are many reasonable approaches to ongoing assessment, the constant factor is the frequent focus on criteria, feedback, and reflection throughout the

learning process.

### 3. Support learning with powerful representations.

Research shows that how information is represented can influence enormously how well that information supports understanding performances. For instance, Richard Mayer (1989) has demonstrated repeatedly that what he terms "conceptual models"—usually in the form of diagrams with accompanying story lines carefully crafted according to several principles—can help students to solve nonroutine problems that ask them to apply new ideas in unexpected ways. For another example, computer environments that show objects moving in frictionless Newtonian ways we rarely encounter in the world can help students understand what Newton's laws really say about the way objects move (White, 1984). For yet another example, well-chosen analogies often serve to illuminate concepts in science, history, English, and other domains (e.g. Brown, 1989; Clement, 1991; Royer and Cable, 1976).

Many of the conventional representations employed in schooling—for instance, formal dictionary definitions of concepts or formal notational representations as in Ohm's law,  $I = E/R$ —in themselves leave students confused or only narrowly informed (Perkins and Unger, in press). The teacher teaching for understanding needs to add more imagistic, intuitive, and evocative representations to support students' understanding performances. Besides supplying powerful representations, teachers can often ask students to construct their own representations, an understanding performance in itself.

### 4. Pay heed to developmental factors.

The theory devised by the seminal developmental psychologist Jean Piaget averred that children's understanding was limited by the general schemata they had evolved. For instance, children who had not attained "formal operations" would find certain concepts inaccessible—notions of control of variables and formal proof, for example (Inhelder and Piaget, 1958). Many student teachers today still learn this scheme and come to believe that fundamental aspects of reasoning and understanding are lost on children until late adolescence. They are unaware that 30 years of research have forced fundamental revisions in the Piagetian conception. Again and again, studies have shown that, under supportive conditions, children can understand much more than was thought much earlier than was thought.

The "neo-Piagetian" theories of Robbie Case (1985), Kurt Fischer (1980), and others offer a better picture of intellectual development. Understanding complex concepts may often depend on what Case calls a "central conceptual structure," i.e., certain patterns of quantitative organization, narrative structure, and more that cut across disciplines (Case, 1992). The right kind of instruction can help learners to attain these central conceptual structures. More broadly, considerable developmental research shows that complexity is a critical variable. For several reasons, younger children cannot readily understand concepts that involve two or three sources of variation at once, as in concepts such as balance, density, or pressure (Case, 1985, 1992; Fischer, 1980).

The picture of intellectual development emerging today is less constrained, more nuanced, and ultimately more optimistic regarding the prospects of education.

Teachers teaching for understanding do well to bear in mind factors like complexity, but without rigid conceptions of what students can and cannot learn at certain ages.

### 5. Induct students into the discipline.

Analyses of understanding emphasize that concepts and principles in a discipline are not understood in isolation (Perkins, 1992; Perkins and Simmons, 1988; Schwab, 1978). Grasping what a concept or principle means depends in considerable part on recognizing how it functions within the discipline. And this in turn requires developing a sense of how the discipline works as a system of thought. For example, all disciplines have ways of testing claims and mustering proof—but the way that's done is often quite different from discipline to discipline. In science, experiments can be conducted, but in history evidence must be mined from the historical record. In literature, we look to the text for evidence of an interpretation, but in mathematics we justify a theorem by formal deduction from the givens.

Conventional teaching introduces students to plenty of facts, concepts, and routines from a discipline such as mathematics, English, or history. But it typically does much less to awaken students to the way the discipline works—how one justifies, explains, solves problems, and manages inquiry within the discipline. Yet in just such patterns of thinking lie the performances of understanding that make up what it is to understand those facts, concepts, and routines in a rich and generative way. Accordingly, the teacher teaching for understanding needs to undertake an extended mission of explicit consciousness raising about the structure and logic of the disciplines taught.

### 6. Teach for transfer.

Research shows that very often students do not carry over facts and principles they acquire in one context into other contexts. They fail to use in science class or at the supermarket the math they learned in math class. They fail to apply the writing skills that they mastered in English on a history essay. Knowledge tends to get glued to the narrow circumstances of initial acquisition. If we want transfer of learning from students—and we certainly do, because we want them to be putting to work in diverse settings the understandings they acquire—we need to teach explicitly for transfer, helping students to make the connections they otherwise might not make, and helping them to cultivate mental habits of connection-making (Brown, 1989; Perkins and Salomon, 1988; Salomon and Perkins, 1989).

Teaching for transfer is an agenda closely allied to teaching for understanding. Indeed, an understanding performance virtually by definition requires a modicum of transfer, because it asks the learner to go beyond the information given, tackling some task of justification, explanation, example-finding or the like that reaches further than anything in the textbook or the lecture. Moreover, many understanding performances transcend the boundaries of the topic, the discipline, or the classroom—applying school math to stock market figures or perspectives on history to casting your vote in the current election. Teachers teaching for a full and rich understanding need to include understanding performances that reach well beyond the obvious and conventional boundaries of the topic.

Certainly much more can be said about the art and craft of teaching for understanding. However, this may suffice to make the case that plenty can be done. Teachers need not feel paralyzed for lack of means. On the contrary, a plethora of classroom moves suggest themselves in service of building students' understanding. The teacher who makes learning thinking-centered, arranges for rich ongoing assessment, supports learning with powerful representations, pays heed to developmental factors, inducts students into the disciplines taught, and teaches for transfer far and wide has mobilized a powerful *armamentum* for building students' understanding.

## WHAT SHOULD WE TEACH FOR UNDERSTANDING?

Much can be said about how to teach for understanding. But the "how" risks defining a hollow enterprise without dedicated attention to the "what"—what's most worth students' efforts to understand?

A while ago I found myself musing on this question: "When was the last time I solved a quadratic equation?" Not your everyday reminiscence, but a reasonable query for me. Mathematics figured prominently in my precollege education, I took a technical doctoral degree, I pursue the technical profession of cognitive psychology and education, and occasionally I use technical mathematics, mostly statistics. However, it's been a number of years since I've solved a quadratic equation.

My math teacher in high school—a very good teacher—spent significant time teaching me and the rest of the class about quadratic equations. Almost everyone I know today learned how to handle quadratic equations at some point. Yet most of these folks seem to have had little use for them lately. Most have probably forgotten what they once knew about them.

The problem is, for students not headed in certain technical directions, quadratic equations are a poor investment in understanding. And the problem is much larger than quadratic equations. A good deal of the typical curriculum does not connect—not to practical applications, nor to personal insights, nor to much of anything else. It's not the kind of knowledge that would connect. Or it's not taught in a way that would help learners to make connections. We suffer from a massive problem of "quadratic education."

What's needed is a connected rather than a disconnected curriculum, a curriculum full of knowledge of the right kind to connect richly to future insights and applications (Perkins, 1986; Perrone, 1991a). The great American philosopher and educator John Dewey (1916) had something like this in mind when he wrote of "generative knowledge." He wanted education to emphasize knowledge with rich ramifications in the lives of learners. Knowledge worth understanding.

## WHAT IS GENERATIVE KNOWLEDGE?

What does generative knowledge look like (cf. Perkins, 1986, 1992; Perrone, 1991a)? Consider a cluster of mathematics concepts rather different from quadratic equations. Consider probability and statistics. The conven-

***A good deal of the typical curriculum does not connect—not to practical applications, nor to personal insights, nor to much of anything else.***



tional precollege curriculum pays little attention to probability and statistics. Yet statistical information is commonplace in newspapers, magazines, and even newscasts. Probabilistic considerations figure in many common areas of life, for instance making informed decisions about medical treatment. The National Council of Teachers of Mathematics (1989) urges more attention to probability and statistics in the standards established a few years ago. Faced with a forced choice, one might do well to teach probability and statistics for understanding instead of quadratic equations for understanding. It's knowledge that connects!

Or for instance, early this year, the *Boston Globe* published a series on "the roots of ethnic hatred," the psychology and sociology of why ethnic groups from Northern Ireland to Bosnia to South Africa are so often and so persistently at one another's throats. It turns out that a good deal is known about the causes and dynamics of ethnic hatred. To teach social studies for understanding, one might teach about the roots of ethnic hatred instead of the French Revolution. Or one might teach the French Revolution through the lens of the roots of ethnic hatred. It's knowledge that connects!

## TAPPING TEACHERS' WISDOM

Where are ideas for the knowledge in this "connected curriculum" to come from? One rich source is teachers. In some recent meetings and workshops, my colleagues and I have been exploring with teachers some of their ideas about generative knowledge. The question was this: "What new topic could I teach, or what spin could I put on a topic I already teach, to make it genuinely generative? To offer something that connects richly to the subject matter, to youngsters' concerns, to recurring opportunities for insight or application?"

We heard some wonderful ideas. Here is a sample:

■ **What is a living thing?** Most of the universe is dead matter, with a few precious enclaves of life. But what is life in its essence? Are viruses alive? What about computer viruses (some argue that they are)? What about crystals? If they are not, why not?

■ **Civil disobedience.** This theme connects to adolescents' concerns with rules and justice, to episodes of civil disobedience in history and literature, and to one's role as a responsible citizen in a nation, community, or, for that matter, a school.

■ **RAP: ratio and proportion.** Research shows that many students have a poor grasp of this very central concept, a concept that, like statistics and probability, comes up all the time. Dull? Not necessarily. The teachers who suggested this pointed out many surprising situations where ratio and proportion enter—in poetry, music and musical notation, diet, sports statistics, and so on.

■ **Whose history?** It's been said that history gets written by the victors. This theme addresses point-blank how accounts of history get shaped by those who write it—the victors, sometimes the dissidents, and those with other special interests.

These examples drawn from teachers should persuade us that many teachers have excellent intuitions about generative knowledge.

## POWERFUL CONCEPTUAL SYSTEMS

It's important not to mix up generative knowledge with what's simply fun or doggedly practical. We might think of the most generative knowledge as a matter of powerful conceptual systems, systems of concepts and examples that yield insight and implications in many circumstances. Look back at the topics listed earlier. Yes, they can be read as particular pieces of subject matter knowledge. But every one also is a powerful conceptual system. Probability and statistics offer a window on chance and trends in the world; the roots of ethnic hatred reveal the dynamics of rivalry and prejudice at any level from neighborhoods to nations; the nature of life becomes a more and more central issue in this era of test-tube babies and recombinant DNA engineering; civil disobedience involves a subtle pattern of relations between law, justice, and responsibility; ratio and proportion are fundamental modes of description; the "whose history?" question basically deals with the central human phenomenon of point-of-view.

If much of what we taught highlighted powerful conceptual systems, there is every reason to think that youngsters would retain more, understand more, and use more of what they learned. In summary, teaching for understanding is much more than a matter of method—of engaging students in understanding performances with frequent rich feedback, powerful representations, and so on. Besides method, it is also a matter of content—thoughtful selection of content that proves genuinely generative for students. If we teach within and across subject matters in ways that highlight powerful conceptual systems, we will have a "connected curriculum"—one that equips and empowers learners for the complex and challenging future they face.

## WHAT NEEDS TO BE DONE?

At the outset, I called teaching for understanding an apple for education. It's the apple, I've argued, that education needs. The apple of course is the traditional Judeo-Christian symbol of knowledge and understanding. It was Eden's apple that got us into trouble in the first place, and the trouble with apples continues. Our efforts to serve up to students the apple of plain old knowledge seems to be serving them poorly.

What it all comes down to is this. Schools are providing the wrong apple. The apple of knowledge is not the apple that truly nourishes. What we need is the apple of understanding (which of course includes the requisite knowledge).

So what should be done? What does it take to organize education around the apple of understanding rather than the apple of knowledge? What energies must we muster in what direction to move toward a more committed and pervasive pedagogy of understanding?

Although the problem is complex, we have been exploring pathways toward such a pedagogy in collaboration with a number of teachers. An early discovery encouraged our efforts. We found that nearly every teacher could testify to the importance of the goal. Teachers are all too aware that their students often do not under-

stand key concepts in science, periods of history, works of literature, and so on, nearly as well as they might. And most teachers are concerned about teaching for understanding. They strive to explain clearly. They look for opportunities to clarify. From time to time, they pose open-ended tasks such as planning an experiment, interpreting a poem, or critiquing television commercials that call for and build understanding.

Our teacher colleagues also helped us to realize that, in most settings, understanding was only one of many agendas. While concerned about teaching for understanding, most teachers distribute their effort more or less evenly over that and a number of other objectives. Relatedly, the institutions within which teachers work and the tests they prepare their students for often offer little support for the enterprise of teaching for understanding. In other words, as Theodore Sizer and many others have urged in recent years, better education calls for a simplification of agendas and a deepened emphasis on understanding (Sizer, 1984). This in turn demands some restructuring of priorities (as expressed by school boards, parents, and mandated tests) and of schedules and curricula that work against teaching for understanding.

Finally, our teacher colleagues help us see that teaching for understanding in a concerted and committed way calls for a depth of technique that most teachers' initial training and ensuing experiences have not provided. Thinking of instruction in terms of performances of understanding, arranging ongoing assessment, tapping the potential of powerful representations—these have a very limited presence in preservice and in-service teacher development. So a second strand of any effort to make a pedagogy of understanding real must be to help teachers acquire such techniques.

Fortunately, many teachers are already far along the way toward teaching for understanding, without any help from cognitive psychologists or educational researchers. Indeed, some of our most interesting work on teaching for understanding has been with teachers who already do much of what the framework that we are developing advocates. They are pleased to find that the framework validates their work. And they tell us that the framework gives them a more precise language and philosophy. It helps them to deepen their commitment and sharpen the focus of their efforts.

Frankly, we should all be suspicious if the kind of teaching advocated under the banner of teaching for understanding came as a surprise to most teachers. Instead it should look familiar, a bigger and juicier apple: "Yes, that's the kind of teaching I like to do—and sometimes do." Teaching for understanding does not aim at radical burn-the-bridges innovation, just more and better versions of the best we usually see. □

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## LETTERS

(Continued from page 7)

out of the curriculum to such an extent that any talk of values is suspect.

—REBECCA O'HERRON  
NEWBURGH, NEW YORK

I am writing to express my concern about your selection of "great books" from William Kilpatrick's larger list (Summer 1993). In particular, I find the books you suggest for young readers to reinforce sexism and sex-role stereotypes. Surely there are better books for young readers than *Beauty and the Beast* and *Little House in the Big Woods*.

In the past I have been pleased with the gender and cultural inclusiveness of your magazine, and I realize that in compiling your list you may have been limited in working from Kilpatrick's list. In addition, your other selections for middle readers and older readers are well chosen. Thus I am surprised and disappointed at your lack of innovation and thoughtfulness in choosing for the younger, perhaps most impressionable, group.

Taken individually *Beauty and the Beast* and *Little House in the Big Woods* are enjoyable tales. However, one should be careful about labeling any book "great" if it places the female protagonist in an abusive relationship that is portrayed as romantic, as *Beauty and the Beast* does. In a society where most violence against women is perpetrated by someone they are married to or romantically involved with, the last thing we should tell our daughters and students is that love can change the beast who imprisons a woman. Most women are trapped in their abusive relationships by that fallacy.

Similarly, I believe that while Laura Ingalls Wilder is an endearing heroine, there are better books for young people to read that portray girls and women who do not have to act within roles defined by male society.

Please be aware that many educators turn to you as an authority. You must be especially scrupulous of the messages you send the teachers of our children.

—DANA AMDAHL  
ALBANY, MINNESOTA

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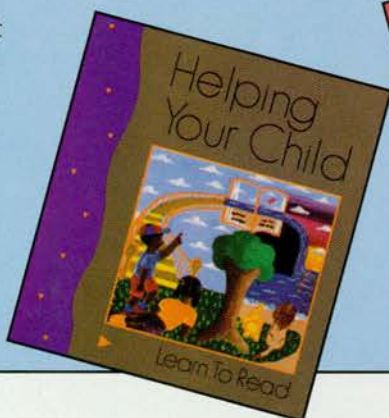
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