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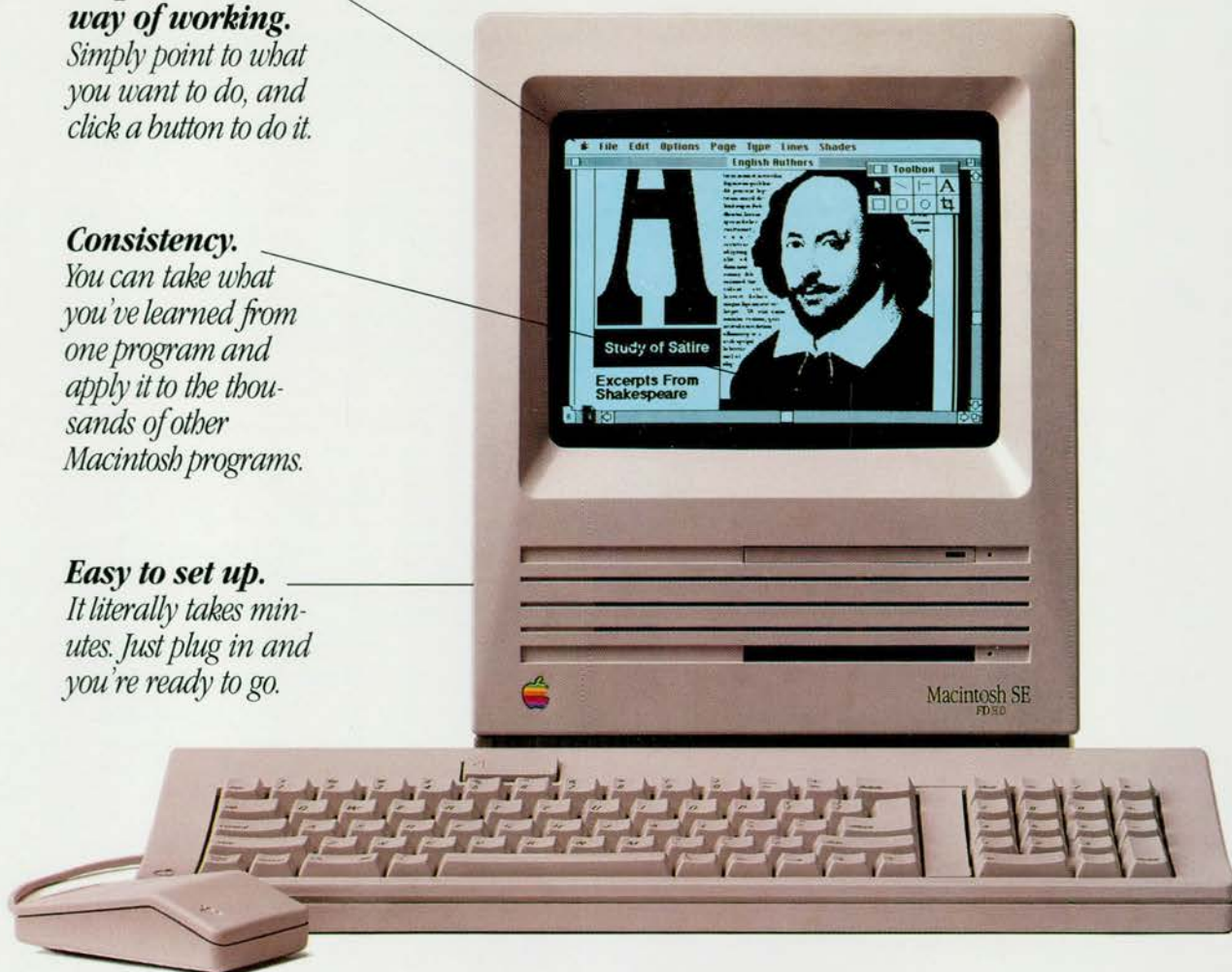
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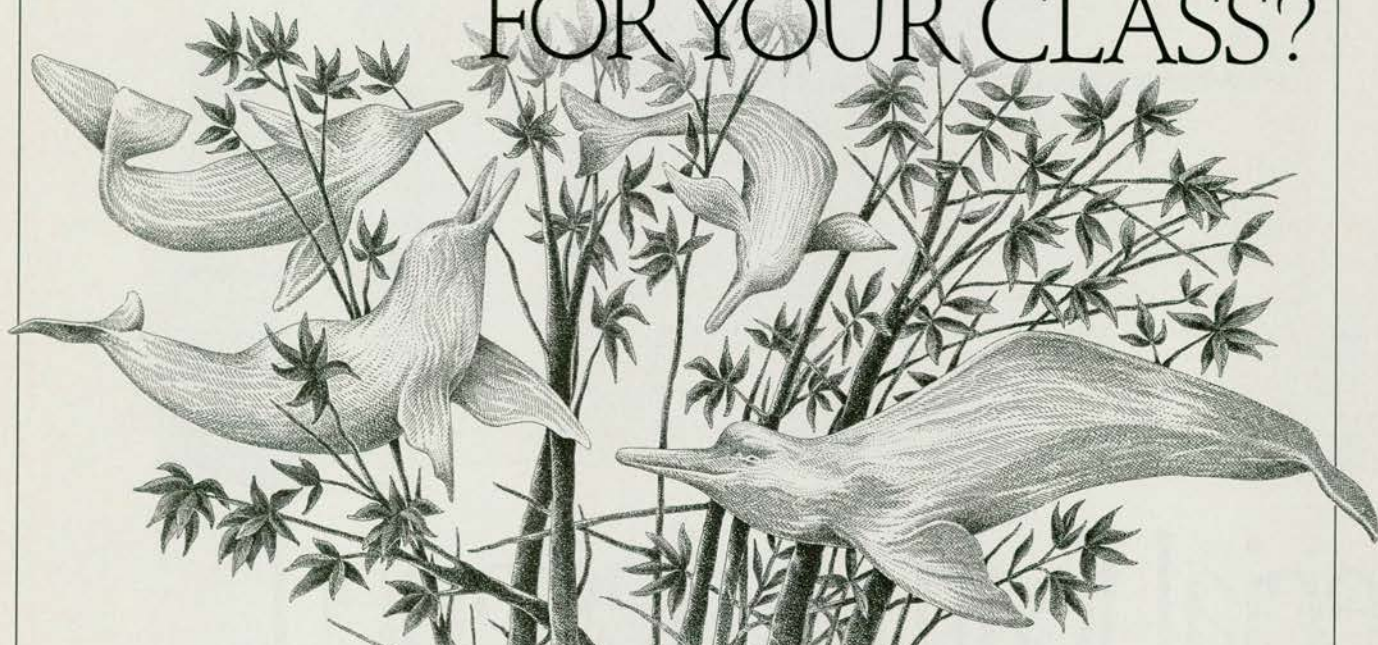
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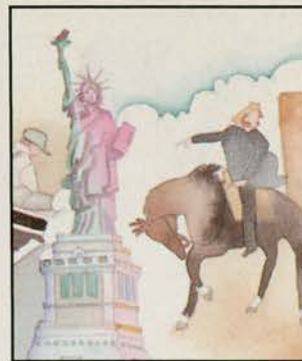
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WHAT IF GOOD JOBS DEPENDED ON GOOD GRADES? 10

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What would happen if the work-bound students at your school knew that the best jobs in town would go to those whose effort and achievement in high school were the strongest? The author considers how we might spark student motivation—and increase teacher authority—by linking grades directly to jobs.

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Everyone seems to agree that science education has to move away from its over-reliance on didactic instruction and the memorization of facts. But proposals that students "do" more science by becoming comfortable with the skills of scientific inquiry, or that the science curriculum be chosen for its "relevance" to students' lives may both fail to improve students' conceptual understanding of scientific phenomena.

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Teachers who are committed to the idea of a "high-track" education for all children but who nonetheless feel overwhelmed by the unpreparedness of many of the students who enter their classrooms will be cheered and inspired by this teacher's account of how she introduced her students to Shakespeare.

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When Solidarity was illegal and Poland was under martial law, teacher Wiktor Kulerski ran Solidarity's Warsaw region and helped organize Teachers Solidarity. Now, with Solidarity sharing government power, he and colleague Andrzej Janowski discuss what needs to be done—especially in education—to transform Communist Poland into democratic Poland.

HISTORY IS FOR CHILDREN 34

By Charlotte Crabtree

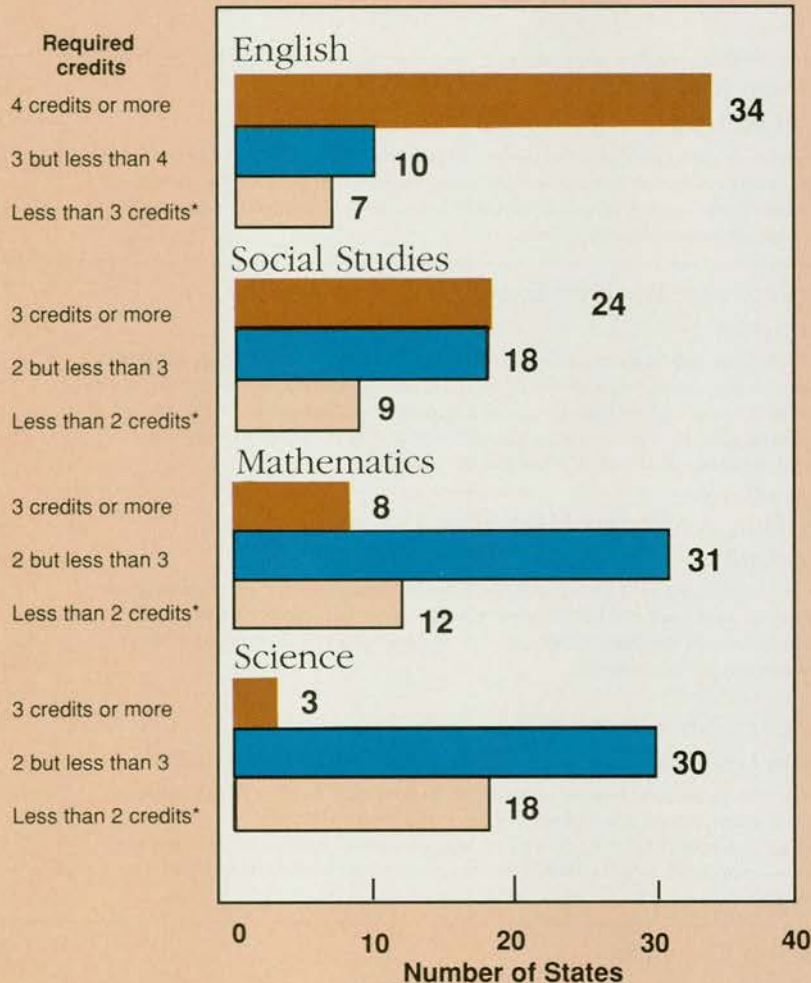
The traditional K-3 social studies curriculum—in which children study their home, their family, and their neighborhood—is a bore. And it's not developmentally desirable either. History, taught at the the right level with the right methods, is a better choice.

NOTEBOOK

How Do Your State's Graduation Requirements Compare?

In 1983, the "Nation at Risk" report called for every school to require its students to complete a minimum of four years of English and three each of mathematics, science, and social studies. Here's how things stood by the spring of 1988.

Number of course credits required by states for high school graduation, selected subjects: 1988



*Includes those states with no requirements in the subject.



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SOURCE: Council of Chief State School Officers, 1988 Policies and Practices Questionnaire, from *The Condition of Education 1989, Volume 1*, U.S. Department of Education

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LETTERS

MORE ON GLOBAL ED/CHINA

André Ryerson's hard-hitting critique of pre-collegiate educational materials on China ("China's Untold Story," Fall 1989) reminded me of a warning (was it from *The Talmud* or Kurt Vonnegut?) to "be careful of what you want; you might get it."

We badly need improved pre-collegiate world education texts, curricula, and teacher training opportunities. They are essential keys to a more competent American public, one able to help make progress toward a world that resolves international conflict without war.

Global education, peace education, and nuclear age education materials are now present in many school systems. How disappointing that so few of them are animated by Ryerson's standard: materials firmly based on the ideals of freedom and democracy "on which our society rests and to which people everywhere aspire."

The *American Educator's* evaluation of China texts will be welcomed by all who share that goal and want to see it made visible in international education materials. The old problem was that not enough attention was paid to introducing American students to those world affairs that will deeply influence their vocations and their responsibilities as citizens. The current need is to ensure *quality* education, which does not in its eagerness to avoid ethnocentric attitudes distort reality and leave an *acentric* residue.

Good global education would strengthen students' understanding of and commitments to their own political community even as it taught world realities and about our duties that transcend our borders.

Congratulations to the American Federation of Teachers for your steady contributions to that goal.

—ROBERT PICKUS
President
World Without War Council

André Ryerson's essay, "China's Untold Story," is not only a strong one, but most importantly, it is also a righteous one.

The question raised has a much greater influence than on just the students. It provides the soil for the growth of hypocritical Sinology and double standards on human rights in U.S. foreign policy.

Since distorted facts on China were given to the schoolchildren, they will grow up as adults who do not really know the reality in China. As a result, nobody will question the absurd thinking of some Sinologists. John K. Fairbank, probably the most well-known "expert" on China (unfortunately!), once said, "The Maoist revolution is, on the whole, the best thing that has happened to the Chinese people in many centuries." Fairbank also claims that a group-oriented society such as China does not necessarily need human rights as the Western world does. Nobody challenges Fairbank because nobody knows the truth.

The U.S. government is very harsh toward the Soviet Union and Eastern Europe for their human rights violations. However, the U.S. government has another set of standards for China. The violation of human rights in China are not always criticized or even mentioned at all.

All of this can happen when most of the people in the U.S. do not know the reality. Unfortunately, with so many distorted facts in the textbooks, the situation will worsen.

—KIN-MING LIU

The writer is a student at the University of Montana

There is little one can add to André Ryerson's overview of the suppression of democracy in China and the distorted view of that society American students get from many textbooks. As Mr. Ryerson correctly points out, the Chinese Communist Party (CCP) under Deng Xiaoping did institute a number of economic reforms, but it maintained firm control over political and social life.

Under Deng, the CCP institu-

tionalized repressive measures, dealt ruthlessly with dissidents, independent publishers, and free-thinking intellectuals who deviated from the party line, and, something not mentioned by Mr. Ryerson, relentlessly persecuted religious believers.

The Deng years were marked by repressions against the estimated 20 million to 50 million Chinese Christians and Tibetan Buddhists. For the CCP, Christians are viewed as agents of foreign influence and must belong to two official organizations, the Protestant Three-Self Patriotic Movement (TSPM) and the Chinese Catholic Patriotic Association (CCPA). Unofficial churches functioning outside government control were routinely persecuted. In the 1980s, many priests—most of them elderly and who had served long labor camp terms in the 1950s-1970s—were arrested. In 1981, 83-year-old former Bishop of Shanghai, Gon Pinmei, who had been imprisoned for nearly 30 years, and at least 10 elderly Roman Catholic priests in that city were arrested. Four of them were known to have been tried in early 1983 and were given sentences of 11 to 15 years' imprisonment, which, given their ages, amounted to a death sentence. That year, some 90 Christian religious leaders were arrested throughout China. Thirty-two Tibetans were also arrested for trying to rebuild a monastery destroyed during the Cultural Revolution.

Religious persecution was not just limited to arrests. In April 1989, an estimated 2,000 to 5,000 uniformed and plainclothes police entered the village of Youtong in Hebei province, the center for the unofficial Catholic church. In the 10-hour raid, 300 villagers were injured, 30 arrested, and 10 reportedly killed. The raid was ordered after the congregation defied the CCPA and held unauthorized masses.

For those of us familiar with Deng's tenure and his record of repression, last summer's massacre at Tiananmen Square came as no sur-

(Continued on page 44)

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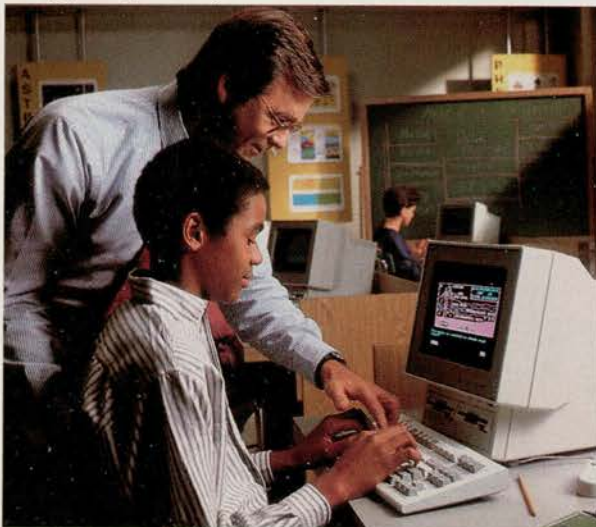
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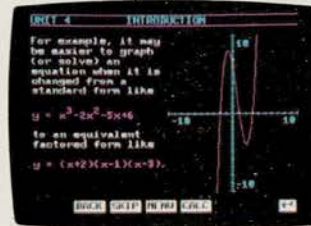
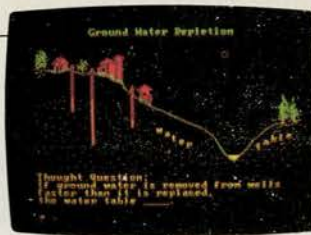
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WHAT IF GOOD JOBS DEPENDDED ON GOOD GRADES?

BY JAMES E. ROSENBAUM*

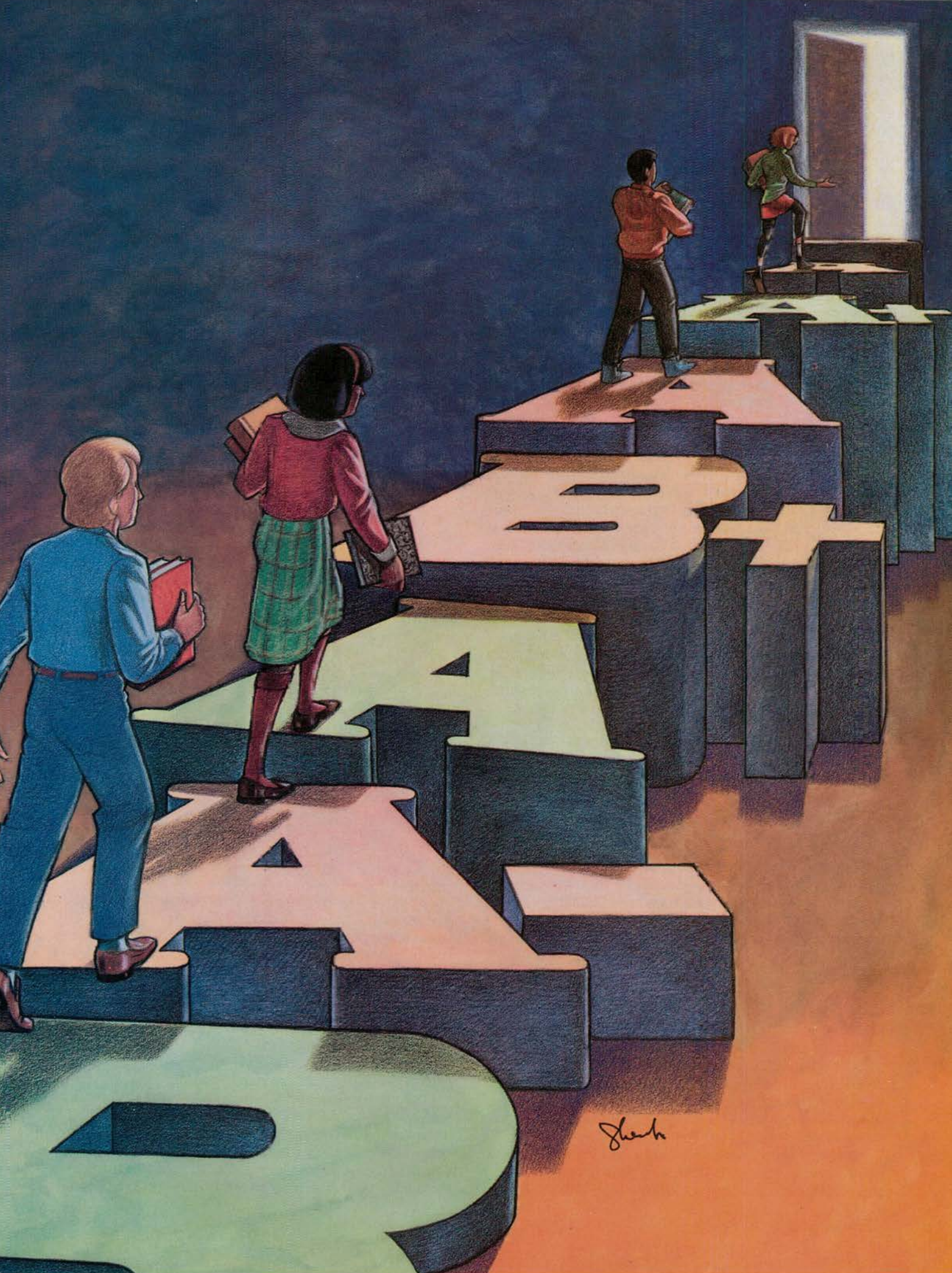
A CRISIS is emerging in the American labor market. Students are graduating from high school with poor basic skills in reading, writing, and mathematics, and employers are so concerned that they are spending a billion dollars a year in basic skills education for their workers. Through the 1990s, these problems will become more serious because the number of youth is shrinking while demand is projected to increase, particularly in jobs requiring the higher skills that youth lack. As one analyst described the double-edged nature of the problem, "Unless workforce basic skills are raised substantially, and quickly, we shall have more

James E. Rosenbaum is a professor of sociology, education, and social policy at Northwestern University. He has written books and many articles on high school tracking and on careers in corporations, and he is now conducting research on ways to improve the transition from high school to work.

joblessness among the least skilled, accompanied by a chronic shortage of workers with advanced skills."¹ Many business and labor groups foresee "labor market disruptions" for some sectors of the economy. The projected labor shortage suggests that we can no longer afford such serious educational failure, nor can we squander new high school graduates in long periods of unemployment and aimless job turnover.

Over the past several years, numerous national commissions have called for schools to improve achievement with longer school days, longer school years, and increased standards for curricula, graduation, and teachers. However, these recommendations have two shortcomings. First, they focus too narrowly on symp-

*Many of the ideas presented here were developed in my work with Takehiko Kariya of the Japanese Institute of Multimedia Education in Tokyo, and our collaboration contributed a great deal to my thoughts on this topic. Of course, I am responsible for the opinions expressed here.



Shank

toms while ignoring the motivation problems that cause poor achievement. Reforms that compel students to spend more hours in school still cannot compel them to exert effort. Like pushing on string, increased hours and demands are ineffective if students ignore teachers' assignments. The commissions have offered no ideas about how to improve motivation.

Second, the commissions focus too narrowly on schools. Schools cannot solve workforce problems alone—they need employers' help. Ironically, while employers blame schools for poor student achievement, they don't consider how changing their own hiring practices could help schools motivate students. There have been thousands of school-employer partnerships, but few have made use of a critical reality: Employers control the most important incentive for work-bound youngsters—access to jobs. In this article, I argue that if a clear link were made between jobs and school performance, if hiring were based on teachers' evaluations of students' achievement and students' efforts, we would greatly strengthen the weakened position teachers now find themselves in, and we would give students a clear incentive to work hard in school.

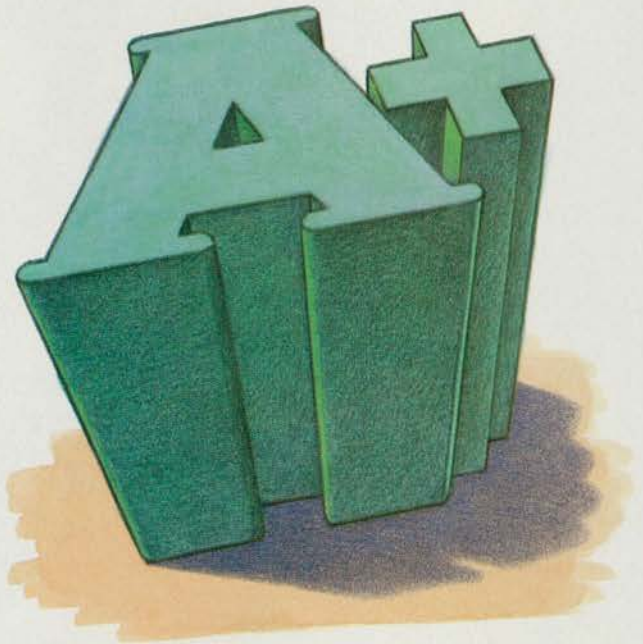
In developing this idea, I will also describe another system very different from ours: Japan's. Japanese employers offer jobs to schools, ask teachers to nominate students based on achievement, and promise to hire many of these students. This article considers how Japan's system works, how employers, teachers, and students benefit, what sacrifices it requires, what prevents abuses and favoritism, and whether aspects of this system would be desirable and applicable in the U.S. My aim in describing the Japanese model is not to suggest we adopt it wholesale but to help us understand a system that we have trouble even imagining. But first, let us look at the American system and what outcomes arise from it.

WITH NATIONAL commissions decrying youth's poor skills and employers spending a billion dollars a year on remedial employee classes in reading, writing, and math, do employers hire applicants based on their school performance? Surprisingly, they do not. In fact, grades, test scores, and other school information have little effect on unemployment, earnings, or the jobs graduates get after high school.²

Why don't grades and test scores influence hiring? Sometimes the fault is with high schools, which fail to send transcripts to employers. However, even when they get grades, many employers don't care about them. In a large survey, employers report that grades are important for hiring college graduates but not for hiring high school graduates, and another study found that most employers don't even request school transcripts.³ One employer actually refused to consider applicants with high grades because of a concern that these individuals would lack social skills. Even when school experience was considered, it wasn't necessarily academic. A bank personnel officer reported that he sought people with social skills, and extracurricular activities were more important than grades.

Although employers don't value grades as signals of productivity, research indicates that they should. In actual practice, youth with better high school grades

When students see that grades don't affect the jobs they will get, teacher authority is crippled.



are more productive workers from the outset, and, after five to ten years of working, they generally receive higher wages.⁴ Apparently, employers eventually reward good grades, but they don't seem aware of the value of grades when they are hiring.

Why don't employers value grades? One reason is that many employers have done better at work than they did at school, so their own experience tells them that school grades don't predict work success. In addition, some report that the abbreviations, course descriptions, and grades on transcripts are hard to understand.

Perhaps the major reason is employers' mistrust of youth. Many employers don't hire any new high school graduates—no matter how exemplary their school record—into stable jobs because they think they are too young and unreliable. They prefer to hire adults twenty-five to thirty-five, who are ready to settle down. Some

corporations, including ones represented on the commissions decrying students' academic skills, have policies against hiring applicants under age twenty-five for full-time jobs.

This strategy may have a short-term logic: Recent graduates may have worse basic skills and work habits than twenty-five-year-olds. However, employers would gain by taking a long-term view. If they hired recent graduates with better grades, students would have incentives to work in school, recent graduates would have better skills and work habits than they now do, and so would twenty-five-year-olds. While employers can get more mature workers by hiring twenty-five-year-olds, they cannot avoid getting the products of this poor incentive system. Moreover, by waiting until applicants reach age twenty-five, employers will have more difficulty assessing academic skills. This may explain why grades (obtained seven years earlier) don't affect hiring for better jobs, since this information is pretty old by the time employers are hiring twenty-five-year-olds.

SINCE EMPLOYERS ignore grades, it is not surprising that many work-bound students lack motivation to improve them. While some students work hard in school because of personal standards or parental pressure or real interest in a particular subject, students who lack these motivations have little incentive since schoolwork doesn't affect the jobs they will get after graduation, and it is difficult for them to see how it could affect job possibilities ten years later.

The consequences are far reaching. In every Gallup poll over the past nineteen years, parents identified discipline as one of the top problems in public schools. More intense studies reach similar conclusions: Students, teachers, and parents all rate lack of student interest, student misbehavior, and drug and alcohol use as the three greatest high school problems. Many kinds of motivation and discipline problems are widespread: absenteeism, class cutting, tardiness, disruptive behavior, verbal abuse, failure to do homework assignments, and substance abuse.⁵

An inventory of problems does not capture their full implications for classroom life. The motivation and discipline problems of a few students can affect a whole class. Even if only a few students are absent in a day, different students are absent each day, so teachers must keep backtracking to help each day's absentees catch up. Even passive student disinterest can interfere with the entire class as teachers adjust to keep most students following. Thus, work-bound students' lack of incentives undermines the overall sense of purpose in classrooms.

While employers ask why teachers don't exert their authority in the classroom, they unwittingly undermine teachers' authority over work-bound students. Grades are the main direct sanction that teachers control. When students see that grades don't affect the jobs they will get, teacher authority is severely crippled. With their authority undermined, teachers still must come to terms with these students. How do teachers respond?

Like lion tamers without a whip, teachers reduce their demands. As long as they are in the same classroom, they must reach an accommodation, and with limited bargaining power, teachers compromise their

expectations. Teachers make an implicit bargain with students in which they demand little of students if students will demand little from them: "In most high schools there exists a complex, tacit conspiracy to avoid sustained, rigorous, demanding basic inquiry."⁶ As a high school senior reported, "As long as I don't cause too many hassles for teachers, they will let me get by and graduate."⁷

This bargain mostly affects work-bound students. Standards for college-bound students—at least those who aspire to selective colleges—are not greatly reduced because selective colleges penalize schools and students with low achievement. Colleges also give teachers authority to evaluate students and give schools incentives to devote resources (better books, teachers, and laboratories) to college-bound students. In contrast, work-bound students can bargain with teachers to reduce standards because employers don't have standards, other than the requirement that an applicant possess a high school diploma. Employers let schools offer low standards and few resources to work-bound students. If employers were linked with schools as colleges are and if they had hiring standards, as selective colleges have admissions standards, then they could have similar influence.

Of course, teachers still control diplomas, which students need to get jobs. However, all-or-nothing rewards like diplomas can only encourage students to satisfy minimum requirements, and failure is not a credible threat against what Theodore Sizer has described as a "common front of [student] uninterest," since teachers cannot fail all students if performances are "uniformly shoddy."⁸ Moreover, teachers are unlikely to fight to maintain standards for work-bound students when employers don't care enough to use grades for hiring.

Incremental rewards like grades are far more effective at motivating people than all-or-nothing rewards, but not if they don't affect valued outcomes. The motivation and discipline problems of work-bound students indicate how ineffective grades currently are.

IN THE 1920s, Japan had a serious shortage of skilled workers at a time of mass unemployment. Several policies were tried to create a better-trained workforce over the next several decades. Many were failures, and even in the 1950s, "Made in Japan" signified inferior production. Yet, today, there is much talk of the superiority of the Japanese system, along with enormous concern that the U.S. cannot catch up. Japanese youth excel in academic achievement and productivity. Some attribute Japan's success to its culture, which the U.S. cannot easily duplicate. But Japan's culture has not greatly changed over this period, while its practices have, so its practices, not its culture, are likely to explain Japan's great success at training work-bound youth.

Japan implemented a system in which high schools are much more involved in allocating students into the labor force than American schools. America and Japan have similar proportions of high school graduates who directly enter the workforce (about 40 percent). But, while American high schools help only 10 percent of these students to find jobs, Japanese high schools help over 75 percent secure employment.

Japanese high schools don't just give advice; they

provide access to jobs. Schools have long-standing relationships with certain employers who offer the same number of jobs to a school each year and expect schools to nominate seniors of dependable quality for those jobs. These employers expect schools to nominate students with better grades for better jobs.

Homeroom teachers advise students' choices and allow them to apply for the school's nomination if their choices are appropriate. A committee of teachers then nominates and ranks students for job openings, which permits students to apply to an employer. These employers cannot choose among all interested students, only those selected by teachers, and students cannot apply to these employers without the school's nomination. Thus, youth compete for jobs before entering the labor market, and teachers make the first selections.⁹

This system should increase teachers' authority over students' jobs if it works as the policy claims. However, like U.S. employers, Japanese employers are uncomfortable relinquishing their influence over hiring. Indeed, 99.7 percent conduct job interviews for high school graduates, and 48.6 percent expressed reservations about letting schools restrict their choices for hiring students. Therefore, we must wonder how often employers ignore teachers' nominations.

Similarly, the policy expects teachers to base selections on students' achievement. Like American teachers, however, Japanese teachers are ambivalent about a heavy reliance on grades. They know students as whole people, and they want to take account of all aspects of students' capabilities and character. We must wonder to what extent teachers nominate students based on academic achievement and to what extent they select favored students or reward cooperative behavior.

In fact, research findings are reassuring on both points. Despite their qualms, employers do accept teachers' nominations to a very large extent. Employers sometimes even hire students they don't want because they don't want to hurt their relations with schools. Even in recessions when they don't need new workers, employers still try to maintain their links with schools by hiring some graduates from these schools (although they may reduce the numbers hired). These undesired hirings are a price employers pay to preserve stable sources of recruits of dependable quality. These temporary costs are regarded as investments in the relationship, not as expenses.

The amount of control Japanese employers delegate is considerable. Employers hire over 81 percent of applicants when they are first nominated, and, of those rejected, over 84 percent are hired by the second firm to which they are nominated. Fewer than 3 percent of all students had to apply to three or more employers. Since some students apply with weak school rankings, schools' influence is probably even stronger than these numbers imply.

Similarly, despite their qualms about grades, teachers do use grades as the primary criterion for nominating students. Teachers report that they feel constrained to use grades in order to maintain their relations with employers. Indeed, 47.5 percent of schools don't recommend students with substandard grades, even if that

means they don't fill their quota of jobs. Moreover, analyzing the jobs students actually get after graduation, we find that grades are the strongest determinant of who gets desirable jobs, while department, attendance, and tardiness have little influence.¹⁰

Skeptics might wonder whether linkages let schools abuse their special influence to relax meritocratic standards and recommend favored students with lower grades. Our results find the opposite. Grades are *more* important for getting good jobs with *linked* employers than they are with *nonlinked* employers. Rather than lowering requirements, schools hold youth to even more stringent achievement standards for the desirable jobs in linked firms.

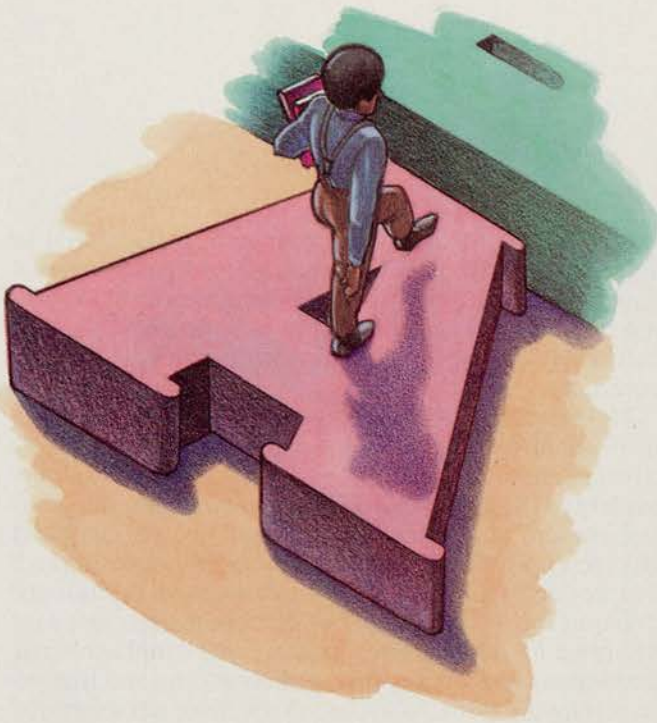
Maintaining these relationships is crucial to a school's success in placing its graduates in jobs and to an employer's success in recruiting capable employees on a continuing basis. As a teacher said, "Getting jobs is only a one-time experience for individual students, but it is repeated year after year for schools." Every hiring decision reaffirms the mutual commitment of the school and employer to each other. Schools must select students who satisfy employers in order to keep on receiving their job allocations in the future, and employers must continue hiring a school's graduates in order to keep on receiving a stable source of employees of dependable quality. Deviations from their agreed standards would jeopardize their relationship, so these standards are stable, dependable, and difficult to circumvent.

IN COMPARISONS of different societies, it is hard to be certain which factors cause outcomes. For instance, it is clear that Japanese students work harder than Americans, but it is not clear why. In *More Like Us*, James Fallows (1989) argues that cultural differences are responsible: Japanese people strive for effort for its own sake, while Americans exert effort for the sake of rewards. The cultural view, however, ignores the rewards Japanese high schools offer: Japanese students might work hard if they didn't have incentives, but they don't have to make that choice, since their efforts are well rewarded.

The strong incentives in the Japanese system surely contribute to the greater efforts by Japanese students. Moreover, if one accepts the cultural view that Americans are more motivated by rewards, incentives like those in Japan would have even greater effects on American students' motivation, compared with the current American system that offers no incentives to work-bound students.

The superior efforts of Japanese students pay off in higher achievement. At a time when American achievement scores have declined and rank poorly in international comparisons, Japanese scores are at or near the top in most comparisons.¹¹ The Japanese advantage is not for top achieving students; they do about as well as their American peers. The Japanese advantage is for students in the bottom half of the class, who have much higher achievement than comparable students in other countries. Japan's incentives for work-bound students, which are stronger than in any other developed country, undoubtedly affect the achievement of these students.

Japanese high schools don't just give advice; they provide access to jobs.



The Japanese system also contributes to more realistic aspirations. It tells work-bound students what they must do to get better jobs and how well they are doing. Every year students can look at their grades; if they are too low, they can either revise their job aspirations or increase their efforts. One consequence is that Japanese students' job aspirations become more realistic over the course of junior and senior high school and are highly realistic by senior year, while American high school seniors often have unrealistic aspirations.¹²

Linkages also make work entry less difficult in Japan than in the U.S. Of high school graduates not attending college, almost all Japanese students (99.5 percent) start working immediately after graduation. In contrast, only 49.4 percent of American graduates have jobs by graduation, and most (58.3 percent) of these are only continuing the part-time jobs they had in high school.¹³

Finally, since Japanese linkages produce such high achieving youth and give employers dependable information about applicants, they may contribute to employers' willingness to invest in young employees and to give them training for more skilled positions.

AMERICANS ARE suspicious of linkages between public schools and employers. Employers worry that exclusive links will prevent them from getting the best applicants from the entire labor market. School staff often worry that links give employers excessive influence over public schools.

Although high school counselors sometimes recommend their best students to a few local employers, they don't do this often, and they don't publicize these relationships. Counselors are not sure if they should be helping employers, which employers they should help, or which employers should get the best students. There are no professional guidelines on these issues. As a result, these linkages tend to be secretive, and they don't affect student motivation since students don't know about them.¹⁴

Better examples of how linkages can work in the U.S. can be seen in private schools, since they are not subject to concerns about using public resources for the private interests of employers. For instance, top-rated graduate schools of management often have strong linkages with employers, in which the same employers regularly recruit similar numbers of graduates every year.¹⁵ While employers ignore grades of high school graduates, MBA students with the best grades get the best jobs and the best pay. Students are aware of this selection criterion, and they work very hard to earn good grades.

Postsecondary vocational and technical schools also have linkages with employers. These schools strive to satisfy employers, since their students are primarily concerned about jobs. One school reports that major employers help the school identify job requirements, requisite skills, and a curriculum for teaching these skills. An extensive placement department develops links with new employers. Quality control is also important. The school gives subject area exams every year to assess each department. Counselors recommend students with better grades for the best employers and best jobs. Private vocational schools' links with employers are highly similar to the high school-employer links in Japan.¹⁶

The Boston Compact is one of the few examples of American high schools trying to increase student achievement by improving linkages with employers. In 1982, Boston businesses promised to increase youth employment if the Boston public schools improved average student outcomes. Employers increased jobs for Boston's high school graduates, but the schools have not done so well at improving student attendance or achievement.¹⁷

Although certainly a step in the right direction, the Boston Compact may have failed to have a significant impact because, while it gives *schools* incentives to improve average achievement, it does not give *students* incentives to improve their achievement, as the Japanese system does. The fact that even the Boston Compact, which seeks to increase school-employer links,

(Continued on page 40)

SCIENCE EDUCATION: IT'S NOT ENOUGH TO 'DO' OR 'RELATE'

BY KATHLEEN J. ROTH

ELEMENTARY SCIENCE teaching has not changed much in the last forty years; it was, and is, basically fact oriented and didactic. Textbooks present science as a large body of knowledge, and science learning involves memorizing facts about dinosaurs, planets, weather, etc. A crowded elementary curriculum and elementary teachers' lack of expertise in science pose an additional, enduring problem: Very little instructional time is allotted to science teaching. Reformers have not been satisfied with a science curriculum that emphasizes recall of facts, and this dissatisfaction has led to a series of attempts to change the nature of elementary science teaching. Each of these efforts has attempted to help students develop higher-order thinking skills—to think scientifically.

By far the most serious and best supported of these reform attempts was the inquiry movement in the 1960s and 1970s, which gave rise to extensive National Science Foundation programs in curriculum development and teacher education. By the 1980s, however, it

was apparent that the inquiry movement had failed to achieve its goals. Teaching practice and commercial materials had adopted some of the rhetoric of inquiry teaching but had not changed their basic character and had not had a significant impact on student learning outcomes.

Thus in the 1980s the reform movement split into three groups: a) a still-powerful group that continues to advocate inquiry teaching, (b) a Science-Technology-Society (STS) group that focuses on changing the goals and content of science teaching, and (c) a conceptual change group that focuses on changing the methods of instruction so that they are more responsive to students' thinking and development. All of these groups agree on the need for reform and on goals that emphasize the development of conceptual understanding and higher-level thinking skills. Advocates of the three perspectives, however, differ in their definition of the relationships among content, process, and attitude goals; in their analyses of the nature of scientific thinking; and in their recommendations about what elementary children can and should be taught about science and the nature of scientific thinking.

Each of the three perspectives contrasts with traditional elementary science teaching in that they each select particular goals for focus and suggest a framework to help teachers focus on meaningful outcomes, instead of trying to "cover it all." While it is tempting to think about ways to blend the three perspectives, in this analysis I will stress the *distinctions* among them. I argue that elementary teachers need a framework or instructional model that helps them limit and focus their teaching on meaningful, achievable learner outcomes; telling teachers to "do it all" is counterproductive. An eclectic approach to science instruction (throw

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in a little bit of everything) is all too evident, I fear, in most elementary science textbooks in use today.

A brief description of typical textbook-based instruction will be used as a point of contrast with the three alternative perspectives. To provide additional points of contrast, examples of how each perspective might organize instruction to teach fifth graders about plants and photosynthesis will be described.

TRADITIONAL TEXTBOOK-BASED SCIENCE TEACHING

The traditional method of teaching science is focused on textbook instruction and didactic teaching. This content-mastery approach to science is organized around discrete topics—planets, electricity, magnetism, dinosaurs—with little attempt to make connections across topics. The instructional pattern typically consists of reading the text followed by answering factual questions posed by either the teacher or the text. Hands-on activities and teacher demonstrations are added to foster motivation but are often selected because they are easy to do or fun rather than for their usefulness in developing conceptual understanding or higher-level thinking. Thus, science teaching (and scientific thinking) is viewed as student acquisition of facts.

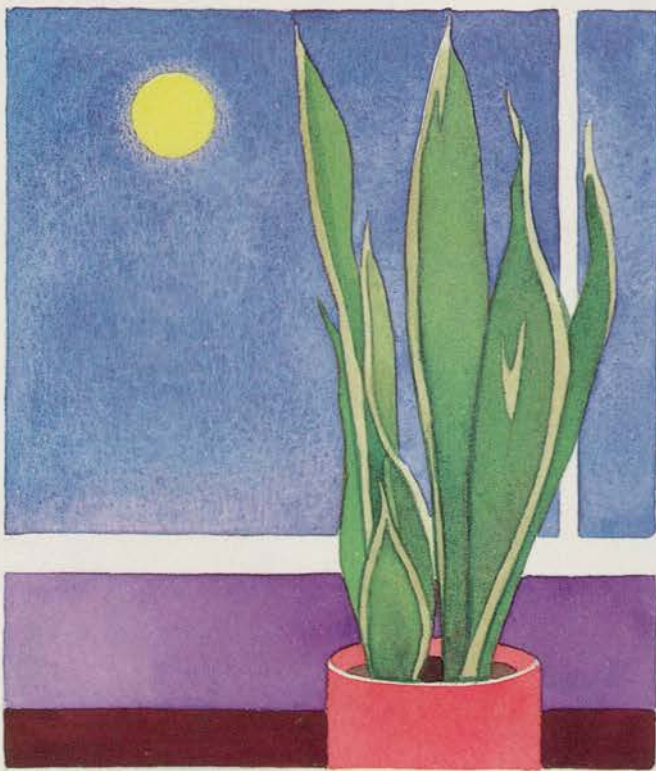
In the Silver Burdett & Ginn *Science* series (Mallinson, Mallinson, Valentino, & Smallwood, 1989), for example, fifth graders learn about photosynthesis in a chapter that presents a smorgasbord of information about activities of green plants. In five lessons, students learn about life processes; transportation of materials in plants; functions of roots, stems, and leaves; structure of leaf and stem cells (veins, stomata, chloroplasts, chlorophyll); the process of photosynthesis (role of energy, water, carbon dioxide; products); storage of manufactured food in fruits and vegetables; use of food energy in respiration; comparison of respiration and photosynthesis; and the use of energy for reproduction (parts of the flower, pollination, fertilization, germination). Thus, a wide spectrum of content is covered at a rapid pace.

In the lesson about photosynthesis, students read detailed information about the cell structure of leaves. The five steps in the photosynthetic process are listed and summarized in a word equation (water + carbon dioxide + energy \rightarrow sugar + oxygen). To "evaluate student understanding," teachers are directed to ask factual questions that can be answered in short phrases taken directly from the text: What does a plant need to make food? (water, carbon dioxide, light energy) (Mallinson et al., 1989, p.12).

In a suggested enrichment activity, students look at leaf cells under a microscope. They draw cells and label the chloroplasts. In this lesson on photosynthesis, students read a lot of information and reproduce it in small bits when prompted by teacher questions. Only in a review question at the end are students required to explain anything (How do green plants make food?). The lesson does not ask students to use photosynthesis to explain everyday observations of plants or even to explain their observations in the enrichment activities.

The lesson on photosynthesis is followed by a lesson

Eighty-nine percent of the students in our study [of the inquiry method] failed to grasp the central concept of the unit.



on plant respiration and a lesson on plant reproduction. This sequence of lessons does not seem likely to foster conceptual understanding and higher-level thinking. Instead, instruction is a parade of lessons marching along at a brisk pace, inundating observers (students) with a panoply of facts and concepts to be absorbed.

INQUIRY PERSPECTIVE

The inquiry perspective contends that students will develop better understandings of the nature of science and will be more interested in science if they are engaged in "doing" science. Student investigations of

phenomena (not textbooks) are the backbone of the curriculum, and the focus of these investigations is on the use and development of science inquiry or process skills—predicting, hypothesizing, observing, recording data, making inferences and generalizations, etc. Students are viewed as little scientists who explore phenomena through hands-on activities and who use and develop scientific thinking skills to build up knowledge and conceptual understandings in the same ways that scientists use experimental work to construct new knowledge, concepts, and theories.

The proponents of an inquiry orientation acknowledge that science content and science thinking processes are both important, interrelated parts of science. They place a clear emphasis on the science thinking skills, however, allowing science content to play a secondary role. In the Elementary Science Study (ESS) materials (Educational Development Center, 1971), content is seen as almost irrelevant. The important thing is that children are engaged in scientific thinking and actions: asking questions, manipulating materials, observing phenomena, and making up explanations to answer their questions. Students “mess about” with mealworms or batteries or mystery powders, and the particular facts or concepts that they learn from these activities are not nearly as important as the lessons they learn about the nature of scientific inquiry.

In an inquiry perspective, the science process skills are generally regarded as the heart of scientific thinking, and these skills are typically organized in a hierarchical fashion. For example, the developers of *Science—A Process Approach* (SAPA) identified thirteen science processes and organized them in a hierarchy according to students' cognitive development (Commission on Science Education of the AAAS, 1968). Processes such as observing and classifying were seen as appropriate to teach at the early elementary level. Integrated process skills (hypothesizing, controlling variables, interpreting data, etc.) were deemed more complex and appropriate for the intermediate grades. Others organize these skills in a hierarchy that matches inductive models of a scientific method.

What is striking in the inquiry-oriented literature on higher-level thinking skills in science is the careful attention paid to describing and sequencing the science thinking process skills and the relative isolation of these thinking skills from a conceptual context. Little attention is given to the nature and development of scientific conceptual understanding. There is an underlying assumption that scientists' development of conceptual knowledge is a straightforward process: that conceptual knowledge is simply the “product” of the scientific thinking processes.

In an inquiry-oriented curriculum, science process skills are the main goal of elementary science teaching. Higher-level thinking is promoted by engaging students in using science processes in hands-on investigations. Content knowledge, conceptual understanding, and positive attitudes toward science are viewed as outgrowths of the inquiry investigations. The focus of instruction is on the development of process skills. If students can understand and use these general thinking process skills, they will be able to develop meaningful conceptual understanding in any area of study.

PHOTOSYNTHESIS IS the focus of the fifth-grade “Producers” unit in the SCIIS *Communities* Teacher's Guide (Knott, Lawson, Karplus, Thier, & Montgomery, 1978). In this unit, three major activities serve as the focus of classroom lessons, and no textbook is used. First, students germinate and measure the growth of various seed parts. This activity is designed to illustrate that germinating seed embryos get food from the seed.

In a second activity, students plant grass seeds and keep some in the light and some in the dark to demonstrate that plants need light to grow and to suggest that plants do not get food from the soil. Toward the end of this activity, the teacher explains photosynthesis to the students and the experiment is interpreted in light of this explanation. Finally, students germinate and measure the growth of bean plants under various conditions: with and without cotyledons (the developing embryo's food supply in the seed) and with and without light. Students are expected to use the idea of photosynthesis to explain their results.

Ms. Kain (pseudonym) and three other teachers whom we observed in our study (Roth, 1984; Smith & Anderson, 1984) spent six to eight weeks teaching this unit. In each of these classrooms, the bulk of instructional time was spent on setting up the experiments, measuring plants, recording results on a class scatter plot, and using the scatter plots to average data and draw line graphs to show patterns of growth. Discussions were also important aspects of lessons. Ms. Kain's questions focused on eliciting students' predictions, observations, and explanations of the experiments. She rarely gave out information, explaining photosynthesis only once during the unit and once in a unit review. Thus, Ms. Kain created many opportunities and a safe environment for students to construct their own explanations of observed phenomena; she never drilled students about definitions or details of the photosynthetic process. She spent eight weeks exploring photosynthesis with her students (approximately twenty-four lessons), quite a contrast with the one-lesson coverage of the Silver Burdett textbook.

And what did the students learn? Our post-tests (Roth, Smith & Anderson, 1983) assessed students' conceptual understanding by asking a variety of questions about how plants get their food. Eighty-nine percent of the students in the study failed to grasp the central concept of the unit: that plants get their energy-containing food only by making it internally out of carbon dioxide and water. Instead, most students began and ended the unit believing that plants take in food from the outside environment and that plants, like people, have many different kinds of food (air, water, fertilizer, minerals, soil, sun, etc.). Students watched and measured plants growing in the light and the dark, they conducted the experiments with germinating seedlings, but they interpreted these observations in terms of their preconceived ideas and failed to integrate the teacher's presentations of photosynthesis into their interpretations of the experiments. At best, students added plants' making of food as one of *many* sources of food for plants, failing to understand the *unique* ability of green plants to use light energy to convert non-energy-containing raw materials into energy-containing food that is

necessary to support growth and life functions. A similar pattern was seen in textbook-focused classrooms. Thus, an inquiry approach did not provide any advantage in promoting conceptual understanding.

AND WHAT did students learn about the nature of scientific inquiry, scientific processes, and scientific attitudes? Many of them found "doing" science (the science processes) "fun" but ended up frustrated by the focus on processes and by all the measuring and recording of data. As Rachel explained,

I don't know *why* we kept measuring those plants. I mean it was fun for awhile, but I already know that plants need light, and now I know it again.

What did Rachel learn about science processes and scientific thinking? She learned that it involves a lot of activity that does not help you make any better sense of things. She learned that science activities and processes are ends in themselves. It is important, for example, to make careful observations and to record them accurately not because such care helps you develop better understanding but because "that's what you do in science." Because Rachel did not develop better conceptual understanding, the processes of science seemed meaningless and not worth the effort. Driver (1983) critiques this doing of science in the absence of meaningful conceptual development, suggesting that the "I do and I understand" slogan might more appropriately be "I do and I am even more confused."

The results of this study also suggest that involvement in hands-on activities did not produce the desired student *attitudes* toward science. Although the activities made science seem fun, they did not necessarily help students value and feel comfortable with science. As a learner, Rachel was clearly frustrated that the doing of science did not lead her to any better personal understandings about plants' need for light. Although she was in a classroom environment where her ideas were valued and where she felt comfortable sharing her ideas, Rachel did not leave the unit feeling good about herself as a learner of science or comfortable in the neighborhood of science. She wondered why she held the same understandings at the end of the unit that she had held at the beginning. She had spent eight weeks measuring, observing, and talking about plants, and no change in her understanding had occurred! This was not a satisfying learning experience for her nor was it an experience that will make her enthusiastic about studying more science. These findings suggest that assessments of student attitudes toward science must dig beneath the surface; it is not enough to know that students have positive attitudes toward hands-on activities. What are they learning about science and scientific thinking?

SCIENCE-TECHNOLOGY-SOCIETY PERSPECTIVE

Many science educators advocate a dramatic change in the goals of K-12 science education. They argue that the overarching purpose of school science is not to create future scientists but to create citizens who under-

stand science in multidimensional, multidisciplinary ways that will enable them to participate intelligently in critical thinking, problem solving, and decision making about how science and technology are used to change society (environmental issues, nuclear power, personal health, energy resources, etc.). Yager and Hofstein (1986) describe this perspective in sharp contrast to both the traditional, disciplinary-based focus of science teaching and to the inquiry approach:

In some respects the traditional content and process dimensions of science may be the dimensions least important and appropriate to us in planning for the year 2000. They may be least important for helping us attain a scientifically and technologically literate citizenry for which so many year. If so, they may be the dimensions of science that deserve little or no emphasis as a science curriculum is planned and newly conceived for all K-12 students.

Yager and Hofstein suggest six essential goals of a quality K-12 science curriculum. These goals stand in clear contrast with those espoused by the inquiry perspective:

1. The human being, human potential, human advances, and human adaptations will serve as the organizer of the curriculum (instead of the structure of the disciplines or the scientific processes).
2. Current problems and societal issues will serve as the backbone of the curriculum.
3. Science and technological processes that students can use in everyday life will be emphasized over processes that scientists use.
4. Practice with decision-making skills using science and technology knowledge in a relevant, social context will be emphasized over skills needed to "uncover correct answers to discipline-bound problems."
5. Awareness should be an integral part of science learning.
6. In dealing with problems and issues, ethical, moral, and value dimensions will be considered (in contrast with traditional science instruction, which is taught as value free and discipline bound).

Thus, an STS curriculum is human and society focused, problem centered, and responsive to local issues. Problems to be investigated are selected for their relevance to students' lives and their multidisciplinary nature. As in the inquiry perspective, students are seen as active learners, but the activities they engage in are focused on *using* scientific and technological knowledge to solve problems and make decisions rather than on *creating* scientific knowledge. Thus, in the STS perspective, students act as young science citizens rather than young research scientists.

THE STS PERSPECTIVE shares with many of the inquiry programs a tendency to separate process goals from content goals and to emphasize process goals over content goals. Content is to be selected based on its interest and relevance for students and on the richness of the societal problem it provides. Thus, content is selected for its potential to serve the primary goals of developing students' decision-making and problem-solving process skills and of helping students learn to integrate values and moral thinking in this decision-making process.

Thus, process or thinking skills are of primary importance in the STS perspective, but the process skills are

As in the inquiry perspective, there is a striking lack of analysis in the STS literature about the particular content or concepts needed to make good decisions or to solve problems.



defined quite differently from those in inquiry programs. The processes emphasized in the STS perspective focus on wise *use* of scientific knowledge in decision making and problem solving about societal problems rather than on the construction of scientific knowledge through careful observation, inferencing, experimentation, etc.

In the STS perspective, decision making and problem solving are viewed as the higher-level thinking skills that students should develop. These skills are seen as needed by all students, not just those bound for science careers. To “think scientifically,” then, one does not need to be able to create or discover scientific ideas the way a

research scientist does. Rather, one needs to be a good consumer of scientific knowledge—finding and using scientific ideas as needed to solve particular problems.

As in the inquiry perspective, there is a striking lack of analysis in the STS literature about the particular content or concepts needed to make good decisions or to solve problems. The kinds of conceptual knowledge needed to do effective decision making and problem solving have not been carefully analyzed or defined. This lack of attention to the nature of conceptual understanding suggests an assumption that the conceptual knowledge needed to think scientifically (to make decisions and to solve problems) is straightforward information that students will rather easily incorporate into their own thinking. Thus, the challenge (or higher-level aspects) of scientific thinking is not in understanding concepts but in using concepts to make decisions and solve problems.

SINCE MATERIALS from an STS perspective are only now in the development phase, I will speculate about a possible STS unit on photosynthesis. A science-technology-society unit would probably not teach about photosynthesis as the focus of a unit. Instead, photosynthesis would be addressed in the context of exploring a technological or scientific problem facing society. For example, a unit might be structured around the problem of the effects of deforestation and industrialization on the warming of the Earth’s atmosphere due to the greenhouse effect. Science concepts relevant to this problem include absorption of solar energy by the Earth’s atmosphere and the changing balance of O_2 - CO_2 in the Earth’s atmosphere due to fossil fuel use and widespread cutting of rain forests (plants use carbon dioxide in the photosynthetic process and release oxygen). The teacher would help students use these concepts to assess the severity of the problem and to think about possible solutions to the growing danger of the greenhouse effect: Should the chopping down of rain forests be slowed down? How? Why would developing nations resist pressures to slow deforestation? What are other ways of slowing the greenhouse effect? How can local citizens influence decisions about slowing fossil fuel usage?

Unit activities might focus on role playing and assessment of the problems from different points of view. Scientific processes could be investigated in the context of studying the evidence that the greenhouse effect is actually a danger. Students might read arguments from scientists holding different opinions about the severity of the threat. The unit-culminating activity would be a student-generated activity designed to take action on these issues, such as writing and circulating a pamphlet about ways to reduce energy consumption in the home, studying home gas and electric bills and trying to decrease consumption for a month, writing to state representatives or members of Congress in support of particular bills related to energy issues, and planting trees on school grounds and encouraging others to plant trees.

In this approach, students would be engaged in complex thinking that requires them first to understand and evaluate the soundness of the evidence offered by expert scientists and then to integrate those under-

standings with understandings of social and political processes. For the unit to be meaningful and to result in student generation of a worthwhile project, the role of the teacher would be a very complex one. Teachers would have to understand underlying scientific principles, the evidence supporting scientists' predictions of the greenhouse effect, and the relationships between political and scientific issues.

The knowledge that students are likely to learn about photosynthesis in such a unit would be limited in the traditional disciplinary sense. For example, discussions of photosynthesis are likely to focus on CO₂-O₂ balance rather than on the food-making function. Because the unit activities focus on problem solving and citizenship action, students are more likely to end the unit understanding that extensive cutting of forests and burning of fossil fuels may result in warming climates worldwide rather than remembering much about photosynthesis. Helping students see how science and technology can both cause problems and help solve problems would be another challenge in teaching this unit. Without such an appreciation, students might come to view science and technology as evil and threatening. Thus, they would not value scientific inquiry and knowledge generated by science.

CONCEPTUAL CHANGE PERSPECTIVE

Of the three perspectives, the conceptual change perspective is the only one that did not originate in response to a social/political climate that demanded reform in science education. In contrast, it is a research-based perspective that grew out of cognitive science studies of learning and knowing in knowledge-rich domains. Research on teaching and learning in science, in particular, provided critical insights about why it is so difficult for students to develop useful, conceptual understandings of many of the subjects they are taught in school (Anderson and Roth, in press; West and Pines, 1985).

In a conceptual change perspective, the primary goal of science education is to help students develop meaningful, conceptual understandings of science and its ways of describing, predicting, explaining, and controlling natural phenomena (Anderson and Roth, in press; Driver, 1987). In this view, scientific knowledge is meaningful to learners only when it is *useful* in making sense of the world they encounter.

Scientific knowledge that can be used by learners is characterized by rich connections between concepts and facts and is organized around key ideas in ways that make the knowledge accessible and able to provide broad explanatory power. This stands in contrast to knowledge that exists as isolated fragments that students can parrot back for recall-focused tests but cannot apply in explaining real-world phenomena. Such connected knowledge is not locked into one tightly organized structure that simply gets larger as a learner adds new knowledge into it (a passive, additive view of learning and a static view of knowledge). Rather, this set of connected knowledge is flexible and constantly changing as the learner revises, reorganizes, and deepens understandings over time (an active, conceptual change view of learning and knowledge growth).

This web of knowledge, or the individual's conceptual ecology (Posner et al., 1982), only becomes useful and meaningful to students when it is integrated with the learners' own personal knowledge and experiences with natural phenomena. Students come to science classes with many ideas and explanations about natural phenomena. Their ideas are experience based and often stand in stark contrast to the scientific explanations studied in school. A central goal of science teaching is to help students *change* their intuitive, everyday ways of explaining the world around them—to incorporate scientific concepts and ways of thinking into their personal frameworks.

Like the STS advocates, advocates of a conceptual change perspective argue that a central goal of science education is to develop scientific literacy for *all* students. The two perspectives, however, define the nature of a scientifically literate society in different ways and they suggest different instructional approaches. The conceptual change perspective focuses on the power of conceptual understanding, arguing that the way to develop scientifically literate citizens is to change instruction so that it helps learners develop rich and meaningful understandings of whatever science they study. Such understanding will help students value science as a sense-making endeavor. The STS perspective, in contrast, approaches the need for a scientific citizenry from a curricular perspective, arguing that it is changes in the *content* of the curriculum that are critically needed. To capture the interests of all students, traditional disciplinary-bound curricula need to be abandoned in favor of current science and society issues.

Unlike the inquiry and STS perspectives, the conceptual change perspective views conceptual knowledge as central in science and in science learning. Where do the scientific processes fit in this scheme? Scientists' work, this position argues, is conceptually driven, and the so-called scientific processes cannot be separated from scientific conceptualizations. Science teaching, therefore, should integrate science processes and conceptual knowledge in ways that better reflect the richness and complexity of science itself.

WHAT DOES it mean to say that scientists' work is "conceptually driven"? Expert scientists do not hypothesize, make inferences, or design experiments in the absence of conceptual frameworks. Their conceptual frameworks are not only influenced by their observations and inferences; their frameworks also *drive* and shape the hypotheses they make, the questions they raise, the things they pay attention to in their observations. What distinguishes their work as science is not these processes, which are processes that are equally applicable in history, economics, mathematics, or the arts, but the particular knowledge that organizes how these processes are used. A scientist who observes well, for example, is not one who spends endless hours documenting and describing every possible detail that can be observed about a particular phenomenon. Instead, a good scientific observation focuses on key features in ways that will contribute new knowledge, that increases the explanatory power of a particular

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AND THEN THEY ASKED FOR HAMLET

BY BARBARA POLLARD

Many, many teachers, often against the tide of prevailing opinion, have held steadfast to the belief that all children—whatever their background, whatever their capacities, and whatever their future plans—deserve a “high-track” education. The best our culture has to offer is not meant to be reserved for just some kids, they’ve argued. Teachers who know and love their subject matter—whether it be the sciences or the humanities—can find a way to make it accessible to all. In the essay that follows, one such teacher tells the story of how she introduced her students—poor children from the inner city of London—to Shakespeare.

We need more such stories. Many teachers who believe in the idea of a rigorous curriculum for all nevertheless feel overwhelmed by the unpreparedness of many of the students who enter their classrooms. We invite our readers to help us build a repertoire of good, concrete, real-life examples of how to present challenging materials to students supposedly “unable to handle it.” In particular, we are looking for accounts of specific lessons or units and the strategies that inspire them. Essays should be 750 to 2,000 words, and we will pay \$150 for any that we publish. Send to “And Then They Asked for Hamlet,” American Educator, 555 New Jersey Ave. N.W., Washington, DC 20001.

—Editor

TO GET A student to feel at ease with what he first perceived as difficult; to get him to move out of his world and into another; to allow him to see his world in the perspective or framework of many worlds is what education is all about. Otherwise, we doom our children to the perception of the Lilliputians who mistook their world for *THE* world. Gulliver knew better.

I suspect that few of us really disagree with this idea in

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ILLUSTRATED BY ROBERT BARKIN

the abstract. It is in the particular classroom, in the attempt to teach a difficult book or skill to unprepared, let alone unwilling, students that the edifice crumbles. "It's one thing to teach *Julius Caesar* or *The Odyssey* in a prep school, or a school of upper-middle-class kids," a voice in my head says, "but not in my school, my classes, or to most of my students." I think one can. Better still, I have done just that, not only in New York City, but in inner-city London and Philadelphia and on the fringes of the bush in Australia.

To teach anything in the face of opposition (poor skills, lack of interest, motivation, etc.) requires conviction and focus, which, in turn, require that a teacher be able to answer questions like these: Why is it important for poor kids in the North End of London, kids who are not even dreaming of attending a university, who come from such varied cultures as Pakistan, India, Jamaica, and the Barbados, to read a work like *Julius Caesar*? What could they possibly get out of a struggle with Elizabethan English in order to understand a play about a group of dead Romans who never flushed a toilet or watched TV? Isn't it more important to teach these children how to write simple, correct English and how to read an English newspaper? And suppose, just suppose, we take them beyond the basic skills. Would it not be of greater value or pleasure for them to read *Jamaica Kincaid* or *Yashpal*?

Faced with these questions, I found myself answering as follows: Shakespeare's version of Caesar's assassination and the ensuing chaos is part of my consciousness. Nevertheless, I have never loved the play. Brutus' faulty reasoning and his consistently poor judgment have always somehow annoyed me. On the other hand, Caesar's cry of "Et tu, Brute!" sums up for me a whole host of horrors. Mark Antony's brilliant manipulation of the crowd—"For Brutus is an honorable man. So are they all honorable men"—is the picture I have conjured up in every text I have ever read on mob psychology and in many a TV election campaign ad I have watched. My students, from Pakistan, the Barbados, etc., are going to live and work in England. They must not only write English, they must *think* English. A culture is transmitted not merely in its language but in its shared imagery, its commonly recollected experiences, real or otherwise. In addition, to have command of a language, written or spoken, requires exposure to its use at every possible level. One must develop an understanding of both its possibilities and limitations. (Such an understanding is not provided by reading *The Evening Standard* or *The New York Post*.) In addition, based on my own experiences and observations, I have never subscribed to what I call the 1, 2, 3 school of learning, i.e., one must write a topic sentence before one writes a paragraph, a paragraph before an essay, etc. Most children run before they can really walk and leap to concepts before they have the information to support them. So, very obviously, I was going to teach *Caesar*.

ON WHAT would I focus? Or, to put it another way, what did I want these inner-city students to get out of it? I wanted them to see the irrationality of both Brutus' and Cassius' so-called rationales for murder. More importantly, I wanted them to understand, feel, and experience how Antony's use of language could

manipulate a crowd, in only a few minutes to abandon their initial response and to become an uncontrollable mob. (I didn't give a hoot about "theme" or "setting" or other such literary terms, or whether or not the clock should strike the hour in a play that pretends to take place in 44 B.C.)

My next problem and certainly the most difficult one was how to get my various group of reluctant fourteen- to fifteen-year-olds to read *Caesar*? I discovered early on that they had never read a play. I decided to begin with a play, written by an eighteen-year-old, Shelagh Delaney. The play, *A Taste of Honey*, is about a white teenager who becomes pregnant with the child of a black sailor and is given aid and comfort by a homosexual neighbor. It is a funny and disturbing play, written in fairly simple English. (It was, if you remember, a hit, both in London and New York.) We acted out the entire play, both in the classroom and in the schoolyard (when we felt a need for a working-class backdrop for this play about working-class people). Because the students found the play so approachable and real, and because I made quite a bit of the age of the author—who was, after all, only a few years older than my students—we were able to discuss it, to pull it apart, to consider the problems of writing a play, of using dialogue and, perhaps, setting, to provide narration, and so on. We took a fight that we had all witnessed in the schoolyard and tried, as a group, to turn it into a one-act play. It was this fight that led us to a discussion of conflict; it was the need to provide motivation and background for the characters that we placed in the fight that led us to a discussion of the problems of exposition (although I don't remember using that word. I think I said "telling the audience").

When we had finished our play, down to the very last detail of setting, and students were beginning to wonder "What next?" and to suggest other ideas for other plays, I took my class on a field trip to a museum to look at copies of Greek and Roman architecture, art, and in some instances, plumbing. What we did in the museum was to speculate on how these people walked, dressed, and lived. We looked at models of amphitheaters and compared them to football stadiums. We talked about how people behave in stadiums at soccer and football games and speculated about their behavior in amphitheaters. It was at the museum, when we were having our lunch on the grass outside, that I told my students, in "once-upon-a-time" fashion, the story of Julius Caesar. They liked the story. They wanted to know what happened afterwards to Octavius and Antony. It was at this point that I told them we were going to read Shakespeare's *Julius Caesar* and that we would treat it in the same way as we had *A Taste of Honey*.

One Indian student said, "But it's Shakespeare." I assured him that Shakespeare was a playwright, as was Shelagh Delaney, and sometimes he succeeded brilliantly and sometimes he didn't. Another student, a Jamaican, said, "But he's difficult. He talks funny. We read something, a poem or something of his in class once, and I couldn't understand a word of it." "Not a word?" I asked. "Well," he conceded, "maybe one."

The next day I gave out the books. I set the scene and then, standing on a chair, I looked down at my students with as much contempt as I could muster, and began—"You blocks, you stones, you worse than senseless

I have never subscribed to what I call the 1, 2, 3 school of learning, i.e., one must write a topic sentence before one writes a paragraph, a paragraph before an essay, etc.



things” Not a student in my class missed the tone of those lines or the attitude of the man who said them. Did they understand every word? Not on your life. Did I explain every word? Don’t be silly, because at that point, we were off and running with Shakespeare.

We did stop and analyze when we reached Brutus’ debate about joining the conspiracy, and when we read the assassination scene and Mark Antony’s funeral oration, and then, not again until we had finished the play. My purpose or focus, as I suggested earlier, was on the experience and language of these scenes. In addition, I hoped they would see that there can be problems and weaknesses as well as strengths in any play, even one by Shakespeare. There should be no work that a student cannot challenge. What is too holy is inaccessible.

THE THRUST of most of the current and widely embraced methodology, from “lit.-logs” to the process approach to “cooperative learning,” is to involve students more actively in their own education. The virtue of such involvement, of hands-on versus passive learning, was noted by Roger Ascham in his book, *The Scholemaster*, published in 1571. The avowed purpose of the developmental lesson of the 1940s and 50s, with its motivation, pivotal questions, and medial and final summary was student involvement. In short, from Ascham in 1571 to cooperative learning in 1989/90, the goal or intention is the same. What differs is the form.

How significant is this difference in form? In the hands of an expert teacher, one with both conviction and knowledge, probably not a lot. One suspects that expert teachers have always preferred the pivotal question (as opposed to the “who” and “what” inquiry) and seen the advantages, in certain situations, of group (sometimes called “committees”) over individual investigation. In the hands of an amateur, the form is often mistaken for substance. To form a cooperative group to handle a question that would not strain half a brain, to ask a pivotal (i.e., a thought-provoking) question and then accept answers after one-second wait time, to always assume that revision is improvement, to assume that because the teacher is standing at the side of the room while students are meeting in groups, that learning is taking place is to mistake shadow for substance, appearance for reality.

To have students re-create a fight witnessed in a schoolyard, as I did in London, may be fun and certainly produces involvement, but it is no more than a game. It becomes a learning activity when students are asked to consider how the conflict achieves importance for the observer; what the observer needs to know about the participants; how as playwrights we could communicate the background and motivation of the characters so that who won or lost mattered to an audience.

It was this struggle with the playwright’s problem with what constitutes dramatic action that made it possible to both appreciate and criticize not only *A Taste of Honey* but *Julius Caesar* as well. When we finished *Caesar*, when we concluded that although it had its great moments, there were some serious problems in the play, several students asked if we could read *Hamlet*. “Just from the way everyone talks about it,” they said, “it must be one of Shakespeare’s better plays.” I couldn’t have agreed more. □

OUT FROM THE UNDERGROUND

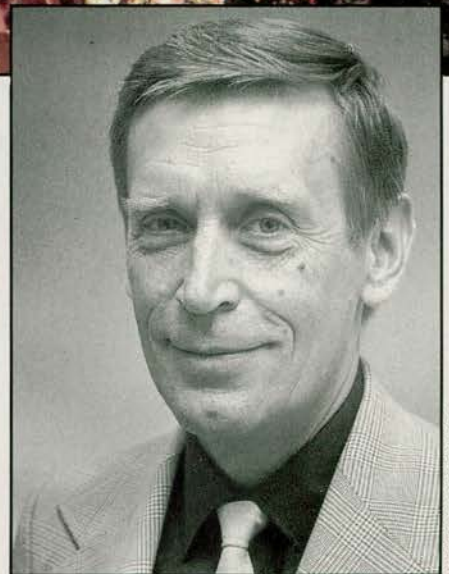
Last May, the leaders of Poland's Communist Party establishment and the leaders of the nation's extraordinary trade union—Solidarity—signed an agreement unprecedented in the Communist world: The banned independent trade union whose strength had brought the government to the negotiating table would be made legal, and semi-free Parliamentary elections would be conducted. The agreement on elections was designed to assure Communist Party control of the new legislature by reserving 65 percent of the seats for Communist coalition candidates. But the Solidarity victory was massive, and it set into motion a series of events that left Solidarity as the leading member of an unstable coalition government whose most important ministries—defense, transportation and communications, police—continue to be headed by Communist ministers. Fully free elections have been promised for 1992. Meanwhile, the new democratic leaders of Poland must determine how to peacefully transform a Communist society into a democratic one, how to convert a collapsed state-run economy into a productive, free one, and how to create a civic society where the nation's many institutions—schools, youth groups, publishing houses, universities, libraries, businesses—are not controlled by the Communist Party but are run in a decentralized way by tens of thousands of individual Poles. The United States labor movement has been providing much assistance to the Polish trade unionists who now find themselves responsible for their nation's future.

Two leaders of Teachers Solidarity, the union's teacher branch, Wiktor Kulerski and Andrzej Janowski, were recently in the United States at the invitation of the AFT and spoke with the *American Educator* about the issues facing Poland generally and its education system in particular. Kulerski, who spent five years in the underground building Solidarity, taught history, biology, and arts for twenty-two years. Jan-

This interview was conducted by Joshua Muravchik, a resident scholar at the American Enterprise Institute who focuses on human rights and foreign policy issues; with Eric Chenoweth, director of the AFT's Teachers Under Dictatorship Project; and Ruth Wattenberg, associate editor of the *American Educator*.



Lech Walesa rallies striking steelworkers in Gdansk, Poland, 1980



Wiktor Kulerski

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Andrzej Janowski

owski was a scholar at the Institute for Educational Research for over twenty years and has been a key advisor to Solidarity on educational issues.

On the day Kulerski arrived in the United States, he learned that he had been elected to the Polish Parliament with a 65 percent majority in his district. In October he was appointed the Deputy Minister of Poland's Ministry of National Education. Janowski is now a vice-minister of Education. Both are now at work creating an independent foundation for Education for Democracy, an effort that was inspired in part by the American Federation of Teachers' Education for Democracy Project.

JOSHUA MURAVCHIK: *Wiktor, when did you become involved in Solidarity?*

WIKTOR KULERSKI: To answer, I have to go back to the years after World War II. My father had worked closely during the war with the prime minister of the Polish government in exile, Stanislaw Mikolajczyk, who was also the leader of the Polish Peasant Party (PSL).

Immediately after the war, my father, Mikolajczyk, and others from the PSL returned from London to Poland where their party constituted the principal opposition to the Communists. In 1947 elections were held. The Communists falsified the results. Many members of the PSL were killed or imprisoned, others escaped into exile. The few remaining PSL leaders—including my father—were tried and sentenced to prison. My father served seven years.

My grandfather also served time—in Prussian prisons—and I hoped that I would be spared. I really had no intention or desire to play politics. I was more interested in other things. But then, in 1976, after the workers' strikes in Radom and Ursus were suppressed, the Workers Defense Committee (KOR)* was created. Among its founders were my father's old cellmate and a priest who served time in the same prison. Once again they were risking their necks. I concluded that the time

*KOR was formed by 14 individuals in the fall of 1976 with the purpose of organizing financial and legal support for the Radom and Ursus workers being tried for their role in the June strikes. KOR, which would have thirty-six formal members but several thousand "collaborators," would play a crucial role in forming the alliance between Polish workers and intellectuals that led to the creation of Solidarity.



Choose Your Own Poland, Vote for Jan Josef Lipski

Lipski was a founding member of KOR.

had come for me, as well . . . that I must pay the debt to my ancestors . . . that nowhere is it written that my life should be easy. So I began to work with KOR.

Then 1980 came. In early spring I met with Zbigniew Bujak—who later would head the Warsaw region of Solidarity—and some of my former students who worked with Bujak in the Ursus tractor and car factory outside Warsaw. They wanted my advice on how to establish a free trade union in the factory. We planned to launch a founding committee in September. Then in August, the strikes in the Lenin shipyards took place, millions of workers joined, and we all began to organize Solidarity.

On December 13, 1981, when martial law was imposed, I succeeded in avoiding arrest (see sidebar, page 30), as did Mr. Bujak and his friend from Ursus, Zbigniew Janas, one of my former students. Together with them I spent five years in the underground. Mr. Bujak became the head of the Warsaw region of Solidarity and I became his deputy. When he was arrested in the spring of 1986, it fell to me to head the Warsaw region. I also served as a member of the underground National Executive Commission (TKK) of Solidarity. After the amnesty in September 1986, I emerged above ground and, with my friends who were also freed, began open activity, although it was still illegal. That's how things stood until the beginning of the Roundtable talks in 1989.

Now, after five years of starring in “wanted” posters, I have won my election, am a member of the Polish Parliament—representing the same district my grandfather represented in interwar Poland—and now have parliamentary immunity!

MURAVCHIK: *Tell us about what it meant to be “underground.” Where were you? How did you survive?*

KULERSKI: I had, of course, a false identity card. My face was changed so that even my close friends and co-workers from before December 13th did not recognize me. Every three weeks I changed my place of hiding. And where I was at any given time, only a very few people knew. Most of my work was done in writing, by letters that were distributed through the underground mail system.

If I had to meet with people who were not in hiding, it was never in the apartment in which I was staying.

Solidarity has won a worldwide reputation for excellent graphics, which are displayed here in a collection of campaign posters from the historic June elections for the Sejm (Parliament).

People who wanted to meet us were very carefully checked and, in some doubtful cases, they had to undergo a “quarantine.” We had pocket-size radio devices made in the United States that automatically searched through the police frequencies to determine if we were being followed. Our specialists attached their own innovation to the radios, since the American equipment didn't cover all the frequencies used by the Polish police. Once assured that the person who wanted to meet with us was not in contact with the police, that person would be brought to where I was hiding and then, afterwards, escorted out.

We had very limited contact with our families as they were under constant police surveillance. I saw my wife maybe once a year. Before seeing me, she would have to undergo a few days of quarantine to ensure that she was not being followed. Then she would be taken by car to the meeting place, but she would have to change cars a few times on the way. The first time I saw her was a year after I went into hiding. My friends “kidnapped” her. She didn't know what was happening until we met.

MURAVCHIK: *When you say you changed your face, do you mean surgically or did you just alter your hairstyle and color?*

KULERSKI: No, no, not surgically. My facial features are very distinctive. And in spite of what you might think, it is much easier to change a distinctive face than a more common one because what you have to do is install features that balance out what is distinctive about it. I have a long face; what you have to do with my face is introduce elements that would shorten it. For example, one of the wrong ways to try to change a long face is with a beard, because a beard lengthens the face. What is indicated, is crossing the face with a horizontal mustache and covering your head with more hair, and crossing it again with eyeglasses with thick frames. These three things can change your face very much. I graduated from Visual Arts High School and studied art history. My friends used a makeup artist to change their appearances, but I depended on myself, and it was very successful.

MURAVCHIK: *When you went underground, everything built during the Solidarity period was destroyed. What was the effect of martial law? What did you think you were going to achieve, and what was the philosophy that guided you?*

KULERSKI: We started not with philosophy but with practice. We knew a few things. First, there were people still left fighting in workplaces, and we had to let them know that at least part of Solidarity's leadership had escaped arrest, that it existed and was functioning.

The second task was to organize new structures. We came to the conclusion that for security reasons we could not build these structures with people known as Solidarity activists before martial law. So all people who

Żeby POLSKA
była POLSKA

2+2
musi być Zawzię
Cztery

Let Poland Be Poland Two plus two must always equal four

This slogan is a pointed reference to Communist propaganda, which, according to popular belief, is so corrupt that it might insist that 2 + 2 equals something other than four.

were working with us, but who were not actually in hiding, were recruited from outside the circle of Solidarity activists and even from outside the membership of Solidarity.

The same thing held for the apartments that we who were in hiding used. They could not be ones that had previously been known for Solidarity activity. If you take into account that every three weeks we changed hiding places, that our meetings took place in still different apartments, that our "offices" were located in still other apartments, and contact points were in still different apartments, you will realize that building up such a network was an enormous, enormous undertaking. That's how we started in December 1981 and January 1982.

So far as my philosophy of working in the underground is concerned, I knew that any centralized and bureaucratized underground structure would be extremely vulnerable to the police and, secondly, that such a structure is not as effective in mobilizing people to work as a decentralized structure. Also, I wanted to prepare people to function on their own, in case we were arrested.

There was one other motivation for a decentralized structure: it is the best preparation that people could have for democracy. We were conducting a struggle underground, but I always remembered that the goal of our activity was to achieve democracy, and people should be trained in being independent, in making their own decisions, and being accountable for them. In the short term, this may be more difficult to achieve, but in the long run it is more effective.

So apart from creating a union structure, I also wanted to create other underground bodies. I didn't want the union to become a monopoly and a vehicle for everything, just like the Communist Party is. So as a union activist, I supported all kinds of extra-union initiatives, for example, the Helsinki Committee, the Committee for Independent Culture, the Social Committee for Higher Education, an independent student union, independent publishers, independent journals, and particularly the independent education movement—I thought that only in this way could we build the foundation for a democratic future.

MURAVCHIK: *Today, obviously, there is a different political situation: Solidarity survived the martial*

law period and all other efforts to repress it to the point where the government finally agreed again to sit down and negotiate. First of all, in the broadest sense, what is the significance of the Roundtable agreements signed on April 4?

KULERSKI: The most important thing we wanted to achieve at the Roundtable was recognition of Solidarity. That legalization had a price, which we agreed to pay, namely, participation in the elections to the Parliament. That was the basic tradeoff at the Roundtable. Everything else was secondary.

A trade union cannot function effectively if it is outside the law. We regarded legalization of Solidarity as absolutely necessary for further struggle, and that is the basic significance of the Roundtable.

MURAVCHIK: *You say that the election was the price you paid to legalize Solidarity. Why did the authorities want to get Solidarity into an election, and why do you describe it as a "price" rather than an opportunity?*

KULERSKI: Because we were being invited to become minority shareholders in an enterprise that had already gone bankrupt.

MURAVCHIK: *I can't imagine that when the authorities exacted from you this "price" of participating in these elections that they foresaw how these elections were going to turn out.*

KULERSKI: Clearly, there was a large miscalculation by the authorities—and a very characteristic one because it demonstrates clearly how far removed the political leaders had become from popular feeling.

MURAVCHIK: *What are the consequences of this election result?*

KULERSKI: First, it is a defeat for the Communists in terms of their authority and prestige. And, because their nationwide list was rejected by the voters in the elections, their most important leaders will not be in Parliament. This creates a potentially dangerous situation. Remember, the main Solidarity leaders, including Lech Walesa, did not run in these elections either. Now we have a situation in which the most important actors for Solidarity and for the Communist Party are not in the Parliament. And, of course, the church hierarchy, another critical actor, is not in Parliament either. So we will have two centers of political decision making. One possible outcome is disillusionment. With Solidarity's victory, people now expect some improvement within six months to a year in their daily lives. But the first real effects of political, social, and economic reform cannot be expected until four or five years have passed. What will the people do? Will they understand? Will they revolt?

MURAVCHIK: *What needs to be done to avert the worst scenario or to minimize its likelihood?*

KULERSKI: What most needs to be done cannot be



So that They Will Be Proud of Us Tomorrow

done. People must have better lives. But we can't hold out hope that Moses will arrange for manna. A vast improvement for most of the people is just not possible.

We can try to compensate in some ways. If people see, for example, that private enterprises are developing quickly, that they are well organized, that it's good to work there, and that after an initial period of a few years, these enterprises will bring profits for the employees too—that will help. The situation will also be helped if people gain control of their own local government bodies. And if people have the opportunity to be active in various citizens associations and political parties, if they see that there is progress in abolishing censorship, if they see that foreign capital is invested in Poland—in a

word, if the sphere of liberties widens and individual autonomy increases, then that will extend people's patience.

MURAVCHIK: *Is there agreement within Solidarity on a program of economic reforms and, if so, is there also agreement between Solidarity and the Parliament?*

KULERSKI: Yes, on both counts. The authorities realize that they are unable to manage the economy by themselves. The understood goal is to "de-nationalize" the economy. The only question is how to achieve that.

The whole economy is now bogged down in such a jungle of rules and regulations and such an enormous mass of bureaucracy that this jungle must just be cut away. This requires an enormous effort to change the laws, to install competent, professional managers who

CRACKDOWN!

Sometime after ten o'clock on the night of the twelfth [of December 1981], after a late night of reviewing proposals and appeals that had streamed in from union locals, [Wiktor] Kulerski decided to go home. He routinely called contacts at the major factories and found everything normal. He told the overnight secretary that he would be in early the next day. He caught the last bus to the same wooded Warsaw suburb where as a Boy Scout he played conspiratorial games. But before he went home to his wife he gave way to a nagging feeling that he should call the office for one final check. The Kulerskis had no phone, so he went to a coin-operated booth. The pay phone was broken. Almost six years later, after he had surfaced under the terms of an amnesty, he reconstructed those critical moments with a sense of wonder.

"I usually hate phones, and I knew that everything was all right, but still I had this compulsion that I had to call." He went to another phone booth several streets away and it too was out of order, as was a third. He then went to a nearby hospital to use

the phone of a friend who worked as a doctor. The secretary at the union office told him that everything was quiet, but as he was saying good night, she suddenly asked him to hold on, that something curious had just happened. After a pause, she came back on the line to say that while they were talking both of the Telexes in the office stopped chattering, as if they were cut off.

Kulerski had bucked an optimistic tide within the union and had for months warned Bujak that a repressive attack was inevitable. From the doctor's office he called his father, a man who is confined to a wheelchair with the rheumatism, emphysema, and blindness he contracted in prison. "Well, it begins," said the old man. "May God keep you." Then the phone went dead.

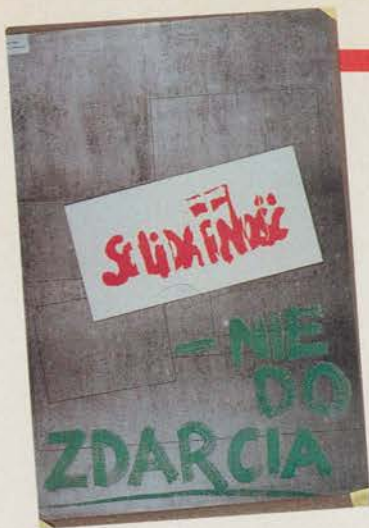
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[That night] all over Poland, slow-moving convoys pulled out of rustic compounds and headed for nearby cities. Just before midnight, all Telex communication was cut, and soon after all civilian phones went dead. About the same time, police couriers drove to gas stations, ordering attendants to lock fuel pumps and turn away custom-

ers. All these measures were applied throughout the country, but in the first stage the focus was on Gdansk, where so many Solidarity leaders had gathered [for a Solidarity convention]. The idea was to seize them all and leave the 10 million-member union to twitch in headless agony until it toppled like a sapped dinosaur.

Within twenty-four hours, close to ten thousand people were in police custody. All Solidarity offices in every city were raided by police who seized records, equipment, and cash before padlocking the doors and posting guards. In the morning an austere General Jaruzelski appeared on television saying that martial law was in effect. On the streets tanks guarded roadblocks, and soldiers patrolled with fixed bayonets to enforce a curfew. To add to the impression that the military was now entirely in command, sketchy television newscasts were delivered by men and women in army uniforms.

Adapted from the book "Mad Dreams, Saving Graces," by Michael T. Kaufman, © 1989. Reprinted with the permission of Random House, Inc. □



Solidarity Can't Be Torn Apart

will not be dependent on party directives, and to create a mixed economy. Poland can be put back on its feet only by a very carefully drawn program. Will the West decide to help? If so, we will accept with greatest joy.

MURAVCHIK: *Are you concerned that some enterprises are going to have to be closed with people losing their jobs?*

KULERSKI: Of course. This is one of the terrible problems that confronts us. We have very many problems like that.

MURAVCHIK: *How much does the further progress of reform in Poland depend on Gorbachev? Would the failure of perestroika in the Soviet Union and the rise of some more conservative force in the Soviet hierarchy automatically bring a halt to the process of reform in Poland?*

KULERSKI: I think our work would be made much more difficult. You have to remember that this reform process has not even started yet in East Germany and Czechoslovakia [Ed. Since this interview, democratic movements have been gaining strength in both East Germany and Czechoslovakia.], and the situation in Lithuania, Latvia, and Estonia would also be different. I'm not sure that it would automatically put to a stop the evolution in Poland, but I think it would be just a matter of time. As more time passes, perhaps we will achieve a level at which it will not threaten us, but that has not happened yet.

MURAVCHIK: *As I understand it, part of the Roundtable agreement calls for new elections—in four years, presumably—that will be entirely free. Do you expect this to happen?*

KULERSKI: You must remember that when I started my KOR activity in 1976, I expected to land in prison. Instead, I saw Solidarity victorious in August of 1980. Then came martial law on December 13th, 1981. When I was in the underground, I again expected to end up in prison. Instead, I now find myself in the Parliament. What can I tell you about the future?

MURAVCHIK: *One more political question. Won't Solidarity experience a serious tension between its role as a union and its role as, in effect, a political party?*

KULERSKI: There is also a third role—as a charitable institution. People come to us with grievances of all kinds. Among the Solidarity leaders whose views I'm aware of, most would like to free us of this double role as

quickly as possible. That's why Solidarity is striving to create an environment in which there will be different political parties operating in Poland. The existence of such parties will free Solidarity from some of the burden that it now has to bear.

Of course there is the danger that once political parties are free to function, a lot of the most active and talented people will leave Solidarity. And Poland suffers from a lack of an elite. For 200 years, with the short exception of the interwar years when Poland was independent, Poles have suffered a process of continuous selective extermination. Generation after generation, the most active, most talented young people took part in national uprisings. As a result they went to prisons, into exile, they emigrated, or were killed.

What I find I'm most envious of in the United States is how many young, active, talented people you have, very well educated, without any inferiority complexes. We have very few such people.

MURAVCHIK: *I would like to ask some questions about how you plan to change Polish education. Let me turn to Mr. Janowski. How did the subject of education come to be an issue in the Roundtable talks?*

ANDRZEJ JANOWSKI: The Roundtable negotiations were intended to address Poland's most important problems, not just the question of Solidarity's legalization. And both sides were aware of the severe problems that afflict Poland's educational system. The curriculum is centrally determined and very ideological in its content. Until now, the basic lines of education have been determined by the party *apparatchiks* who viewed the schools as a vehicle for "promoting socialist morality" and preparing children "to build a socialist society." These are the kinds of words that have been used. The social studies curriculum in particular is propagandistic.

KULERSKI: The basic theme promoted in social studies is that true freedom for workers was brought by the [Soviet Union's] October [1917] Revolution. This revolution freed children from child labor. It secured social benefits for working people, led to the liquidation of unemployment, freed people from religious superstitions, and gave people true freedom. In the West, where there was no Communist revolution, working people are completely in the clutches of a small number of capitalists who have all the money and power. There is unemployment. People suffer from lack of social welfare. They are exploited. Wages are very low. Their strength and their health is being used up. Even children have to work.

JANOWSKI: Wiktor's description of the social studies curriculum is somewhat exaggerated. Wiktor has described the very crude Stalinist propaganda that was promoted in Polish schools during the fifties. Some elements of this presentation still exist, but they are not so starkly expressed.

I think the current problem is not so much the propaganda, because there is little of it and it's subtle, but rather what is being left out, what is not said.

KULERSKI: Andrzej is not wrong when he says the propaganda is more subtle today, but he does not take into account one thing: that the ordinary Pole perceives these subtleties differently and draws different conclusions. A textbook may be written in a less brutal way.



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But it is being taught by teachers who have internalized the practices of previous years, by teachers who perfectly well realize what is expected of them from the Ministry of Education's inspectors.

ERIC CHENOWETH: *Andrzej, would you say that Polish history—particularly in the twentieth century—is presented accurately in the schools?*

JANOWSKI: No, it is not. But the problem is not so simple as outright falsification. In a way, what is missing is a degree of consistency. For example, on the same page, you can find a nice reference to the leaders of the independent Polish Republic in 1918 and also how nice it was to have the [Soviet] socialist revolution in 1917. Of course, these two sentiments are not consistent.

KULERSKI: A lot is omitted also. The history books say nothing about the extermination of Poles in the eastern territories of Poland, which were occupied by the Red Army from 1939-41. There is nothing said about the extermination of entire villages and of activists in the Polish Peasant Party, carried out by the NKVD [the Soviet secret police, later reorganized as the KGB] and Polish security services. There is no mention of the armed underground resistance to the Communists carried on from 1945-1951. Nor of the 1968 anti-Semitic campaign. There is no mention of the difficult history of Polish-Ukrainian relations, or of anti-Semitic pogroms, for example, the one in Kielce in 1946. The brief twenty-year history of independent Poland between the wars is very complex and is very inadequately described.

What is being emphasized in the textbooks is Poland's military tradition. But the history of Poland's civic and democratic movements are not presented well or at all.

JANOWSKI: What we have discovered from our studies is that the great lack of information about Polish history among students has been partly remedied by the efforts of ourselves and others to publish underground books about Polish history. Even official books have been published that are decent, if not totally correct. As a result, I think our greater problem is that people's understanding of certain political and social concepts has been contaminated.

MURAVCHIK: *Could you explain what you mean by this?*

JANOWSKI: The people of Poland have a total misunderstanding of very important concepts—of abstract and practical concepts—which are necessary to describe society: "democracy," "social democracy," the political concepts of "left" and "right," of parliamentary systems, of justice, a lot of ideas that are necessary for understanding and thinking about society and politics.

The authorities, in speeches, newspapers and textbooks, use these terms in false, propagandistic ways.

Young people who know only the false meaning of a concept reject the whole concept. This makes it impossible for us to communicate with them on a whole host of subjects. We are trying to find ways to give back to words their original meanings—meanings that have been twisted through years of misuse in propaganda.

This is why we in Teachers Solidarity have developed as one of our several major underground publications a dictionary of political terms. I took the *Britannica Dictionary of Modern Thought* and translated into Polish one hundred and ten terms that I know to be used falsely in Communist propaganda and in the Polish educational system.

CHENOWETH: *Can you give an example of how the meaning of a concept has been deformed and then rejected by young people?*

JANOWSKI: Take "social justice." The need for "social justice" has often been used as an explanation, or excuse, for Party behavior. Only the Party provides "social justice." Social justice comes to justify and mean whatever the Communist Party wants for the society. Young people then reject the idea of social justice.

RUTH WATTENBERG: *Wiktor mentioned that while textbooks have improved since Stalinist times, many teachers have continued to teach in the old ways because they felt an inspector might be looking over their shoulders. Who is this inspector? How does he know what is going on in the schools?*

JANOWSKI: The inspector is like the school superintendent for the region, and he has a staff of people, most of whom have close contact with the Party secretaries and functionaries from this same region. So a teacher may feel that any criticism or animosity from this inspector, or any directive issued by him, may express the feelings and disapproval not just of the individual, but of the Party. The result is a lot of fear. The extra-legal status of the Party creates more fear. You are blind about your critic's authority. Is he in a position to fire you? Can he call the school inspector and ask him to fire you? This ambiguity is part of the system. The "leading role" of the Party never was clearly put into some kind of legal framework.

This is why teachers are afraid. Not only teachers, of course. But because teachers are usually isolated, underpaid, and unappreciated, they are very easily made more anxious than other workers.

MURAVCHIK: *How will the educational reforms that you envision change the world of teachers?*

KULERSKI: Until now the teacher was simply an instrument. He had a very detailed and rigid curriculum. He had a textbook that he had to use. He had a list, a syllabus of additional readings that people used. He had a schedule of what he was to teach at which point during the school year, and in many cases he even had a schedule for each individual lesson.



Our Candidate for the Sejm Wiktor Kulerski

As a result of the Roundtable agreements and the elections, the teachers now have the opportunity to use supplementary materials—and not only those aids that are listed in the minister's rules and programs. He can also use independent publications. One clause of the Roundtable agreement says that anyone may express any views in school that do not contradict the Universal Declaration of Human Rights. This opening will allow Teachers Solidarity to develop and introduce supplementary materials on a large scale—an enormous task for us. Another clause says that political parties may influence educational programs only through the Parliament. [Ed: In the past, a regional or local Party secretary could send a directive for implementation to the heads of the "Party cells" that function at all workplaces, including schools.] Finally, there are general clauses that talk about increasing teacher autonomy and giving teachers a role in selecting the school director. "Self-government," what you would call "student councils" or "faculty councils," will now be able to function seriously and not just serve as instruments of Communist rule.

MURAVCHIK: *It is immediately obvious why you would need new democratic structures and a wholesale change in the social studies and history curricula. But does Poland's need for educational reform go further than this?*

KULERSKI: Our teacher rank and file is in rather bad shape. First, for forty-five years it has undergone a process of negative selection, culminating with the imposition of martial law after which a very large number of good teachers were defiant. Many of them were dismissed, with the vacancies often being filled by wives of army or police officers. Second, teachers are very badly paid and, therefore, it's often the least-able people who enter the profession. Third, teachers are not educated in the universities but at pedagogical schools that are very politicized.

If the school directors and the teachers gain greater autonomy, the first task will have to be to educate the teachers, to raise their qualifications, raise their level of civic consciousness and win them over to the idea of

education for democracy. That is a huge task.

MURAVCHIK: *How do you propose to move forward with this task and with curriculum reform?*

KULERSKI: The Roundtable agreement on education has provided us with a remarkable opportunity. The authorities have agreed that a curriculum based on the Universal Declaration of Human Rights is in order. But they won't bring this about. We must. The agreement empowers teachers to use outside curriculum materials and to resist inappropriate political directives from the heads of Party branches. But what materials? This is an opening for Teachers Solidarity to introduce materials. We are now starting to work on a three-step education for democracy program, and I will list the steps. First, there is a program of basic reference publications for students and for teachers. These must be basic. For example, we published in the underground two thousand copies of the text of the Universal Declaration of Human Rights and a smaller edition of Andrzej's basic dictionary of modern political terms. Now we must think of printing these in much larger quantities. And we need more such materials.

Another example: If we had a social studies textbook to recommend, we would probably be able to force its use in the entire educational system. But we haven't such textbooks. We can't wait for the minister to develop one. It becomes our job.

Second, we must train the teachers about how they themselves may achieve greater democracy in their schools, both through their union activities and through organizing self-government in their schools.

Third, we must produce both written and audiovisual materials dealing with the history of democracy and its practice. We would like to make these materials available to teachers and students.

To create these materials, rethink our curriculum, train our teachers—this is an enormous task. A first training course on these issues is being planned, with the AFT, for January. In addition, the AFT is helping to organize an American team of experts that will help us on an ongoing basis. We will organize a Polish team that will prepare a proposal and a list of what we will need in order to carry it out, and the American team will provide advice, counsel, and assistance in obtaining the materials. □

* * *

Postscript: Since the time of this interview, the AFT has been working closely with the new Ministry of Education and Teachers Solidarity to bring about the kinds of educational changes discussed here. This fall, the AFT sponsored a visit to Poland by Diane Ravitch, a noted educational historian, to talk with Solidarity teachers and ministry officials about the meaning of democracy and how it can be taught in the schools. A fuller training conference is planned for the winter.

HISTORY IS FOR CHILDREN

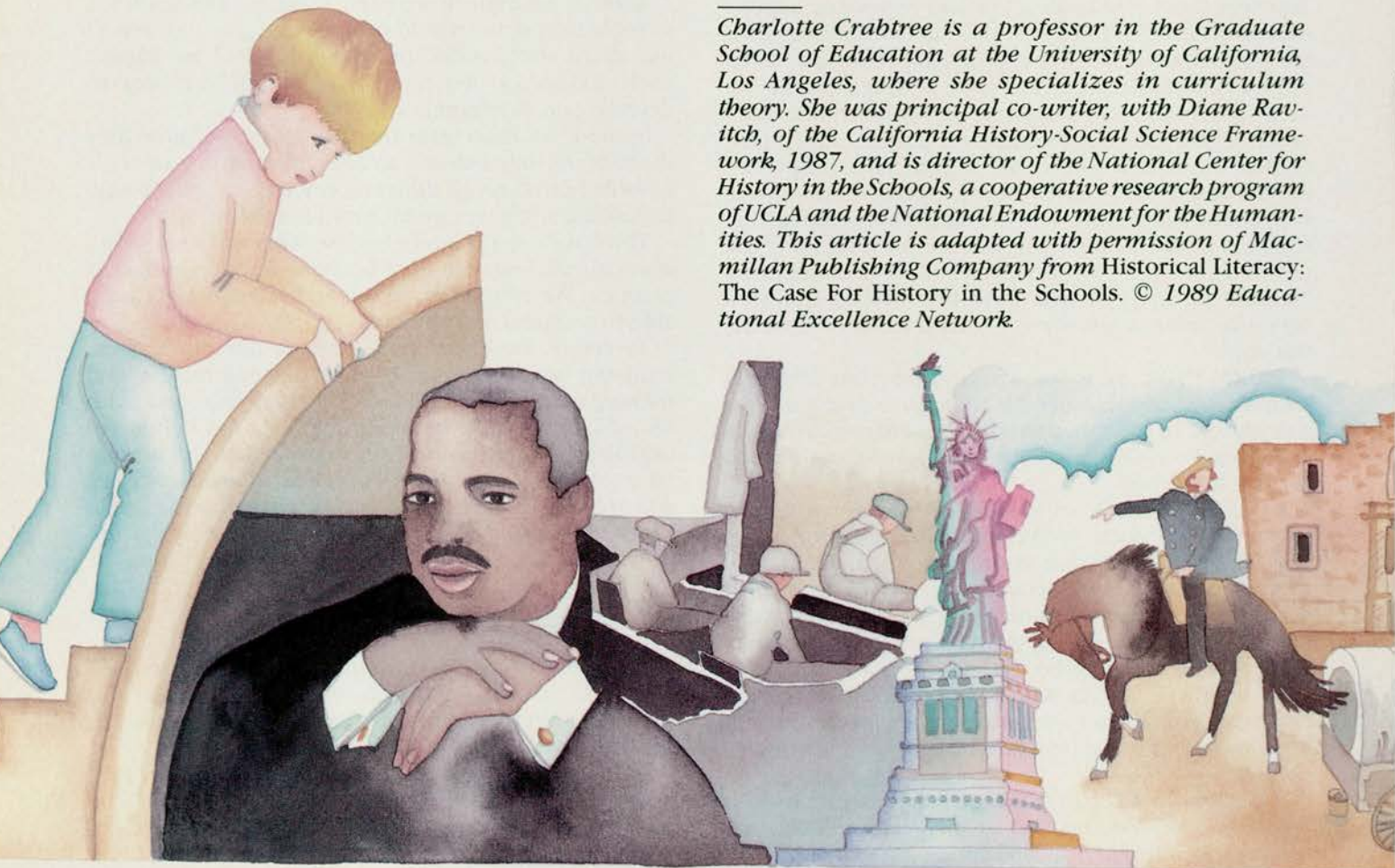
BY CHARLOTTE CRABTREE

RETURNING HISTORY to the elementary school curriculum is one of the decade's major movements for school reform. This movement is not, of course, without its critics. Certain school folk, wedded to assumptions that have dominated the elementary school curriculum for over fifty years, strongly protest the change. Children, they argue, cannot attain the perspectives of historical time and therefore are incapable of understanding the past. The immediate surroundings and present-day world that children daily experience

are rich enough, these critics maintain, to serve as the subject matter of their curriculum. Forays into distant times they cannot understand, or studying about people they cannot place in historical perspective, are a poor and irrelevant curriculum alternative for the young.

Such objections to the teaching of history must be addressed by those who speak for history in the education of school-age children. Fortunately, these objections yield in the face of what we know from contemporary studies of childhood learning and development and from tested practices in a good number of

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forward-looking schools, public and private. This article will explore such evidence and consider its implications for building an appropriate curriculum in history for the elementary school years.

At issue is the long-lived and sacrosanct "near to far" or "expanding environments" curriculum model. This is the curriculum adopted over the past half-century by virtually all school systems in the nation and strongly sustained by the nation's textbook industry. Up to grade five, this curriculum has little or no historical content; instead, it emphasizes the sociological and economic aspects of children's lives in the family, the school, the neighborhood, and the community.

The most comprehensive and so far successful challenge to the constraining assumptions of the near-to-far curriculum model is the recently adopted *History-Social Science Framework for California Public Schools, Kindergarten through Grade Twelve (1987)*. The framework committee that drafted this document included classroom teachers and curriculum leaders from the schools, and historians, social scientists, and learning and curriculum specialists from universities and from research and development centers. Every issue that arises when considering change in the elementary school curriculum was soundly debated by this

group. One by one the arguments barring history from childhood education fell, and the curriculum that emerged reflects the accord achieved within the committee for a history-enriched and, in four years out of the seven from kindergarten through grade six, a history-centered program of studies. The most enthusiastic proponents for this change were, in the end, those best qualified to judge: the experienced elementary school classroom teachers on the framework committee.

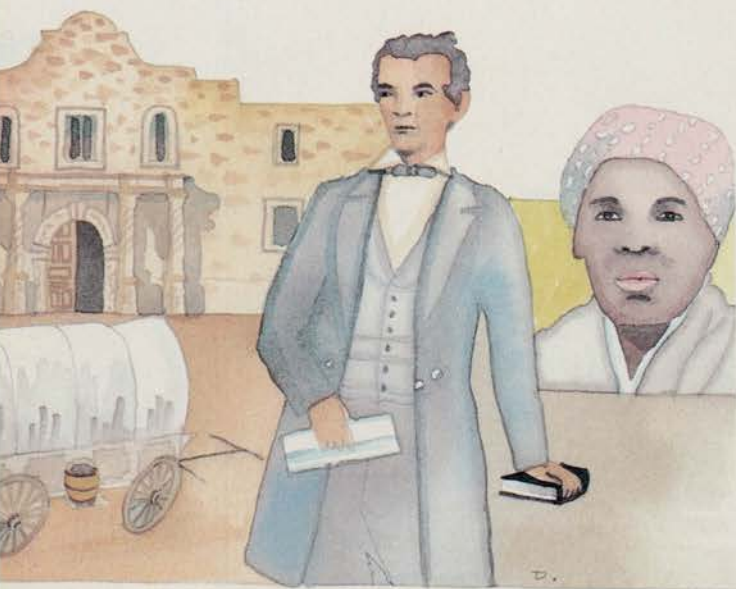
What arguments rallied the forces for change? First among them was the evidence that the monolithic march from near to far in the customary expanding environments curriculum model is supported neither by developmental psychology nor by research in children's learning. Through circulation of correspondence received by committee member Diane Ravitch from four eminent educators, each a seminal thinker in his field, the committee was provided searching appraisals of the validity of the expanding environments model.

Philip Phenix, philosopher and Arthur I. Gates Professor Emeritus of Teachers College, Columbia University, wrote on May 24, 1986:

The self/family/community/region progression is presumably based on the notion that learning must proceed within the context of the known and familiar and only gradually move out into the larger domains of the unknown and unfamiliar, as the child expands his or her experience. But such a view seems to me a recipe for boredom and sterility, doing poor justice to the expansive capacities of the human mind. Although teaching must obviously take account of where the student is, the whole purpose of education is to enlarge experience by introducing new experiences far beyond where the child starts. The curious, cautious, timid presumption that the limits of expansion are defined in any one grade year by the spatial boundaries defining the expanding boundaries dogma is wholly without warrant. Young children are quite capable of, and deeply interested in, widening their horizons to the whole universe of space and time and even far beyond that into the worlds of the imaginary. And all this from kindergarten years or even before! The concentric circles of the expansion dogma appear nothing more than a very adult conceit designed for administrative control through neat curriculum packages unrelated to the realities of human learning.

Joseph Adelson, director of the Psychological Clinic at the University of Michigan, wrote on June 2, 1986:

I have never understood the logic presumably informing



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the “expanding environments” approach, since it did not seem to me to be based on anything we knew about cognitive development in that period . . . Let me assure you that there is nothing in cognitive science, or in developmental research, which supports the present way of doing things. In fact, I’m quite convinced you could turn the sequence on its head, going from the community to “myself,” without its making much of a difference. Furthermore the current curriculum is quite vapid and seems to induce a considerable degree of boredom.

Bruno Bettelheim, the distinguished psychoanalyst and professor of education who for twenty-six years directed the University of Chicago’s residential school for highly disturbed children, wrote on May 7, 1986:

. . . the presently taught curriculum in the social sciences in the early grades is a disservice to the students and a shame for the educational system. Children of this age are sufficiently surrounded by the realities of their lives. The texts I have seen do not explain [their] sources or meaning to the child, and only repeat in tritest form a reality with which they are all too well familiar . . . What children of this age need is rich food for their imagination, or a sense of history, how the present situation came about . . . What formed the culture of the past, such as myths, is of interest and value to them, because these myths reflect how people tried to make sense of the world.

Jerome Bruner, a cognitive psychologist long recognized for his distinguished contributions to the field of instructional psychology and to the study of thinking, included in his correspondence of May 12, 1986, the following analysis along with references to his recent book, *Actual Minds, Possible Worlds*, for its treatment in depth of the reasons behind his comments.

There is little beyond ideology to commend the Hanna [i.e., expanding environments] program and its endlessly bland versions. Whatever we know about memory, thought, passion, or any other worthy human process tells us that it is not the known and the settled but the unknown and the unsettled that provokes the use of mind, the awakening of consciousness . . . Starting kids off with the familiar and then going out to the unfamiliar is altogether in violation of this deep principle of thought and of narrative.

These are stinging comments from four of education’s most erudite and respected scholars. With one accord, all judge the expanding environments model to be the offspring of unsupported dogma and in violation of known principles of learning. Phenix, in a final passage, concludes his indictment of the model with the judgment that it is both “irrelevant to the child’s growth and unduly limiting of normal development of thought and feeling,” strong words indeed.

By contrast, three of these four scholars address the question of alternatives, and specifically propose history and literature as developmentally appropriate studies for the young child. “History and literature,” Phenix wrote, “. . . are essentially concretizing presentations of human experience and are therefore best suited as a basis for social studies. These forms of symbolizing enlarge the child’s experience as interesting unanalyzed wholes, from which as he grows older abstractions can be developed.” Among the virtues of history for children, Phenix noted its ability vicariously to provide “a sense of personal involvement in exemplary lives and significant events, and to supply an appreciation of

values and vision of greatness, all this within the context of moving narrative and dramatic appeal.”

PARENTS, CHILDREN’S librarians, and teachers of the young have long known the power of superbly written biographies, myths, legends, folktales, and historical narratives to capture children’s imagination and to hold their interest. Incorporating enduring themes of conflict and personal choice; of sacrifice and responsibility; of power and oppression; of struggle, failure, and achievement, sometimes against overwhelming odds, these stories connect in powerful ways with these same impulses and conflicts in children’s own lives. They engage children vicariously in the experiences and perspectives of others, expand their ability to see the world through other’s eyes, and enlarge their vision of lives well lived and of their own human potential.

Whether these biographies, stories, and narrative histories are drawn from the recent past or from some long-ago reaches of human history is not the critical factor in their accessibility to children. Rather, it is the nature of the story told, its power to capture children’s imagination, to draw them into the historical event or human dilemma, and to speak to children on matters of enduring worth that should determine its selection for inclusion in the curriculum.

The continuing appeal of Aesop’s fables, the tales of Robin Hood, or the frontier adventures of Wilder’s *Little House* series speaks to this point. So, too, does the extraordinary success of the *Odyssey* and *Aeneid* programs for elementary schools that are sponsored by the American Philological Association through teacher institutes supported by the National Endowment for the Humanities and operating today in individual schools throughout the United States. Reporting on the success of these programs in their schools, one group of teachers commented that the *Aeneid* addressed universal questions as it recounted particular events. Students who are so frequently uprooted themselves can identify with the Trojans in their wandering. Those who have lost a parent or a friend can mourn with Aeneas as he returns to Sicily for the funeral games. When students



discuss the merits of the Trojan journey—asking whether Aeneas should remain with Dido, whether he can choose his fate to any degree, or whether the Trojan women were justified in burning the ships—they participate as actors in the past. They come to understand circumstances and character, to begin to grasp their own part in the spiritual civilization that continues into the present moment.

Observing how children's involvement in the adventures of Aeneas had spread throughout all levels of one elementary school, one observer from the National Endowment for the Humanities asked why children found these programs interesting. "They're so exciting," came one child's eager answer, immediately echoed by the rest. One is reminded of Paul Hanna's 1935 indictment of the history-centered programs he was seeking to displace. He objected to them, he said, because they provided children a "happy life for the few hours they spend in school"! Given the terrible strains of the Depression years, children should, he argued, be engaged instead in community studies of the great social and economic ills then facing the nation.

BUT CAN these programs really be historical if children have not yet grasped the structure of time and chronology necessary for placing long-ago events in their proper historical context and relationship to each other? The answer, of course, lies in understanding and working with the developmental sequence through which children achieve such higher powers of historical thinking. Recent studies by Levstik and Pappas (1987) support these observations by demonstrating that second-grade students can think historically when events are presented in story form and that continuing growth in their historical understanding proceeds developmentally over the elementary school years.

It matters not that young children have no well-developed mental maps of time for placing people's adventures in temporal relationship according to years, decades, centuries, or eras. For young children it is enough to know that they happened "long ago." "Before I was born?" younger children may ask. "Oh, yes."

"Before my mother was a little girl?" they may continue. "Yes, even before that. Long before that." "Oh, long ago," they may solemnly conclude. And soon, more refined time concepts take shape, as teachers help children to differentiate today, yesterday, long ago, long, long ago, and reaching back to the beginnings of recorded history, long, long, long, long ago. The concept of time, children quickly learn, is a spatial one, involving the mental construction of a continuum of time along which events can be arranged. Historical dates are irrelevant in these early stages and do not belong in the primary classroom, for the mathematical understandings that make their relationships meaningful are not yet formed. But the *spatial* learnings that allow these critical insights to develop are under way.

Within their first five years of life, young children, we now know, develop ordered sets of causal, spatial, and temporal relationships that render their world not a "buzzing, booming confusion," but a causally ordered, comprehensible, and meaningful environment. This process starts in early infancy. Infant cognitive development is now found to be surprisingly abstract, with infants even in their first year of life using rules for dealing with time, space, and causal relationships. "Well-mothered" infants, interacting with a caring adult, repeatedly play out motion-time-and-space patterns that test their environment and disclose its regularities. Interacting with their environment in this manner, and then "turning over in their minds" what they have discovered, infants develop their sense of order and their rules for operating within the regularities of their world.

As infants gain mobility, their exploratory world widens, and with it the complexity of their temporal, spatial, and causal understandings. Depending upon the richness of experiences available to children and the nurturing they receive from supportive and interested adults, the years of later infancy can be a time of increasing problem solving, creative play, and abstract symbolization. By ages three and four, well-nurtured children regularly produce "mental maps" or cognitive patterns of time and spatial relationships that they have abstracted and detached from the specific activities that



brought them forth.

So important are the growing networks of spatial understandings developed during these early years, that psychologists who have studied their development suggest that "spatial knowing" may in fact be paradigmatic for the ways children come to know. Spatializing the non-spatial, their findings suggest, may in important ways facilitate learning even in non-spatial fields.

This notion is intriguing and brings to mind two down-to-earth examples of teachers who have had good success developing in young children some early understandings of historical time. One, an inner-city supervising teacher, constructs with them a temporal sequence of events using a clothesline and clothespins that together create a visual representation of the passage of time. The children first tie a knot near one end of the clothesline to represent "today" and then clip at that place a recent photo of themselves. They then move back a little distance along the clothesline to attach a baby picture brought from home. After the teacher read a biography of Martin Luther King, Jr. to the class, the children made drawings illustrating the Reverend King's life and clipped them to the line farther back in time. The Reverend King, they then understood, lived earlier, a contemporary of their grandparents. A "long, long ago" story is similarly illustrated and attached to the time line still farther back, a process repeated as each new historical story is read to the children. Inevitably, dinosaurs are brought up, and children decide that these precursors of the human story should occupy a place on the time line long, long, long, long ago.

Spatially displayed on this clothesline's representation of time, these historical moments become easily accessible to children in terms of their "before" and "after" relationships and establish a sense of historical continuity that lays a foundation for deeper historical analysis in coming years. Another teacher, this one of somewhat older children, lacking bulletin board space, converts the classroom windows along one side of her room into a time line. Then, as her third graders' study of their local history unfolds, they paint pictures to illustrate specific historic events and tape them to the

windows, in succession, to represent each succeeding period of their study, from prehistoric to modern times.

BY THE middle elementary years, mathematical understandings are sufficiently developed to allow children's meaningful identification of years, decades, and centuries on the basic time line, and their accurate placing of events according to the date of their occurrence. By this age, children's intellectual development also permits some kinds of historical analysis that link events in terms of their antecedents and consequences and support early stages of causal analyses.

One should not, of course, overreach the limitations of children's thinking in this regard. Analyzing the multiple causes of an event (the Revolutionary War, for example, in a fifth-grade study of American history) is a developmental achievement in preadolescence and requires strong instructional support. It is important to remember that in history, as in mathematics, science, or any other field of learning, the process is developmental. Children will not approach all at once the intellectual complexity demanded by historical analysis. It is folly, however, to suggest for that reason that history should not be taught in elementary schools. Leaving all such instruction to later secondary years, when the adolescent mind has emerged "recognizably adult," would be incomprehensible in other fields of school learning. We do not defer all instruction in mathematics to the senior high school and then rush students through textbooks of a thousand pages or more in a forced march to "cover" the material for which no prior foundations or deep personal interests have been established. Only in history are such approaches seriously contemplated and applied. The unhappy results are widely evident in the displeasure high school students take when a meaningless parade of facts, dates, and hurried events is imposed upon them.

Historical thinking, including causal analysis, takes many years to acquire, but its foundation is rightly laid in the elementary school. One approach being developed for older children in our work with experienced Teacher Associates in the National Center for



History in the Schools incorporates striking a balance between (1) rich narrative history that moves the chronology of events along in a compelling and interesting manner and (2) specific "dramatic moments" in the narrative that the students plumb, looking for deeper meanings of the selected landmark events and turning points in the historical narrative. The dramatic moments chosen are those that best bring the period vividly alive for students out of the problems and actions of real men, women, and children who were caught up in the forces of their time.

In developing the "dramatic moments," we use history as the great integrative and synthesizing discipline of the social studies since understanding historical events involves geographic and economic analysis and the study of political institutions, to mention several of the social sciences that are embraced by thick historical narrative. Take geography as an example. Studying why societies developed when and where they did reveals the critical geographic relationships among site, resources, people's technological skills, and settlement patterns. Studying human movement, a dominant theme throughout all of history, must include the motivations that drove such migrations as the European conquest and colonization of the Americas, the enforced transport of millions of Africans to these regions, the westward movement of American settlers into the trans-Appalachia and trans-Mississippi territories, and the northward movements of Mexican settlers into their vast territories in present-day western and south-western United States.

A HISTORY-CENTERED curriculum for elementary school children can be a rich curriculum indeed, drawing widely upon learning in the social sciences and the humanities and deeply involving children through activities that are developmentally appropriate. It remains, then, to consider how such a curriculum might best be organized for learning across the elementary school years. The California curriculum framework offers one approach by beginning each year of instruction from kindergarten through grade two in the child's

immediate present and then moving outward in space and back in time to enrich children's geographical and historical understandings. The model is sometimes termed the "here-there-then" approach to widening children's horizons and expanding their universe into realms far beyond their immediate surroundings. With the middle grades the curriculum becomes history centered and adopts a rich narrative approach in grade-three studies of local history, grade-four studies of state history, grade-five studies of American history through 1850 (and of the immigrant experience 1850 through the present day), and grade-six studies of the ancient world, in which children will have developed interests through the lively literary selections in mythology, folktales, narrative histories, and literature provided throughout the preceding grades.

A second approach, also recommended by the Bradley Commission's 1988 guidelines for history in schools, follows the conventional "expanding environments" curriculum but includes yearly historical and literary studies that connect with that year's topics of family, neighborhood, or community, thus wrenching them free from the narrow presentism from which they now suffer. By incorporating literary selections and historical studies of children, families, communities, peoples, and nations throughout the grades, this modification opens for children far richer and more engaging materials than most now enjoy.

A third pattern recommended by the Bradley Commission centers around yearly instruction in literature and primary documents that are then studied in relation to the historical times they bring to life. The pattern is, essentially, a child's version of the "Great Books" approach to curriculum making, with literature used to take children into adventurous excursions through historical periods.

Are teachers ready for such changes? Our wide experiences with teachers in the field strongly suggest that this is the case. The elementary curriculum has become so thin, so skills driven, so intellectually sterile and boring to teachers and students alike that teachers are reaching out with enthusiasm for a curriculum that returns to classrooms the pleasures of stories worth telling, of ideas worth pursuing, of adventures that capture and hold children's attention and lead them into the historical perspectives that help each find his or her place in the long sweep of human history. □



Historical Literacy: The Case for History in American Education, from which this article was adapted, was produced by the Bradley Commission on History in the Schools, published by Macmillan Publishing Co., New York, New York, and is available in bookstores across the country.

Teachers may also be interested in History Matters, the monthly newsletter of the Bradley Commission, which contains teaching ideas, notices about relevant books and materials, and brief reports on trends and developments in history education. For a complimentary subscription, write: The Bradley Commission on History in Schools, 26915 Westwood Rd., Suite A-2, Westlake, Ohio 44145.

GOOD JOBS FOR GOOD GRADES

(Continued from page 15)

does not link hiring with students' grades indicates how reluctant Americans are to make explicit linkages.

A few Boston high schools and employers, however, acting on their own, have extended the idea. They informally agreed to use grades, teacher evaluations, and attendance to determine who gets highly prized jobs.¹⁸ These informal arrangements suggest that Japanese linkages are a viable option for the U.S.

Although American public schools rarely have linkages with employers, they do have many other linkages. High school counselors often develop long-lasting, trusting relationships with college recruiters from certain colleges, and their evaluations may carry strong weight with colleges. Like their Japanese counterparts, American counselors won't recommend a student with substandard grades to a college recruiter who visits every year for fear of jeopardizing their relationship. Moreover, standardized tests (SAT and ACT exams) are used as a check on counselors' recommendations and grades in the U.S., as they are in Japan. These similarities are not surprising: Much of Japan's system was modeled after the U.S. system. The only difference is that Japan extended our college admission system to jobs, a step we have not taken.

Indeed, the high school-work transition is the only area where links are so undeveloped in the U.S. Links exist between high schools and colleges, colleges and graduate schools, colleges and employers, and vocational and graduate schools and employers. The absence of links between public high schools and employers is an anomaly that may account for the special problems of work-bound youth. This insight points the way to solving these problems.

OF COURSE, we wouldn't want to copy the Japanese model exactly. The one-dimensional stress on grades and the overwhelming importance of first jobs are elements of their system that are not acceptable in the U.S.

Yet many aspects of this system would help American schools and employers. The Japanese model indicates that improvements cannot be made by schools alone. Employers must also be involved. To motivate students and bolster teacher authority, employers can take three steps: show students that some desirable jobs are available to them, hire students before they leave school, and hire based on grades.

First, *employers can show students that some desirable jobs are available to them.* It is difficult for students to see why they should acquire math and writing skills if they can only anticipate a job flipping hamburgers when they graduate. Employers must give good jobs to recent graduates rather than delaying access to these jobs for so many years that high school students cannot relate these jobs to their own efforts in school. Such changes would help students see a path from school to work that makes schoolwork relevant.

Second, *employers can hire students before they leave school.* Rather than letting youth fend for themselves in the labor market, employers and schools could collaborate in the hiring process. Employers could tell

schools about job openings and the kinds of youth they hire, they could ask schools to recommend promising students, and they could make hiring selections while students are still in school, so schools could help students' choices and employers' selections.

Third, *hiring based on grades would give employers better information about students' skills and work habits* than they can get from any other source. This can also create incentives for work-bound youth to work in school and to acquire basic skills, and it can put these incentives under the control of teachers so they have authority over students.

SCHOOLS ALSO have a role. Schools can reduce the work-entry problems of work-bound students and bolster the authority of teachers by offering the same services to work-bound students that they now offer to the college-bound: having strong ties with employers, advising employers and students, and making their evaluations useful to employers.

First, *schools will be more effective if they have strong ties to employers.* Schools must be trusted by employers. The Boston Compact did this by having employers (the Private Industry Council) select career specialists to work in the schools, in addition to the schools' guidance counselors, who are too busy advising students' course and college selections to help with jobs. These career specialists know employers' needs and are trusted by employers, so they can effectively place students in jobs. This, in turn, makes them more effective in encouraging school achievement and in giving teachers greater influence.

Second, *schools can help advise employers and students.* Rather than employers assessing youths based on only a brief interview, schools can draw upon extensive information about students to recommend qualified students to employers, just as they do for colleges. If hiring occurred while students were still in school, schools could help work-bound students to find jobs, training, or apprenticeships, just as they help college applicants. Work-bound youth should not have to choose between continuing afterschool jobs and long periods of job search, job hopping, and involuntary job turnover.

Third, *schools can make their evaluations more useful to employers.* Schools should make the course titles, abbreviations, and grading systems in transcripts easier to understand. Professional organizations should work to develop a standard transcript that is comparable across schools.

Grades could also be adapted to be more useful to employers. While Japan uses only one kind of grades, the American version should have several kinds of grades: the standard grades for achievement, grades for raising one's achievement, and grades for effort. These new kinds of grades would be more motivating to students in the bottom half of the class for whom traditional grades are only demoralizing. "Effort grades" would give employers information about work habits that they cannot easily assess in other ways. Qualities measured by the effort grade—such as commitment, perseverance, a cooperative spirit—may be more important to employers filling certain kinds of jobs. Moreover, separating these three kinds of grades would make each more valid, since teachers are often tempted to raise the

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grades of low-achieving students who work hard.*

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THERE ARE strong and weak versions of the reforms discussed in this article. The weak version would incorporate these reforms into our current system. High schools could make transcripts more meaningful and understandable, while employers could use them in hiring decisions. These steps would give students incentives, give teachers authority, and give employers valuable information.

The strong version, which directly links specific high schools and specific employers, requires additional effort, but it provides two advantages. First, linkages strengthen incentives: They let high schools promise a certain number of good jobs to students. Students would be more motivated if a school can promise fifty good jobs to the top students, certain moderately good jobs to the next-best students, etc., than by vague platitudes that grades count. Second, linkages would pressure schools to prepare students better. The threat of losing its links to valued employers would keep a school working to provide good education to its students.

Our reluctance to take grades seriously in hiring youth is well intentioned but short-sighted. Although we are reluctant to let poor grades reduce students' access to good jobs, our kindness undermines their incentives to work in school and hurts their achievement and their job options. The job world increasingly requires the reading, writing, and math skills that grades reflect. Even jobs in warehouses, which formerly only required a strong back, now require the use of computers for locating goods and keeping inventory. We cannot and should not protect students from these realities, for they will only get stronger in future decades. A linkage system realistically tells students how they are doing and what they must do to get the jobs they want.

Raising the stakes does not mean totally foreclosing opportunities. Americans would not tolerate a system that condemns poor students to bad jobs forever. Students who don't get skills in high school can get them later on their own or by returning to school. Employers

* Grades are often more useful to employers than tests. Although tests let employers compare applicants from different schools, most employers hire from only one or two local high schools, so comparisons across schools are not needed. Grades evaluate a broader range of performances over a longer period of time than tests, and they are less affected by test anxiety. Grades also more closely reflect real-world achievement, which occurs in social interactions with peers and supervisors. Moreover, grades indicate students' achievement relative to teachers' demands, which is directly analogous to work situations where employees must satisfy supervisors' expectations. Even the College Board says that students' high school records should influence college admissions more than SAT scores, and the SAT adds very little (typically less than 1 percent) to the prediction of freshman grades over what the school record alone can predict. Tests are probably even less useful for predicting job performance.¹⁹

now hire people over age thirty for skilled and clerical jobs if they can show the requisite skills, and, given the shortage of these skills, this openness is not likely to change. Of course, keeping opportunity open reduces the urgency of achieving in high school, but students will see that the sooner they get the required skills, the sooner they are on the way to getting good jobs.

Another concern, as noted earlier, is that employers will exert inappropriate influence over the school curriculum. Japanese laws prevent employers from determining curriculum, and these laws are enforced by government agencies and the vigilance of teachers and the public. Since Americans are more mistrustful of employer influence than the Japanese are, it is likely that we could prevent abuses at least as well as they do.

MINORITIES MAY be wary of these changes, but minorities, in particular, should welcome them. When grades don't affect hiring, schools cannot offer work-bound students strong enough incentives to learn basic skills. Low-income and minority youth may be even more sensitive to school-provided incentives because of declining parental influences, and their basic skills may be particularly hurt by a lack of incentives.²⁰ While affirmative action can help minorities gain access to entry jobs, entry jobs are a hollow victory without the skills to get promotions, and the EEOC has little influence over promotions when employees lack basic skills. Efforts to help minority youths get jobs must not undermine their incentives to work in school.

The labor shortage of the 1990s provides great opportunities for low-income and minority youth, but only if they see incentives to work in school. During the labor surplus of past decades, minorities became fatalistic because they were competing with white youth, who had early advantages, contacts, and prejudices going for them. In the coming decades, rather than being a zero-sum competition for too few jobs, the labor market will be the reverse—a competition for too few workers. In this situation, minorities won't have to surpass whites to get skilled jobs; they will get these jobs if they have the requisite skills.

These considerations lead to a very optimistic conclusion. Low-income and minority youths can be given a new message: "There is a new game now, and the new rules help you!" Low-income and minority youths don't have to improve their relative rank; they only have to gain the requisite skills. But to get these skills and to overcome the fatalism built over previous decades, minorities will need reassurance that incentives apply to them and that schools can help them get good jobs. School-employer linkages and school-provided help in finding jobs will be particularly helpful to these youths whose families are not well connected with employers.

The labor shortage in the 1990s will create great challenges and opportunities. We cannot produce more eighteen-year-olds by 1995, but we can stop wasting the ones we have. Indeed, we must do so. We cannot afford to let work-bound students be poorly educated and spend long periods floundering before getting work. Employers and schools must begin taking action now to give students clear incentives to work in school and to give teachers the authority to channel these incentives for the advancement of learning. □

FOOTNOTES

¹ Howe, Harold, et al. 1988. *The Forgotten Half*. New York: William T. Grant Foundation. See also Committee for Economic Development, 1985. *Investing in Our Children: Business and the Public Schools*. New York: National Commission on Excellence in Education, 1983. *A Nation At Risk*. Washington, D.C.: U.S. Government Printing Office, April; National Assessment of Educational Progress. 1985. *The Reading Report Card*. Princeton, NJ: Educational Testing Service; Berlin, Gordon and Andrew Sum. 1988. *Toward a More Perfect Union*. New York: Ford Foundation; Eurich, N.P., 1985. *Corporate Classrooms: The Learning Business*, Princeton, NJ: Carnegie Foundation for the Advancement of Teaching.

² Griffin, J.L. et al. 1981. "Determinants of Early Labor Market Entry and Attainment: A Study of Labor Market Segmentation," *Sociology of Education*, 54: 206-221; Meyer, Robert H. and D.A. Wise. 1982. "High School Preparation and Early Labor Force Experience," Pp. 277-347 in *The Youth Labor Market Problem*, edited by Richard B. Freeman and D.A. Wise. Chicago: University of Chicago Press.; Willis, Robert and S. Rosen. 1979. "Education and Self-Selection." *Journal of Political Economy*, 87: 527-536.

³ Bills, David. 1986. "Educational Credentials and Hiring Decisions: What Employers Look for in Entry-Level Employees." Unpublished paper. University of Iowa; Crain, Robert 1984. "The Quality of American High School Graduates: What Personnel Officers Say and Do," John Hopkins University. Unpublished paper.

⁴ Bishop, John. 1987. "Information Externalities and the Social Payoff to Academic Achievement." "Working Paper #8706. Cornell University Center for Advanced Human Resource Studies; John Bishop. 1989. "Why the Apathy in American High Schools?" *Educational Researcher*, 18:1, 6-10.

⁵ Birman, Beatrice F. and Natriello, Gary. 1978. Perspectives in Absenteeism in High School. *Journal of Research and Development in Education* 11:29-38; Chabot, Richard B. and Garibaldi, Antoine. 1982. "In-school Alternatives to Suspension: A Description of Ten School District Programs." *Urban Review* 14: 317-336; Cusick, Philip A. 1983. *Inside High School: The Student's World*. New York: Longman; DeLeonibus, Nancy. 1978. "Absenteeism: The Perpetual Problem." *The Practitioner*, 5, 13; DiPrete, Thomas A. et al. 1981. *Discipline and Order in American High Schools*. Chicago: National Opinion Research Center.

⁶ Sedlak, Michael W., C.W. Wheeler, D.C. Pullin, P.A. Cusick. 1986. *Selling Students Short*. New York: Teachers College Press, p.5.

⁷ Rosenbaum, James E. 1976. *Making Inequality*. New York: Wiley; Rosenbaum, James E. 1978. "The Structure of Opportunity in School." *Social Forces* 57, 236-256; Rosenbaum, James E. 1980. "Social Implications of Educational Grouping," Pp. 361-404 in David C. Berliner (ed.), *Annual Review of Research in Education*, American Educational Research Association.

⁸ Sizer, T.R. 1984. *Horace's Compromise: The Dilemma of the American High School*. Boston: Houghton Mifflin, p. 158.

⁹ Although only 10 percent of employers have special relations with schools, they are the larger firms, they hire about half (49.6 percent) of all the work-bound graduates from each school, and they offer the most desirable jobs (jobs with more training, security, and advancement). As a result, these employers have a greater impact on each school's graduates.

¹⁰ Some teachers note that this constraint does help them resist pressures from influential parents. If they succumb to parent pressures and nominate students with substandard grades, employers will ignore their nominations and possibly stop offering jobs to their school in future years. Indeed, analyses find that social class background has very little influ-

ence on the jobs youth get after high school. See James E. Rosenbaum and Takehiko Kariya. 1989. "From High School to Work: Market and Institutional Mechanisms in Japan." *American Journal of Sociology*, 94:6 (May): 1334-65; and Takehiko Kariya and James E. Rosenbaum. 1988. "Selection Criteria in the High School to Work Transition: Results from the High School and Beyond Surveys in the U.S. and Japan." Presented at the Annual Meetings of the American Sociological Association, Atlanta, GA.

¹¹ National Commission on Excellence in Education. 1983. *A Nation at Risk*. Washington, D.C.: U.S. Government Printing Office, April.; E.J. Crosswhite et al. 1984. "Second Study of Mathematics: Summary Report, United States." Urbana, IL: U.S. National Coordinating Center. Mimeograph; John Bishop. 1989. "Why the Apathy in American High Schools?" *Educational Researcher*, 18:1, 6-10; Ronald Dore and Mari Sako. 1988. *Vocational Education and Training in Japan*. Center for Japanese and Comparative Industrial Research, Imperial College.

¹² Kariya, Takehiko and James E. Rosenbaum 1987. "Self-selection in a Japanese Junior High School." *Sociology of Education* 60(3): 168-80; Rosenbaum, James E. 1980. "Track Misperceptions and Frustrated College Plans." *Sociology of Education* 53 (April) :74-88.

¹³ Nolfi, George J. et al. 1978. *Experiences of Recent High School Graduates*. Lexington, Mass.: Lexington Books: 53.

¹⁴ While some observers assert that public schools serve the interests of employers (S. Bowles and H. Gintis 1976. *Schooling in Capitalist America*. New York: Basic Books), these accounts are vague about the nature of this subservience. My own observations indicate that the cooperation between business and public schools is very limited, with both parties reluctant to increase it. Given the limited amount of research on this question, however, the only matter that is clear is how little we know.

¹⁵ Burke, Mary Alice. 1984. *Becoming an MBA*. Ph.D. dissertation. Northwestern University.

¹⁶ Yet there are important differences, too. Although grades seem to influence job placements, this private vocational school does not explicitly define grades as criteria, so students may not see clear incentives to improve their grades. Moreover, this private vocational school has preferential links with certain employers, but it doesn't have guarantees. For instance, a corporation that relies heavily on this school's graduates does not hire in recession (even though we might suppose that it is in their interest to do so if they want the main supplier of their technical personnel to survive). I should note that this account is based on a single school; I know of no other studies of how private vocational schools relate to employers.

¹⁷ Farrar, Eleanor and Anthony Cipollone. 1988. "The Business Community and School Reform: The Boston Compact at Five Years." Unpublished paper. March. State University of New York, Buffalo.

¹⁸ Rosenbaum, James E. 1989. "Empowering Schools and Teachers: A New Link to Jobs for the Non-College Bound" in *Investing in People, National Commission on Workforce Quality and Labor Market Efficiency*. U.S. Dept of Labor. Washington, D.C.

¹⁹ Resnick, L. 1988. "Learning in School and out." *Educational Researcher*, 16:9, 13-20. B. Rogoff and J. Lave (eds). 1984. *Everyday Cognition: Its Development in Social Context*. Cambridge, MA.: Harvard Univ. Press. Jencks, Christopher and James Crouse. 1982. "Aptitude vs. Achievement: Should We Replace the SAT?" *The Public Interest*. Crouse, James. 1988. *The Case Against the SAT*. Chicago: University of Chicago Press.

²⁰ Wilson, William J. 1987. *The Truly Disadvantaged*. Chicago: University of Chicago Press; National Assessment of Educational Progress. 1985. *The Reading Report Card*. Princeton, NJ: Educational Testing Service.

LETTERS

(Continued from page 6)

prise. But, as Mr. Ryerson suggests, it probably came as a surprise to millions of students who had been misled by textbooks to believe that China under a beneficent Deng was a progressive bastion of equality and tolerance. Perhaps Mr. Ryerson's informative article will lead to the compilations of books that record history, not rewrite it.

—R. BRUCE MCCOLM
Executive Director,
Freedom House

In his essay, "China's Untold Story," André Ryerson displays considerable knowledge of the dark side of China's road to socialism. He has more than amply documented his claim that "social studies distort reality (and) ignore questions of democracy and repression" in that nation. In view of the depth of Ryerson's information about what really has been going on in China over the past 40 years, I find it intriguing that he professes to be "stunned" and "bewildered" by the distortions of reality found in nearly all of the books he surveys.

He discusses a possible reason for this state of affairs—the idea that the field is "animated by doctrines that denounce ethnocentrism" (meaning that we should not judge other nations by our cultural norms)—but pretty much rejects this as an adequate explanation. After all, he points out, the very textbooks that are silent on human rights in China have no problem condemning Nazi Germany and South Africa. Clearly, a double standard is being used (according to Ryerson) depending on whether nations are "tyrannies of the left" or "tyrannies of the right." It is obvious that this is the heart of the matter for Ryerson, although he attempts to hedge on his position via rhetorical questions and qualifiers, such as "so it seems."

I agree with Ryerson that a double standard is operative, but the rosy picture of China found in textbooks occurs for another reason. The crucial factor is that for several decades or more, China has been obsessed (nearly as much as the U.S.!) with the Soviet menace. The U.S., of course, has exploited China's hostility to the U.S.S.R. to the hilt. U.S. relations with

China, including military collaboration, have been guided by the maxim that "any enemy of my enemy is my friend." Virtually all China scholars, whose ranks have mushroomed since the late 1960s, have fallen into the lockstep with this type of Realpolitik, basically because the State Department line dovetails with their own sentiments concerning China and the Soviet Union. There is also the persuasive fact that funding for research, whether from government or private sources, is far more generous for scholars whose work supports a positive image of China. Other influences are no doubt at hand, but the outcome is that China scholars who turn out the most idealized accounts of life in Red China are the most ardent Sovietphobes. Their views of and on the Soviet Union would surely meet with Ryerson's approval.

What holds for these China scholars also holds (often perhaps in a watered-down form) for authors of global studies texts in their treatment of China. By and large they accept the dualism of Good Chinese Socialism versus Evil Empire Socialism. How could it be different? After all, their textbook presentations rest upon the ostensibly scientific work of mainstream scholars whose expertise, we should note, is also sought by the mass media in order to crank out (at least up to the Tiananmen Square slaughter) yet another romanticized tale of life in China.

Who are these textwriters to move against such a stream? And even if they were so inclined, how would a text sell that describes China as yet another Evil Empire led by megalomaniacs who have done nothing (according to Ryerson) except push their nation into one economic disaster after another and savagely repress any form of dissent?

Put briefly, Ryerson's view that distortions in textbook treatments of China reflect a double standard by which tyrannical nations are denounced as long as they are not leftist has little to commend it. Far more crucial is the animus of anti-Sovietism that remains a key theme in U.S. foreign policy as well as a stance still fervently taken by the vast majority of intellectuals/scholars no matter what their field.

Ryerson's dubious diagnosis of the

roots of textbook distortions is matched by his notions about a possible remedy. He suggests that "when textbook authors and publishers learn the lesson that the desire for human rights is universal . . . our children will get the schoolbooks they deserve." It appears that Ryerson is much more of a utopia-dabbler than the "utopia-seekers" he derides.

—JACK L. ROACH
Professor Emeritus
University of Connecticut

The author replies:

I much appreciate the remarks of Robert Pickus and of Kin-Ming Liu. The information on China provided by R. Bruce McCole very usefully supplements my own.

Jack L. Roach argues that the bias of textbooks in favor of China's Communist regime is due to "the animus of anti-Sovietism that remains a key theme in U.S. foreign policy," which characterizes as well the majority of American intellectuals, grant-bestowing foundations, and hence China scholars and mainstream textbooks. Most textbooks, it is true, handle the history of the Soviet Union more accurately than they do that of Communist China. I would deny that this proves any "animus of anti-Sovietism." It signifies, rather, a better respect for the historical evidence. Nor is Professor Roach's thesis sustained by the example of Cuba, an obedient Soviet ally, which is rosily portrayed by many of the textbooks that favorably represent Communist China. As for curriculum material published by global, nuclear age, and peace education groups, most have little or nothing critical to say about Soviet policies since 1945, while savagely condemning our own.

Professor Roach says that my observation that textbooks betray a double standard in judging tyrannies of the right and tyrannies of the left "has little to commend it," but he neither disputes the evidence I give nor offers any of his own. Finally, his charge that I am "a utopia-dabbler" because I affirm the universal basis of human rights reveals the difference of beliefs between us, which our partial agreement on the facts cannot bridge.

—ANDRÉ RYERSON

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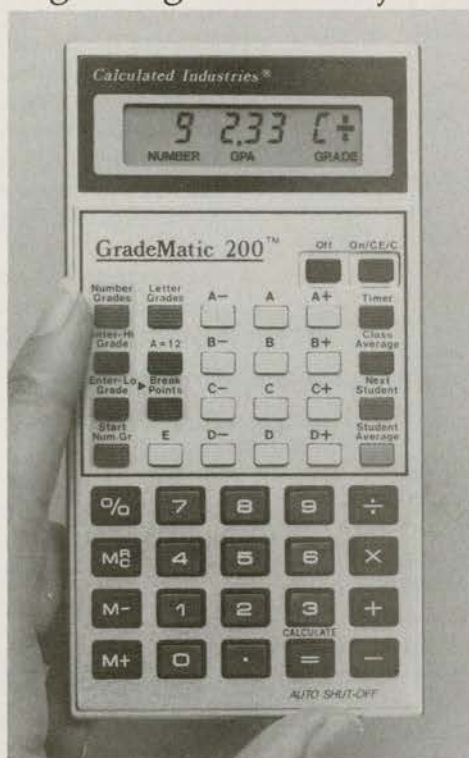
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SCIENCE EDUCATION

(Continued from page 22)

conceptual framework, that generates new understandings about relationships among concepts, or that raises significant questions about accepted conceptual frameworks. The scientist who makes such critical observations does not just happen to see what others have not seen because of expert "observation skills." To set up the conditions in which important observations are made, the scientist draws from existing conceptual knowledge, asks questions about important pieces of the framework, develops hypotheses, and designs experiments that will permit the critical and relevant observations to be made. Thus, skillful observation is intimately linked with both conceptual knowledge and with all the other "processes" of science. As Millar and Driver (1987) argue, each of the scientific "processes" can be submitted to a similar critique. These processes are not meaningful in isolation, and they are not science in the absence of a scientific conceptual framework.

Thus, the integration of science processes and conceptual knowledge is characteristic of expert scientists' thinking. In addition, this approach maps more effectively onto students' ways of learning science. When science processes are taught in relative isolation from conceptual knowledge, students often develop a misleading picture of science as "doing" for doing's sake. In my own studies of process-focused teaching, I identified students whose naive theories went unchallenged and unchanged despite weeks of process-focused instruction. These students did not view the processes of science as helping them better understand their world. Scientific processes, and science itself, were viewed as mysterious things that only certain smart people do and understand.

Practicing process skills in isolation of conceptual development does not help students understand how science processes are useful in understanding the world. Instruction that involves students in using these scientific processes to change their own theories in ways that are personally meaningful and consistent with scientific explanations provides a powerful alternative to process-focused instruction. To make such changes, students need to do difficult cognitive work that includes the use of science processes (predicting, hypothesizing, observing, inferring). Students do not, however, practice these processes in isolation and the goal is not for them to be better observers or predictors. Instead, these processes are used in the service of developing better explanations of natural phenomena.

THE CONCEPTUAL change perspective challenges two traditional ways of characterizing "higher-level thinking" in science. First, as discussed above, the usual representation of conceptual knowledge and science processes as separate kinds of scientific thinking does not accurately reflect what we have learned about the nature of science learning. Conceptual knowledge and the scientific processes must be intimately interwoven to be meaningful. Second, views of scientific thinking processes as a hierarchy of levels suggest that conceptual understanding is a relatively straightforward, lower-level process that students need as a basis for

doing higher-level thinking. This view does not capture the ways in which the processes typically labelled as "higher order" (application, synthesis) are used in the development of meaningful, conceptual understandings.

In my own studies of middle school learners who successfully integrated ideas about photosynthesis into their personal conceptions about how plants get their food (Roth, 1986), I gained a new appreciation of the challenges students face in changing their personal theories and misconceptions and coming to understand scientific concepts. The successful conceptual change learners used a variety of "higher-level" thinking skills in the process of developing the conceptual understanding that plants make (rather than take in) their own food. These students continually tried to use new information to explain and make predictions about plants and their needs. Often this was a difficult and confusing process, as students encountered areas where their knowledge was incomplete or in conflict with ideas presented ("I thought *water* was the plants' food"). Such conflicts led to analyses of the differences between them and to restructuring of students' personal conceptual frameworks. Students used experimental observations as well as teacher explanations to help them rethink their ideas. These students were metacognitively active, monitoring their developing understandings and resolving areas of confusion ("If water isn't their food, then why does my Mom water her plants?"). In the end, they developed conceptual understandings of photosynthesis that they could use to explain why plants in a cave will die or why we need to water plants and give them sunlight. Their ability to apply these concepts to a variety of real-world phenomena, however, was a *reflection* of their conceptual understanding rather than a higher-level thinking skill that was developed after their conceptual understanding was in place (as suggested by taxonomies like Bloom's that place "application" at a higher level than "knowledge"). These students' conceptual learning was not straightforward, bounded, lower-level thinking. Their conceptual change learning required the integration of a variety of sophisticated, higher-level cognitive and metacognitive thinking skills. Thus, the development of meaningful conceptual knowledge is a complex process, involving a great deal of higher-order thinking. In a conceptual change perspective, conceptual understanding *is* higher-level thinking.

RECENTLY, I taught a group of fifth-grade students about photosynthesis using a modified version of conceptual change curriculum material I had written and evaluated in two earlier research studies (Roth, 1985; Roth & Anderson, 1987). The materials began by presenting a problem to be solved: What is food for plants? Only after students' entering answers to this question had been elicited and challenged was the idea of photosynthesis explained. Students were then given numerous opportunities to make sense—to reconcile the idea of photosynthesis with their entering conceptions. Photosynthesis was taught as a first step in helping students learn in a year-long program about ecological interactions and about changes in energy and matter.

The unit began by eliciting students' definitions of "food." The text explained the difference between everyday definitions of food (anything we eat or drink) and a definition of food as energy-containing matter. After agreeing that water is not food by this definition, the students became involved in a lively debate about how plants get their food. Most students asserted that water is one important food for plants, while others pointed out that water does not have energy in it. Students had interesting experience-based arguments to support their belief that water did provide energy for plants ("rain water has energy in it but drinking water doesn't"). The class made a chart listing their ideas about how plants get their food, and this chart was revisited several times throughout the month-long unit.

Two hands-on experiments (adapted from the SCIS "Producer's" unit, Knott et al., 1978) and one discussion of a historical experiment provided initial information to help students puzzle through the problem of how plants get their food. An experiment with germinating seed parts suggested that young plant embryos get food that is stored in the seed's cotyledon. In discussing the results of this experiment, the idea that water did not contain energy for plants was again discussed. But many students still made predictions in the next experiment that grass seeds would grow in both light and dark conditions if they were watered because water is their food. Water was still a confusing issue.

While the grass seeds were given time to grow, von Helmont's famous experiment of 1642 was read and discussed. Students' predictions agreed with von Helmont's: As the tree in the tub of soil grows, the weight of the soil will decrease as the tree "eats" materials from the soil. When the students found out that the soil in von Helmont's experiment did not lose any significant weight, they accepted this as evidence that the plant was not "eating" soil. But they remained puzzled about why plants need soil and what fertilizers and minerals do for plants. I encouraged these questions while trying to keep the students focused on the problem of how plants get energy-containing food. As the grass plant experiment proceeded, and plants in the dark began to yellow and die, students became increasingly convinced that sunlight was somehow important and unsure about the role of water. Clearly, soil and water *alone* could not keep a plant alive. The sun seemed to be very important. But is the sun itself the food for plants, as many students believed?

Only when most of the students' entering ideas about food for plants had been either ruled out or brought into question was an explanation of photosynthesis given: that cells in plants' leaves use light energy from the sun to change water and air into energy-containing food. After this idea was explained in contrast with students' entering ideas, students were given many opportunities to use photosynthesis to explain everyday phenomena. In addition, their own application questions were rewarded and encouraged. One student, for example, wondered about the fact that *only* plants could make food. Did that mean that without plants, there would be no food? Another countered that we could live on candy bars if we didn't have plants. I encouraged this debate and later brought in Snickers

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bars. We analyzed the list of ingredients, talking about how each ingredient (corn syrup, sugar, peanuts, chocolate) had been made by a particular kind of plant.

Application opportunities included problems posed in overhead transparencies (How did this plant produce a potato?), questions posed for students to write and/or talk about (What if only one leaf of a plant could get sunlight? Could it live? Why or why not?), and further experimentation. Students also wrote in science log books about their evolving ideas, receiving feedback questions and comments from the teacher. Application activities included analysis of controlled experiments as well as other, seemingly nonscientific activities, such as role playing the life of a bean seed embryo. Card-sorting activities where students constructed (in pairs and individually) different concept maps showing the relationships among ideas were also used.

At the end of the unit, students revisited their initial explanations of how plants got their food and wrote and talked about how their ideas had changed. The post-test asked a series of application questions for which students had to write out predictions and explanations. There was also a mini-interview question in which students were asked to arrange words related to photosynthesis (air, water, sun, fertilizers, soil, cotyledon, leaf, stem, etc.) in a conceptual map and then explain their arrangement. Most students demonstrated a coherent understanding of the key concepts; the interviewer questions permitted individual coaching to clarify remaining confusions. Students' comments and questions revealed ways in which their conceptual understanding had generated a new sense of wonder and sense making:

John: Ms. Roth, I used to think that plants were just kind of *there*, ya' know? They just sat there. But now I know that they're really very busy little things, aren't they? There's lots going on inside them.

Ted: I know plants can use water, air, and sun to make food . . . but, I mean, *how* do they do that?

This unit involved much more time than the one lesson on photosynthesis outlined in the Silver Burdett & Ginn text (Mallinson et al., 1989). And yet the unit did not present many of the technical terms covered in the Silver Burdett & Ginn lesson—chloroplasts, stomata, carbon dioxide, hydrogen. But students were able to make predictions and observations, to change and develop explanations, and to apply ideas in a meaningful time frame; that is, they were provided time to change their understandings. The instructional model proved both workable for me and productive of meaningful

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conceptual understanding for my students. Although it did not call for explicit teaching of science processes, students regularly used these processes in constructing their developing understandings. Although it did not focus on exploration of societal issues, the unit provided a base for later study of the cutting down of rain forests explored during a unit on ecosystems. And students came to appreciate an issue important in their own society—that we need plants to produce *all* of our food (including Snickers!).

CONCLUSIONS

Each of the perspectives reviewed in this paper uses analyses of the nature of scientific thinking to define the goals of elementary science instruction and to advocate particular approaches to science teaching. The three perspectives share a concern that science teaching practice needs to change: It needs to become more focused on helping students think scientifically rather than on memorizing facts. To accomplish this goal, difficult curricular and instructional decisions have to be made. Given elementary teachers' limited time for planning and teaching of science, it is critical that the scope of the elementary science curriculum be limited and that teachers be supported in developing a coherent and manageable model or framework to guide their science planning and teaching. I find the conceptual change perspective to provide the most promise in terms of impact on students' understanding of science and scientific thinking. This framework also provides a useful tool for guiding daily teaching and planning because it frees teachers from long lists and hierarchies of skills and facts to be learned and helps them focus instead on important aspects of scientific understanding. □

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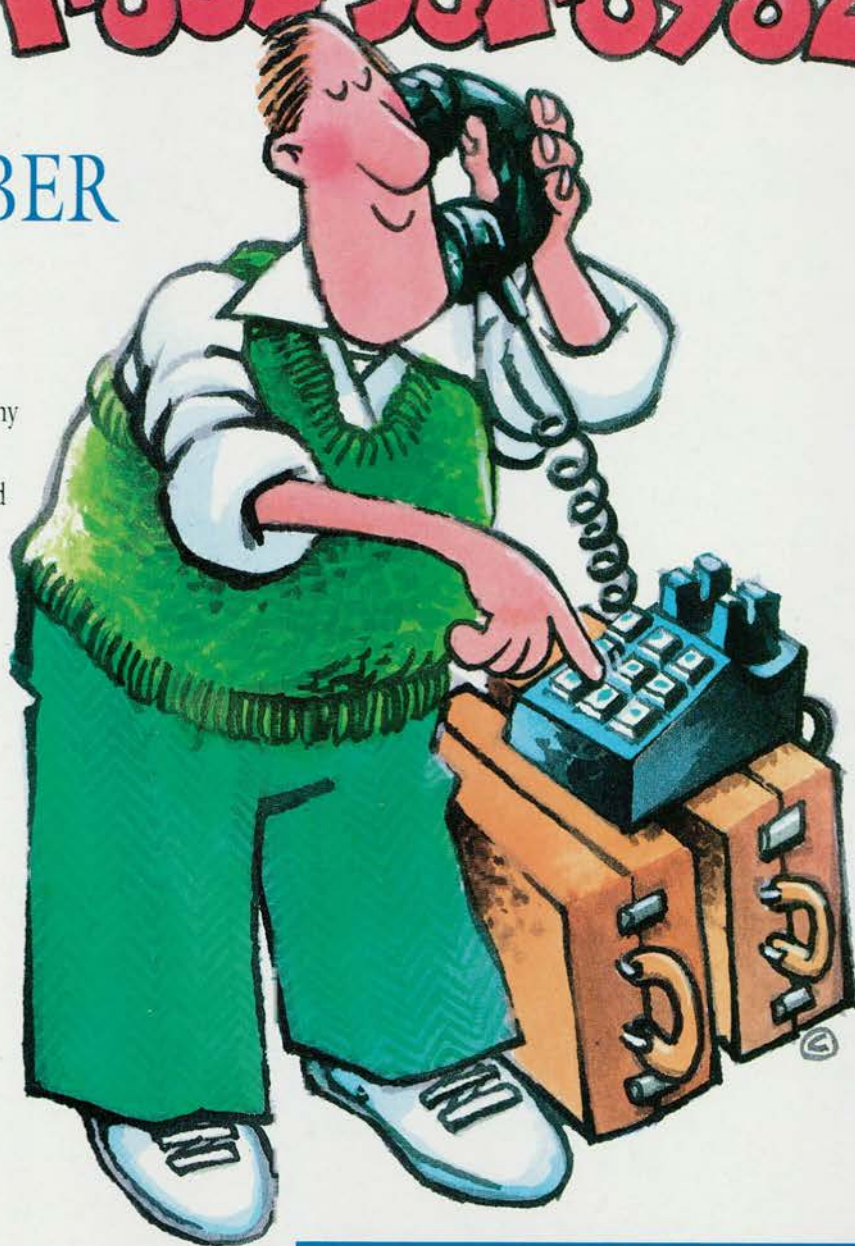
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