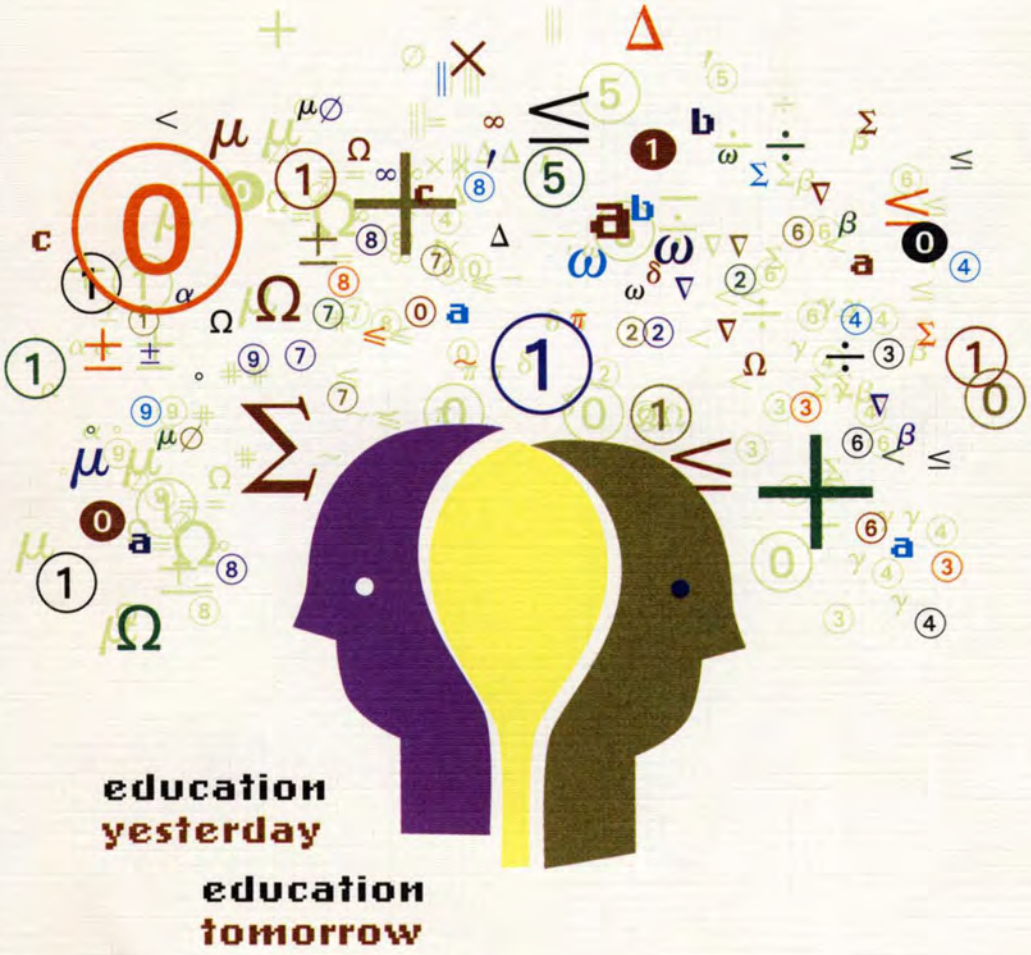
DÆDALUS

JOURNAL OF THE AMERICAN ACADEMY OF ARTS AND SCIENCES
FALL 1998
US: $7.95
CANADA: $10.35



Cover design by Michael Schubert, Director of Ruder-Finn Design

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Education Yesterday, Education Tomorrow

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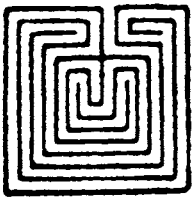
Issued as Volume 127, Number 4, of the
Proceedings of the American Academy of Arts and Sciences



Fall 1998, "Education Yesterday, Education Tomorrow"
Issued as Volume 127, Number 4, of the Proceedings of the American Academy of Arts and Sciences.
ISBN 0-87724-008-6

Library of Congress Catalog Number 12-30299.

Editorial Offices: Dædalus, *Norton's Woods, 136 Irving Street, Cambridge, MA 02138. Telephone: (617) 491-2600; Fax: (617) 576-5088; E-mail: daedalus@amacad.org*

Dædalus (ISSN 0011-5266) *is published quarterly by the American Academy of Arts and Sciences. U.S. subscription rates: for individuals—$33, one year; $60.50, two years; $82.50, three years; for institutions—$49.50, one year; $82.50, two years; $110, three years. Canadian subscription rates: for individuals—$42, one year; $78.75, two years; $109.50, three years; for institutions—$60, one year; $102, two years; $138.50, three years. All other foreign subscribers must add $7.00 per year to the price of U.S. subscriptions. Replacement copies for damaged or misrouted issues will be sent free of charge up to six months from the date of original publication. Thereafter, back copies are available for the current cover price plus postage and handling. GST number: 14034 3229 RT.*

All subscription orders, single-copy orders, and change-of-address information must be sent in writing *to the* Dædalus *Business Office, 136 Irving Street, Suite 100, Cambridge, MA 02138, U.S.A.*

Printed in the United States of America.
Printing Office: 2901 Byrdhill Road, Richmond, VA 23228.

U.S.A. newsstand distribution by Eastern News Distributors, Inc., 2020 Superior Street, Sandusky, OH 44870 (Telephone: 800-221-3148).

Periodicals postage paid at Boston, MA, and at additional mailing offices.

Postmaster: Send address changes to DÆDALUS, *136 Irving Street, Suite 100, Cambridge, MA 02138, U.S.A.*

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Preface to the Issue "Education Yesterday, Education Tomorrow"

READERS OF *DÆDALUS* FREQUENTLY ASK how issues of the Journal originate, who proposes the themes, and how they develop into the kinds of publications that appear four times each year. The story can be simply told. Recommendations for themes may come from any quarter, including those who read the Journal and believe that certain subjects ought to figure. In this instance, the idea for the issue originated with a Fellow of the American Academy of Arts and Sciences, Kenneth G. Wilson, and his colleague Constance K. Barsky. Wilson, reading the fall 1995 issue of *Dædalus*, "American Education: Still Separate, Still Unequal," saw the need for a further issue on American schools that they hoped might emphasize two themes. Wilson asked whether it might not be useful to consider certain of the proposals made for reforming elementary and secondary education in recent years, reflecting on how effective they have been in changing America's educational system. In this connection, his particular interest was to determine what the quality of research has been on questions relating to education, and whether, quoting the penultimate essay in that issue, "We Need to Know More," the imperative requirement at this time may not be for improved educational research. These concerns with educational research and development figure

prominently in the essay written by Wilson and Barsky, which comes at the conclusion of the volume and expands on themes treated in his book, *Redesigning Education.*

Other essays in the issue, including those written by Seymour Sarason, Karen Seashore Louis, Daniel Bromley, Robert Hampel, Lauren Resnick and Megan Williams Hall, and Victoria Marsick, suggest how divergent are the views of those who know America's primary and secondary educational scene well, who write candidly about what they perceive their problems to be, accepting that there is little agreement today about the condition of America's schools or what the various major reform efforts of recent years have in fact accomplished.

Seymour Sarason, unimpressed with much of what has happened these last years and showing scant regard for *A Nation at Risk*, perhaps the most celebrated educational reform document of the early 1980s, is very specific in what he imagines needs to be done to change the system. For him, the word "system" is all-important. There has been abundant tinkering—everyone acknowledges this—but there has been no fundamental systemic change, no capacity to engage all who in one way or other determine what goes on in the nation's classrooms, a company that, Sarason writes, must be seen to include teachers, school administrators, boards of education, state departments of education, colleges and universities, state legislatures and executive branches, the federal government, and parents. Meaning to be provocative, he poses three questions: "Why is it that despite the billions of dollars expended in the post–World War II era the results have been so meager, and some would say nonexistent?" Knowing that "you can always find a classroom and a school (almost always an elementary school) whose features are exemplary," he asks: "Why is it that these instances remain isolated, i.e., they do not spread or diffuse to other schools?" For him, this is the most important question. In Sarason's view, the American educational system "learns nothing from its failures and is incapable of learning from and then spreading its 'successes.'" Finally, he asks what others also comment on: "Why is it that as students go from elementary to middle and finally to high school that their level of boredom and disinterest increases discernibly?" Reserving judgment on what

the charter-school movement may in time bring in the way of innovation, Sarason argues that American schooling, today as in the past, has as its prime purpose the "taming and socializing" of children. Refusing to blame teachers or students for their purported failure to perform well, Sarason sees both as "the victims of an educational system they did not design."

Karen Seashore Louis is considerably less pessimistic. In her view, most reform proposals in recent years have been dominated by three concerns: to meet the changing needs of students and their families; to make the educational system more accountable for its performance; and to prepare the nation for the "global economy" of the twenty-first century. Louis recognizes that the call for systemic reform in the last decade, which has figured so prominently on state agendas, is "typically defined as higher, mandatory standards linked to new curricula and better methods of assessing students' achievement of the standards." In looking at the "waves of reform" that have appeared since the publication of *A Nation at Risk*, Louis acknowledges that teachers are rarely viewed as the "culprits" in the system's failure; they are seen as the "victims of a fragmented social vision about the goals of education—a system in which we require 'AIDS awareness education' but no specific understanding of economic and political geography." For her, there is no avoiding the real problem: "the low professionalization of teachers, who are poorly prepared and insufficiently supported to carry out the complex tasks demanded of them in today's schools." Discussing the "chaos" characteristic of America's educational system, and indeed the disorder of the American democracy more generally, she accepts that educational reform will always and necessarily be slow, but she sees many reasons for being optimistic, believing that the new and "eclectic mix of actors and ideas" bodes well for the future.

Daniel Bromley is somewhat less sanguine. Seeing most of today's educational reforms as "modest," he accepts that they are necessary but is less certain that they are sufficient, given the complex problems they seek to address. Looking at the literature on educational reform, he divides a segment that originates with the "educational community," concerned principally with learning, tests, and teaching processes, from the

segment that finds its home in what he calls the "economics community," concerned with the efficiency of the educational enterprise. For this second group, the "market failures" are all-important, and they are explained by the existence of "teachers' unions, bureaucratic administrators, meddling school boards, and oppressive state departments of education." Many, according to Bromley, see "the school as a firm in need of some hard-edged management advice." Bureaucratic inertia must be overcome; economic incentives need to be introduced to reward able teachers and administrators, and to drive out those who are inadequate. Bromley knows that those who understand American education realize that this is too simple a formula. Given the heterogeneity of American children, not to speak of the variety of chores set for America's schools today, it is scarcely surprising that so few are successful. Beyond this, however, Bromley sees a more serious problem: as he explains, "Few schools, to judge from their behavior, seem to believe that a relentless commitment to excellence and hard work is an essential of schooling in America. In simple terms, middling expectations cannot possibly yield other than middling outcomes." Low expectations, in his view, "deaden the current educational experience, and they work against innovation over time." The country is surfeited with "educational policy proposals." What is urgently needed is for greater attention to be given to what American universities and their schools of education are doing to train teachers, to professionalize those prepared to choose teaching as a career.

If Bromley's argument is for the professionalization of teaching, Robert Hampel emphasizes a quite different kind of responsibility that teachers must assume. In his view, so long as educators "tacitly condone part-time employment, electronic media, and peer pressure," America's students will remain as they are. For Hampel, the well-being of the country's young must be a prime concern of those who teach them. This is not to say that these are times of "chaos and crisis" for those who are young—Hampel is less pessimistic about their condition than many who gaze at the grim statistics of drug abuse and violent crime. He argues that the many programs introduced to help troubled youth have in fact made a great difference in their

lives. Recognizing the gravity of the conditions that exist for urban minority male teenagers, which he describes as "horrendous," his concern is with them but also with the many others, not impoverished, who spend twenty or more hours each week before their television sets and, in their adolescent years, work for twenty or more hours in what passes for part-time jobs. Such part-time work offers "meager educational benefits," Hampel writes, and there is no evidence that peer-group pressure causes many to strive for anything that could be mistaken for "excellence." So long as homework requires approximately four hours a week on the average, and so long as cars, clothes, and music have a commanding appeal for the young, paid work will continue to be their summum bonum, particularly in their high school years, and very little will change.

It is reasonable that the first segment of this *Dædalus* issue, written by men and women deeply concerned with the state of American education today, should include an essay by Lauren Resnick and Megan Williams Hall, who argue that today's education-reform movement, unlike those of earlier times, is alive and prospering. In their view, "despite the end of the Cold War and the recent upturn in the economy," which might in other circumstances have spelled the end of the nation's preoccupation with its schools, "the country is still gripped by concern for its education system." In the interest taken by governors and mayors, the Congress and the president, Resnick and Hall hear voices arguing for standards-based education. How, they ask, is one to explain this continued interest and concern? In their view, it is the changed economy in the new information age that makes imperative the creation of a more educated labor force; this, as much as anything, provides the chief incentive for educational reform. This is not to say that major changes are imminent, but only that the new interest in linking changes in pedagogy to institutional changes augurs well for the future. The time for "tinkering" with the system appears to be over. This interpretation, so very different from the one offered by Seymour Sarason, suggests why educators are themselves divided on whether there is indeed a "new core theory of teaching and learning," as both Resnick and Hall believe, and whether it provides the basis for a transformation of American

education that will, in their words, be both "radical and sustainable."

Victoria Marsick, believing that learning both in the workplace and in the schools in the twenty-first century will be fundamentally different from what has been common in the last hundred years, describes what she believes to be promising developments in education that are likely to create "communities" of employees and teachers of a kind unknown in the past, pledged to sharing information and learning in wholly new ways. Describing learning experiments that are not widely known but are beginning to be used, thought to have the greatest possible importance for adult education and for the "lifetime learning" increasingly spoken of as a necessity in the future, Marsick's observations draw largely on her work as an adult educator in corporations. Whether these or other comparable schemes will in fact have the influence she hopes for in the schools of the twenty-first century and in the creation of a new kind of teaching profession, less isolated and more committed to cooperation, time alone will tell.

While those who provided the principal incentive for this issue of *Dædalus*, Kenneth Wilson and Constance Barsky, were somewhat less sanguine about the long-term utility of certain of today's proposed educational reforms, they recognized the significance of such efforts in providing better instruction in many things, including the all-important development of reading skills. Still, their demand for the creation of a new academic discipline, which they call "Change Science," reflects their belief that something more is needed than what is currently being provided by educational reformers, even those who espouse schemes that are both celebrated and adopted. In their view, the R&D that has made possible major changes in other very large and complex systems in this century simply does not exist in education. Believing this, they asked whether there might not be profit in studying certain of these other major American "systems" that have successfully used scientific knowledge and technological innovation to achieve change. Rather than look at other country's educational systems, purportedly superior to the American, seeing what the United States might learn from them—the foreign models on offer being different at different

times, with the Soviet Union, Japan, and Germany all figuring—Wilson and Barsky asked whether a study of successful American "systems" as varied as health care, agriculture, communications, and power might not prove to be more useful. Their plea is for a commitment to be made to new kinds of scientific inquiry in the field of education, joined to an understanding of how technological innovation may be expected to follow from such initiatives.

Neither Wilson nor Barsky imagine that these other systems are in some sense perfect. They believe, however, that they are less static than the educational system, hence their concern to find authors willing to describe how these systems have evolved over time. Daniel Fox and John Ludden, writing about American health care and how it has changed since the early twentieth century; Wallace Huffman, invited to write about American agriculture, a system thought to be without parallel in the world, for its capacity both to innovate and to produce record yields; Richard John, concerned principally with communications, particularly in the creation of an American postal system, and later of telegraph and telephone facilities; and Thomas Hughes, writing about power systems, particularly in respect to the invention and dissemination of electric light and power—these authors tell very different stories that have a single thread in common. They are "success stories" of a kind, though it would be a mistake to imagine that they are tales of unadulterated success. Still, no one would seriously argue that American education has shown comparable scientific and technological innovation, though some might say that the nation's priority in acknowledging the need for a mass public-education system to serve *all* children is as large a social invention as any that can be claimed for American medicine, agriculture, communications, or power.

Looking at American medicine and health care, Fox and Ludden recognize that some Americans continue to feel a certain nostalgia for the physician of yesterday, for the "house calls" that they could be relied on to make, but also for the "magic bullets" that for a time seemed to make American medicine almost a miracle science. Such nostalgia is strangely incongruous in our age when the major providers of health

care, the HMOs, speak a very different language, concerned with "population health," preventive care, cutting costs, and giving satisfaction to those who principally pay for the nation's health care, the federal government and business. Fox and Ludden know that today's health care is very substantially different from what was common even a few decades ago. The federal government and businesses large and small, insisting that health-care costs not be allowed to escalate any further, are influential in determining what medical, surgical, and other care is made available to all, including the aged and the poor. There is little room in this new system for the kind of individual care thought to be characteristic of the past. If science and technology have combined to make life at birth and into extended old age possible for millions who would otherwise have departed this earth at a much earlier age, if mid- and late-twentieth-century medical science and technology have utterly transformed the medical and all of its associated professions, creating markets for health care that never existed before, there is no possibility of a return to the past, and few would in fact wish it. Today's health-care system has spawned a new kind of competitiveness—based as it is on the "market principle"—with the HMOs, preoccupied with their own fiscal viability, determining what care is provided. Considerations of cost are seen to be absolutely crucial in determining what procedures and treatments are on offer. Not all who experience this new medical regime are entirely satisfied with it, as Fox and Ludden acknowledge, but they do not dwell on those who see only advantages in this private enterprise health-care system, so different from what exists in much of the rest of the developed world, including societies as different as those of Canada, Germany, the United Kingdom, and France. While the authors do not claim that this medical "market" system has overwhelming significance for American education, those who advocate charter schools and the like imagine that educational reform will occur only when competition exists between school systems, when schools and teachers are evaluated, chosen, or shunned on the basis of their performance. If HMOs see their clients as "customers," something of the same mentality is thought to be relevant in the sphere of education.

Wallace Huffman, writing about the American agricultural system, very appropriately entitles his essay, "Modernizing Agriculture: A Continuing Process." As with medicine, scientific achievements have been absolutely crucial to what has happened in the United States. What is significant, however, is that farmers had to be willing to adopt the new technologies. Beginning in 1890 and continuing to this day, that research has flourished, supported by state governments, the federal government, and private industry. The land-grant colleges and the state agricultural extension services—both characteristic American institutional inventions—were committed to the education of farmers and rural adults more generally, seeing the dissemination of accurate information about farming as only one facet of a continuing concern with family welfare. If most nineteenth-century science in agriculture had a "weak scientific knowledge base," with very few individuals being trained to do such research—it being thought more an "art" than a "science"—this was no longer the case after 1920. It is in this latter period that "technology" comes into its own, with technical inventions of many kinds leading to productivity levels never previously known. If there were 4.5 million farms in 1890, 6.4 million in 1910, and almost the same number in 1935 (6.8 million), that number had diminished to 1.9 million in 1990. Yet aggregate American farm output in 1990 was 5.5 times larger than in 1890, with much of the more rapid growth occurring after 1935 when the average farm size increased and farms became more specialized in the products they produced. Huffman believes that this tale of agricultural change has significance for those concerned with the reform of schools; if a "science of agriculture" had to be developed before modernization could occur, the same may be true of education, and Huffman knows that instant results are not to be expected.

A not very different story is told by Richard John; he too emphasizes the importance of developments in the nineteenth century that served to create an American communications system that had unique and highly advanced features. Some may be surprised by John's assertion that "the earliest—and, very possibly, the most fundamental—innovation in American communications took place in mail delivery." As he explains,

"Beginning in the 1790s, the government undertook for the first time to provide a geographically far-flung population with regular, time-sensitive information about commerce and public affairs." That this postal system spawned "an elaborate communications infrastructure that included the stagecoach industry and the newspaper press" is rarely recognized by those who pay attention only to what the railroad and the telegraph did to unite the country. For John, the American postal system was "one of the earliest of the great technological systems of the modern age." The Post Office Act of 1792 gave Congress rather than the executive the authority to establish new postal routes and, just as importantly, allowed newspapers to be sent through the mail at very favorable postal rates. Until the Civil War, a stagecoach-based system was used to distribute the mail, superseded then by the rapidly evolving rail system. The United States postal system was uniquely efficient and innovative through the 1830s; it was no longer that at a later time. John writes: "It is something of a puzzle why so many subsequent postal innovations—including city delivery, railway mail, rural free delivery, and parcel post—lagged behind their counterparts in Europe. Equally perplexing is the repeated failure of reformers to expand the jurisdiction of the post office department to embrace telegraphy and telephony, as was common in much of the rest of the world." In telling the story of the Morse telegraph and the development of Western Union—which enjoyed great success for a time but failed to recognize why it should adopt the nascent telephone industry—John's concern is to describe the kind of shortsightedness that in the end led to disaster for Western Union. An expansive communications strategy, as conceived by a group of agile and aggressive business executives at AT&T, led to the creation of a utility that had little tolerance for competition, believing that its commitment to develop a single national telephone system under Bell control was in the nation's interest.

Thomas Hughes, no less concerned with how technological systems affect society, believes that the history of American electrical power systems, properly understood, may have lessons useful for those concerned with the reform of American elementary and secondary education. Developing arguments

very reminiscent of those advanced by Alfred Chandler, Jr., in the Spring 1996 *Dædalus* issue, "Managing Innovation," Hughes suggests how much institutional invention made new kinds of industries possible. If power systems in the United States agreed by 1910 to combine central generating stations of very different kinds, and if this made for more efficient and secure distribution of electric power, there has been no comparable willingness by school systems to share human and physical resources, thereby reducing costs, but also making for better service. In Hughes's view, the concern with a potential loss of autonomy has impeded America's schools from recognizing what they would gain from being connected with other schools, and indeed with other cultural and social organizations that together form what he terms a "socioeducational system." The latter phrase is very rarely used by those advocating educational reform. Hughes develops the concept of "reverse salients," borrowing a military metaphor. It is essential, in his view, to "discern the weakest point, or reverse salient, in a system and attempt to strengthen it." Hughes demonstrates how this concept worked in changing power systems; he is no less concerned that it be thought about in connection with educational reform. Recognizing that individuals will differ about what are in fact the most significant "reverse salients" in America's schools, he knows that some will see it as a "lack of reading skill" in students, while others will dwell on the "absence of computer facilities," and still others on "the lack of positive parent participation."

While certain educators may scoff at the idea that laymen—not themselves professional scholars in the field of education—can illuminate a subject on which there is so much contemporary controversy and such limited agreement, an argument can be made that it is precisely such individuals who may help to provide new thought about school reform, particularly if they can be brought into some sort of meaningful dialogue with those who make American elementary and secondary schooling their research subjects, and also those who teach in, administer, and govern the country's schools. That other professions and "systems" do not provide precise guidance for those concerned with school reform will be obvious to those who read this issue.

Yet the information that is provided may indeed provoke the kinds of inquiry that are so desperately needed today.

It is well to be reminded that over a century has passed since a book rarely cited today, *The Public School System of the United States*, written by Joseph Mayer Rice and published in 1893, spoke of the deplorable condition of America's elementary and secondary schools, where a "mechanical" approach was common. For Rice, as for many who followed him, including John Dewey, incontestably the most influential and profound commentator on American schooling, the teacher-centered and curriculum-centered approach was anathema. It was the child who needed to be brought to the center. Those who continue to rail today against what they deem to be the hazards of educational practices that make drill all-important as pedagogy, imagining that rendering young children and adolescents obedient and docile is still the principal school objective, are in effect repeating what has been said for a century. Has there, in fact, been so little change in education?

If some schools today resemble, even in superficial ways, those condemned by Rice and, more importantly, by Dewey, it is a mistake to imagine that the progressive educational philosophies of the late nineteenth and early twentieth century have had no effect on America's schools. Dewey's concern was to develop a "science of education," and while some may question the worth of that science as it has evolved in this century, believing it to be inferior to what has been characteristic of medicine or agriculture, Dewey's commitment to schooling as the essential prerequisite of democracy has never been openly disavowed. For him, education was "the fundamental method of social progress and reform," and this has remained an article of faith for American businessmen and politicians, teachers and parents, even for those never able to accept the full progressive educational program that Dewey advocated. It is significant, then, that Dewey's most important educational writings were produced between 1894 and 1916, and that this is the time made memorable principally for the presidencies of Theodore Roosevelt and Woodrow Wilson, when political, social, and economic reforms of the greatest importance were enacted. Who would argue that the educational reforms of that

day were equally important? Greater access to schools, not least for the children of immigrants, became common, and high schools proliferated in numbers unknown elsewhere; but was a new profession established, very different from the one that had existed in the decades immediately following the Civil War?

Given the subjects treated in this issue of *Dædalus*, it may not be irrelevant to recall that 1910 was the year that the Carnegie Foundation for the Advancement of Teaching published its celebrated report on "Medical Education in the United States and Canada," prepared after very extensive research by Abraham Flexner, with an introduction by the Carnegie Foundation's president, Henry S. Pritchett. In an age when candor was not suspect and when the term "political correctness" had not yet been invented, both spoke about American physicians in ways that only a few in equally responsible positions have thought to do about America's teachers then or since. In his very hard-hitting introduction, Pritchett wrote: "For twenty-five years past there has been an enormous over-production of uneducated and ill-trained medical practitioners. This has been in absolute disregard of the public welfare and without any serious thought of the interests of the public." Medical schools had been profitable so long as they were not required to invest in expensive scientific equipment, and so long as their instruction remained largely "didactic." Now, something else was required, and the colleges and universities of the country needed to bestir themselves to provide the kind of scientific education that was called for. In the words of the Carnegie report, they had failed to do so in the preceding twenty-five years, unable "to appreciate the great advances in medical education and the increased cost of teaching it along modern lines." Many medical schools were still actively training physicians manifestly unsuited to their avowed healing vocations. What was to be done? The recommendations were for fewer medical schools, better equipped, with a smaller number of students graduating each year, and those who did being better educated and better trained. Refusing to mince words, Pritchett wrote, "... in the future the college or the university which accepts a medical school must make itself responsible for university standards in the medical school and for adequate support for medical education. The

day has gone by when any university can retain the respect of educated men, or when it can fulfil its duty to education, by retaining a low grade professional school for the sake of its own institutional completeness."

There was no comparable report at the time on what was required for the educating and training of America's teachers or what, indeed, proud and self-respecting colleges and universities might do to advance such education. Indeed, it would not be unfair to say that there has never been a report comparable to that of Flexner's, detailing how the country's elementary- and secondary-school teachers might best be prepared for what John Dewey knew to be one of the country's most essential professions. That the excitement and preoccupations of World War I precluded an equally candid and searching treatment of teaching as a profession, that the prosperity of the 1920s, with the self-satisfaction that it engendered, no less than the difficulties created by the world economic depression of the 1930s, may have militated against an equally comprehensive and intensive inquiry are all reasonable explanations. Though American schools, with their vastly expanded elementary- and secondary-school student populations, increasingly urban, with many the children of immigrants, might have profited from major new investigations, none of very great moment was undertaken—certainly none that could, by any standard, be compared with what Flexner had done in his study of the medical profession.

It was only after World War II that new and fundamental criticism of the American school system emerged, initially from individuals, but increasingly from bodies established by foundations and others to inquire into the country's schools, its teachers and administrators. A work like Arthur Bestor's *Educational Wastelands: The Retreat from Learning in Our Public Schools*, published in 1953, and Rudolph Flescher's *Why Johnny Can't Read*, published in 1955, sounded a tocsin that resonated for many. If Bestor and Flescher tended to be somewhat hyperbolic in their criticisms, others, at the end of the war and in the first years of the peace, were considerably more modest, though no less concerned to see fundamental change in American education. Thus, for example, Vannevar Bush, renowned for his

work in helping to develop the atom bomb, published in 1945 *Science: The Endless Frontier,* which scientists recall principally because it laid the groundwork for the establishment of the National Science Foundation, a federally supported agency that gave scientific inquiry support on levels never previously contemplated. Few who have not read the work realize that Bush had another objective, which was to argue that the country was cheating itself in allowing so many of its youth to abandon school at so early an age, often after the fifth grade. If the country had come to recognize the importance of educated talent in the war itself, the lesson should not be lost in the new and more peaceful age that seemed to be beckoning. The same kind of interest that helped provide the rationale for the G.I. Bill of Rights, with its incomparable provisions for providing high-educational opportunities for those who had served in the country's armed forces, was now being advocated at much lower levels by those who recognized the importance of trained talent, which could only be secured through effective schooling.

If these and other comparable books of 1945 and the immediate postwar period more generally helped create a new interest in schooling and education, even touching on the questions of curriculum at every level, it was only the launching of *Sputnik* in 1957 that generated the exaggerated fears that gave legitimacy to all manner of reform proposals calculated to make the country more secure. New federal funding was provided for what were considered to be defense-related subjects—science, math, and foreign-language study being thought most important in the new dangerous age opened by the Soviet Union's purported scientific and technological prowess. As the 1960s progressed, those concerns continued, but they now had to share a place with a growing preoccupation with what were considered to be serious domestic issues, too long neglected. Questions of race, deprivation, discrimination, and poverty became increasingly important, and they quickly affected the tenor of all major discussion on critical educational themes.

It is well to be reminded that James Bryant Conant emerged in this period as one of the country's major commentators on American education. *The American High School Today*, published in 1959 after the Soviet launch of *Sputnik* but planned

and largely written in the years before, enjoyed a very considerable success, like his less well-known *Education of American Teachers*, published in 1963; the first of the two sold some 170,000 copies, but neither can be said to have made a lasting impress on America's schools. Conant, renowned as a former president of Harvard but also as one of the distinguished scientists responsible for the atom bomb, had chosen after his service as high commissioner and ambassador in Germany to accept support from the Carnegie Corporation to research and write about American schools. Not surprisingly, he voiced an opinion that had become almost canonical by that date: the country needed to offer educational opportunity to all of its youth. It was the "comprehensiveness" of the American public education system that had such great appeal for Conant; in his mind, this was what made it so different from what was common in Europe, where social class so largely determined educational opportunity. If Conant had any criticism of the American public high school, which he greatly admired, it was that "the academically talented student, as a rule, is not sufficiently challenged." John Gardner, who served as president of the Carnegie Corporation and the Carnegie Foundation for the Advancement of Teaching, had long propagated a comparable theme. The idea of "excellence" had great currency at the time, and it was in no way surprising that the former president of Harvard, who had done so much to open his own institution to students from every part of the country whose academic credentials were impressive, should stress this same theme.

It there was any great originality in Conant's studies, any decided boldness, it lay in his proposals for the reform of the education of teachers. Determined that incompetent and inexperienced teachers should no longer be allowed to enter the system—understanding that this was the only way to give the profession greater self-confidence—he argued that only the upper third of any high-school graduating class should be allowed to enter programs that would lead to their being certified as teachers. English, foreign languages, and mathematics were praised as the subjects prospective teachers should seek to excel in. The "methods" and "foundations" courses that so frequently dominated in most undergraduate and graduate education pro-

grams, designed specifically for future teachers, were disparaged. Conant knew that such courses did nothing to enhance the reputation of those who took them. He recognized also that the practice training of teachers was manifestly insufficient. Taking a leaf from medical-school practice, Conant argued for the creation of "clinical professors," who would, in effect, train the teaching novices. Only in these ways might the teaching profession hope to gain the kind of prestige that had come in the twentieth century to those who practiced law and medicine. It is not wholly surprising that these recommendations, treading on the gouty toes of men and women committed to quite other educational theories and practices, did not have the institutional consequences intended.

In the years after the assassination of John F. Kennedy, quite other issues came to the fore. It was in this period that the most hyperbolic statements were made about what education might be reasonably expected to achieve, not least for the disadvantaged, and how not only were all children to be given access to educational opportunity but that their success in school could be guaranteed if only sufficient funds were forthcoming for teachers' salaries and essential school equipment, and if bureaucrats and politicians could be compelled to cease their interference in schools. Such exaggerated praise of what the American schools were achieving or might hope to achieve was not wholly persuasive either to the Carnegie Task Force on Teaching as a Profession, which issued *A Nation Prepared: Teachers for the Twenty-First Century* in 1986, or to the so-called Holmes Group, which released in that year a report on *Tomorrow's Teachers*. Four years later, in 1990, that same group issued a report on *Tomorrow's Schools*. While this second report showed a continued fidelity to Dewey's old belief in the central importance of education for the success of the American democracy, the rhetoric had changed substantially. Schools were now defined as "learning communities," where egalitarian values should predominate, and where, necessarily, a major effort had to be made to attend to the professional development of teachers in quite new ways. Clearly, there was work to be done in readying teachers for the complex task of instructing all children, never allowing an earlier bias in favor

of excellence to dominate over the continuing concern to avoid competitiveness, to guarantee social solidarity. At a time when the news media were filled with stories of Japanese and German student accomplishment (as indicated by test scores when compared with that of their American peers), and when the disorders of juvenile life in the United States figured prominently, it was significant that the old Dewey rhetoric was repeated in a new form, dwelling on the importance of student-centeredness as opposed to curriculum-centeredness.

These reports, so very different in their emphasis and recommendations from what had been proclaimed in 1983 in *A Nation at Risk,* suggest how those who acknowledged American school deficiencies were divided on what needed to be done. If the Carnegie and Holmes reports dwelled on the need to reform the profession of teaching, and if *A Nation at Risk*, the work of the National Commission on Excellence in Education, appointed by President Reagan's Secretary of Education in 1981, seemed to argue the same, their emphases differed substantially. Those who wrote *A Nation at Risk* were preoccupied with appointing teachers competent in their designated special subjects. Others who found the teaching profession wanting in the later 1980s and early 1990s were substantially less preoccupied with these matters and more determined to bring other issues to the fore on the country's education agenda. Their concern was with how to educate the new generation, so different from any previous one—which included the children of divorced parents or absent fathers, often of illegitimate birth (a term rarely used, "single-parent family" being much preferred), who were habitually subjected to the violence of the streets, the home, and television. Others, apparently in a more conservative vein, worried about how children reared in late-twentieth-century America could be made respectful of learning. Still others emphasized the importance of providing an education that would in the end give America's youth meaningful employ in a new global economy that would not tolerate the slackness or ignorance of an earlier day. It was not unusual for some, and not only those who wrote *A Nation At Risk* or subscribed to its ideas, to emphasize how important education was to the success of the American democracy. John Dewey lives on, in however attenuated a form.

The differences suggested in this issue of *Dædalus*—differences over what is to be done, over what can be done—are very real. They cannot be dismissed as the angry or utopian visions of men and women who choose to ignore certain realities. If there is no "science of education" comparable to what exists in American medicine or agriculture, and if the scholarship that would produce such learning is both controversial and suspect, what hope can be held out for fundamental change? If the teaching profession in the United States today enjoys little of the repute attached to medicine or law, is there any reason to believe that the proposed "cures" for teacher malaise will in fact be effective? While lip service is habitually paid to education, and has been from time immemorial, is there reason for being at all confident that state legislatures, the federal executive, and Congress will in good time enact legislation calculated to alleviate the problems of a profession unable to recruit a fair share of the more talented high-school and college graduates? Are any of the major colleges and universities of the country prepared to do for their schools and departments of education what Flexner and his colleagues demanded almost a century ago that they do for medicine? Are there reasons to believe that the inventiveness attributed to American agriculture and communications—an inventiveness that goes beyond technological prowess—can be fostered in those who share responsibility for America's schools? If an increasing concern of our society is with how well we educate the poor and disadvantaged, if this interest has escalated in the last decades, is there evidence to suggest that we are equally concerned with how well we care for their health? Are we prepared to admit that great numbers are neglected in the United States today in ways uncommon in any other advanced industrial democracy? If many of the systems described in this issue are "product driven," are such criteria of "success" at all applicable to an educational system that is "reform driven," that cannot define itself in product terms?

A question that must be asked is what research can do to lead the United States out of its present educational morass. Is there reason to believe that those who launched the agricultural experiment stations in the 1890s faced less complex problems

than educational researchers face today? Were medical researchers at the time of Flexner advantaged in a way that is not common for those concerned with educational research then or even now? What are the powerful constituencies working for fundamental change? Can new research possibly defeat the political, economic, social, and cultural forces that seek only more limited changes and are divided about what needs doing? Because the responsibility for schools rests largely with state governments, their legislatures and governors, while responsibility for research rests largely with the federal government, can the state authorities bestir themselves to apply pressure for larger federal appropriations for educational research? What can powerful American foundations do to support such research? Are they at all satisfied with what they are presently doing or have done in the past?

These and other like questions may be asked by those who read this issue. They will understand why Kenneth Wilson and Constance Barsky perceived it as they did, and why all of us are grateful to the Ohio State University for the financial support it offered. In two conferences held in Columbus, Ohio, and in numerous private meetings held in Cambridge at the House of the American Academy of Arts and Sciences, plans for the issue were made and revised. All of us would wish to thank also the Rockefeller Brothers Fund, the William and Flora Hewlett Foundation, and the Carnegie Corporation for their generous help.

S.R.G.

Seymour B. Sarason

Some Features of a Flawed Educational System

I ASSUME, PERHAPS WRONGLY, that most readers of *Dædalus* have had no meaningful relationship to schools apart from their own early schooling and occasional contact for their children. Candor requires that I say I have learned *not* to discuss matters of educational change with such people—at least not to discuss them seriously—because of their tendency to rivet on a single cause or solution. And when I do, it is not because I think I know so much but rather because I have to steel myself against the feeling that I am unable to convey how fantastically complex and interrelated the issues are and, significantly, that there are no villains, only victims. I want to convey that complexity, but I usually succeed only in engendering the reaction (visible but not verbalized) that I am making a simple problem unnecessarily complex. That is why I had some misgivings about writing for this issue of *Dædalus*. I agreed to participate because the audience *Dædalus* serves and reaches is comprised of many people who vastly underestimate the complexity of institutional change even though in their own professional fields they do not. Again, candor requires that I expect that some readers are of the opinion that the problems of school reform would be mammothly reduced if school personnel were brighter and better educated. If only it were that simple!

In an essay I wrote in 1965 I said that if the education-reform movement continued as it was in terms of its substantive focus and style of intervention, I held out no hope for its success, or even its partial success. With each of my subsequent publications

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my prediction became more explicit.[1] In the 1960s and 1970s, most people willingly approved of dramatically increased expenditures for school reform. They did not anticipate immediate improvement; however, they certainly did not expect that by the end of the millennium their expectations would confirm the adage that the more things change the more they remain the same. Indeed, today many people no longer believe that increased expenditures will accomplish anything, and by many people I include a far from minuscule number in the educational community who will not say publicly what they say privately (to me, at least). That is especially true in regard to our urban schools, which they regard as lost causes.

A number of questions have to be asked and answered (however provisional and incomplete the answers) if one seeks to judge and redirect reform efforts. The three most important questions are: 1) Why is it that despite the billions of dollars expended in the post–World War II era the results have been so meager, and some would say nonexistent? 2) You can always find a classroom and a school (almost always an elementary school) whose features and accomplishments are exemplary. Why is it that these instances remain isolated, i.e., they do not spread or diffuse to other classrooms or to other schools? 3) Why is it that as students go from elementary to middle and finally to high school that their level of boredom and disinterest increases discernibly?

I regard the second question as the most important because how you answer it speaks volumes about the other two. The brief answer to this question is that our educational system has all of the features of a nonlearning system: It learns nothing from its failures and is incapable of learning from and then spreading its "successes." This is not explainable on the basis of an individual psychology—there are no villains who have willed this state of affairs. It is a system of parts that is not coordinated in a structural sense and among which there is little agreement about the purposes of schooling; indeed, the parts are frequently in an adversarial relationship.

What are the parts of the system? Teachers, school administrators, boards of education, state departments of education, colleges and universities, state legislatures and executive branches,

the federal government, and parents. In one way or another, directly or indirectly, with varying degrees of formal power, each of these parts plays some role in determining what goes on in a classroom. Despite the fact that there are hundreds of thousands of classrooms, the behavioral and programmatic regularities in these classrooms are highly similar.[2] How the classrooms are organized, the role of teachers and students, the contents of books, and the allocation of time to this or that activity are some of the similarities. It is understandable that if you observe a classroom, you will "explain" what you see in terms of a teacher and a group of students who are heterogeneous in many ways. There is truth to that explanation, but it is a partial truth because the major regularities you observe bear to some degree the imprimatur of other parts of the larger system. For example, how teachers teach is incomprehensible apart from how they were taught to teach in colleges and universities.[3]

Sitting in classrooms you see teachers and students; you cannot see a system. A system is literally a creation, a conception, intended to help us identify parts, flesh out their interactions, and give us direction for how to go about improving the system. For all practical purposes the education-reform movement has not been informed or guided by a system's ways of thinking, which in large measure explains why "here and there" successes remain isolated and why we have learned so little from the far more frequent failures.

Let me illustrate this point by referring to the tragedy of the *Challenger* spaceship. Soon after the spaceship exploded, attention focused on the failure of the O-rings due to the relatively cold outside temperature. The problematic relationship between temperature and the O-rings had been recognized and discussed *before* takeoff. Why then was the takeoff not postponed? One explanation is that the agendas of representatives of the private contractors and diverse parts of the NASA bureaucracy were in conflict. The launching of a spaceship is the end result of a very complicated system of parts that is deliberately organized to avoid decisions that in any way may be a threat to safety. What the investigative committee determined was that, yes, the O-rings were the immediate "cause," but that "cause" was the end result of a system of adversarial parts marked by concerns about

publicity, politics, money, status, and adherence to predetermined schedules. From the outset the investigating committee assumed that their task was to determine not only the immediate cause but if and how that cause was embedded in a system conducive to producing it, therefore requiring a change in the system. The decision to launch the *Challenger* was preceded by many other decisions by representatives of different parts of the system, not all of which were at Cape Canaveral. In some vague way we know that a launch is the end result of the workings of a system, but it takes a tragedy for us to recognize that how a system is supposed to work is not the way it always does. We are far from recognizing that in regard to our educational system.

The concept of a system is bedrock to the sciences. In the post–World War II era there have been more than a few scientists who have indulged their rescue fantasy to improve schooling. In the 1950s and 1960s we had new math, new physics, new biology, new social studies. In no way am I suggesting that these scientists were dealing with unimportant problems. But I do contend that in regard to these problems they sought, or at least assumed, that their accomplishments would spread, i.e., their demonstrations would generalize far beyond the initial sites of their demonstrations. The spread was minimal. It is ironic that none of these scientists transferred their system-based way of thinking to education. Each identified a "cause" of poor school performance and sought to repair it. They did not ask, what is there about the system that produces the cause I seek to repair? They failed for a number of reasons, but certainly among the most important was their failure to think in system terms.[4]

Kenneth Wilson in *Redesigning Education* directs our attention to the role of the continuous improvement or self-correcting features of a successful system.[5] Needless to say, in the most unvarnished way he says that our existing educational system is notable for its inability to self-correct. Indeed, he asserts that the present system is literally incapable of assimilating the self-correction process; it is unrescuable. I agree. Beginning in 1965, I predicted that the reform movement would go nowhere, and I elaborated on that prediction in my book *The Predictable Failure of School Reform.*[6] The limitations of that book are revealed

in its title: my focus was on one part of the educational system. Soon after its publication I began to confront the system qua system but resisted coming to the conclusion that, however cogent my analysis of a school might have been, that school was embedded in a system that would continue to defeat efforts to improve features in the culture of the school. That explains my enthusiasm for Wilson's book. Wilson had less to *unlearn* than I did. Wilson has not (yet) given us a blueprint of what it means to deal with the system qua system, although aspects of a blueprint are given in his book.

Let me now turn to a reform that is getting a good deal of attention and that allows me to elaborate on some of the points I have made above. It is a reform that is both heartening and disheartening, although I predict that the disheartening aspects will prevail. I refer to charter schools sanctioned by state legislatures—schools that are not subject to the rules, regulations, and practices of the local or state board of education.[7] In the presidential campaign of 1996 both Dole and Clinton supported charter schools; indeed, Clinton said he was increasing the budget item to support three thousand charter schools. What is heartening about the concept of the charter school is that it is the first "official" recognition that the present system is unrescuable, i.e., it is a system inimical to changing the system. The system is anti-change; it is an obstacle to innovation; it is incapable of self-correction or self-improvement. A school has to depart from the system if it is to achieve its purposes. Neither Dole nor Clinton saw or made that point. In addition, Dole promised to eliminate the Department of Education on the assumption that by eliminating or mammothly reducing the federal government as part of the system the states would be unleashed from the bureaucratic intrusions of distant Washington. For Dole there was nothing wrong with the existing system that eliminating the federal part of it would not cure. Historically, that is nonsense; it belies an ignorance of why and how the states pleaded for federal intervention.[8] To suggest that before the federal government became a part (a stakeholder) in the educational system the state control and supervision of schools had *any* of the features of a self-correcting stance is truly to play loose with history. In

any event, the implicit significance of the acceptance of the concept of charter schools cannot be overestimated.

There are several disheartening aspects of the charter-school movement. The first is that it is being proclaimed as a kind of solution to the improvement of educational outcomes—witness President Clinton's intention to increase dramatically the number of such schools. The fact is that in the enabling legislation, state or federal, there are no funds to describe, study, and evaluate the complicated process by which such a school is created, actualized, and developed (i.e., the problems encountered, the modes of dealing with those problems, and the basis they provide for judging partial or complete success or failure). We know, with some certainty, that these schools will vary in the accomplishment of their stated goals. We can also say with certainty that in the absence of dispassionate description and analysis we will not know how to explain their success or failure. The concept of the charter school is too important in its policy implications to depend on anecdote or personal opinion; in matters of educational reform we have been down that road too many times. Consistent with Wilson's position, the charter schools now being created have to be considered as model A that will be superceded by model B (and then C) on the basis of carefully obtained evidence. Increasing the number of such schools does not mean that their quality improves. Put another way, unless the charter-school movement is informed by self-correcting, self-improving processes, we will get action but not wisdom, unreliable opinion and not the learning we need.[9] Generally speaking, words like research and evaluation are far more odious in state governments than in the federal government. I am not talking about so-called basic research but rather research-evaluation applied to an important practical problem with expectations of crucial practical consequences.

In *The Creation of Settings,* I have argued that there are *predictable* problems in the creation of any new setting.[10] The charter school is an instance of the creation of a new setting, and careful studies of these schools are called for. Whether foundations will support such study—given that their track record in supporting research-evaluation of educational policies, especially when such studies require a longitudinal methodology, is a dis-

mal one—it is impossible to say. It is precisely because charter schools represent the most forthright critique of and challenge to the existing educational system that its advocates should feel the deepest obligation to study them in as careful and as diverse ways as possible so that subsequent generations of charter schools can benefit from the successes and failures of earlier models. Absent such studies of a sample of model A charter schools, there may well be no model B or C. That would add another chapter to the unpleasant history of educational reform. The existing system is a nonlearning, non-self-correcting one. The same appears to be characteristic of the way in which charter schools are being conceived and implemented.

Charter schools represent an alternative to how a single school can be governed. A more general question to ask is, how might a new educational *system* be governed? I asked that question as I read about the constitutional convention of 1787. That convention was called to repair the inadequacies and dangers of the Articles of Confederation. It became evident, especially to James Madison, that the Articles were unrescuable; rather than engage in an effort of repair the convention started, so to speak, from scratch. Can we possibly hope for a comparable review of an American educational system that is not working? Who would undertake such a review? Does it make any sense to recommend an appointed commission that would do for education what the delegates to the Philadelphia convention accomplished more than two centuries ago to change the American political system? The history of federally appointed commissions is certainly not a happy one. Those, for example, most critical of President Reagan's *A Nation at Risk* would almost certainly join me in arguing that his commission produced a report of pallid generalities. Their sense of urgency and crisis was followed by nothing resembling concrete ideas or proposals.

Although it is true that one should not expect federally sponsored commissions or groups to issue reports that clearly have their intended consequences, two are instructive exceptions.[11] The first was the group that during World War II had the task of planning for services for and the care of what would be an unprecedented number of battle casualties. Neither by past performance, location, or quality of its facilities, nor by its struc-

ture and ethos, could the then–Veterans Administration (VA) discharge its obligation to those veterans. The planning group came up with concrete proposals that essentially created a new VA as well as changed medical education in general. The second exception was the federally sponsored Joint Commission on Mental Health, which dramatically changed state mental-health programs, especially in relation to state hospitals; they were overpopulated warehouses that, like VA hospitals, were isolated and unrelated to communities and centers of training and research.

Why did the plans of these groups break new ground? First, the fact that drastic changes were in order was recognized by those not only in the professional communities but, crucially, at the highest layers of political authority and leadership. Second, the groups were comprised of people with long, direct experience with the problems with which they had to deal. Most were chosen because of their dissatisfaction with the past system and its practices. Third, they did not focus on considerations of cost but rather on the overarching question of what needs to be done to improve the quality of care. They did not need to do extensive studies to demonstrate what was obvious: the existing system was costly, and though those costs would escalate, quality would not improve. And fourth, precisely because of the level of political sponsorship as well as the social and economic climate of the early postwar years, the groups had reason to believe their proposals would be widely diffused.

In regard to education, political leaders show no understanding that the governance of the educational system is a major cause of the system's inability to engage in self-correction. For example, when Dr. Linda Darling-Hammond's 1996 report on preparatory programs for educators was published, she and those who helped her must have assumed that it would be read and acted on.[12] In fact, it has had no play in the mass media; just as there are "nonpersons," this appears to be a "nonreport."

Why has no president or other individual in high elective office ever commissioned this kind of report? Why have they failed to call on such individuals to assist them? Why, indeed, will they not accept that the governance of the educational system is the most resistant obstacle to major reform? If the

governance issue, which necessarily calls for political leadership, is bypassed or glossed over, there will never be major change. In *How Schools Might Be Governed and Why,* I sketch, very summarily and provisionally, a new form of governance, realizing of course that clarifying the issue of governance is beyond the capabilities of any one individual.[13]

The key objective at every level of governance should be to promote and sustain contexts of productive learning. In the film *Mr. Holland's Opus,* the first half of the film shows Mr. Holland's approach and practices with his high-school students. They illustrate a context of *unproductive* learning with which we are all too familiar. His students are bored, hostile, and semisomnolent. The second half of the film is about his epiphany: He is forced to recognize that he had been insensitive to "where the learners were and where they had started." Armed with his predetermined calendar-driven curriculum, assuming that his knowledge of and love for music could be poured into and assimilated by his students, and unaware that the music he loved was unfamiliar and strange to his students, he produced the opposite of what he intended. He did not know—he had never been taught to know—that the artistry of teaching finds its source in the ability to start with where the learner is, in using that starting point to build bridges to new knowledge and outlooks heretofore not in the student's ken. William James and John Dewey discussed this a century ago in regard to the classroom.

If anything can be said about the educational-reform movement, it is that the reformers have been grossly insensitive to one of the most important ingredients of a context of productive learning: engendering and sustaining the desire to learn and change because it has practical, personal utility. Reformers have not established a context in which the fruits of research do not remain in an ivory tower but are diffused in ways and for purposes that make practitioners want to learn and change. You can learn because you are required to learn, which is very different from wanting to learn.

If we asked university professors to justify the existence of a university, the answer will be that the obligation of the university is to create and sustain contexts in which its faculty learns, changes, and grows in relation to his or her interests. You can

have a university with no or very few students. The assumption is that the faculty will create a similar context for their students. If you ask schoolteachers to justify the existence of an elementary, middle, or high school, the answer will be that it is for students; it is not for the learning and development of teachers. Yet if contexts for productive learning do not exist for teachers, they cannot create and sustain that context for students. And that is precisely the case for the students and teachers in the modal American classroom, and especially so in our urban schools. The present system of governance cannot rectify this state of affairs because it is the major bulwark of that state of affairs.

You can talk about and legislate for high standards, you can change curricula, resort to block programming, advocate for vouchers and charter schools, require teachers to take more courses, lengthen the school year, involve parents, support site management—you can do all this and more, but if the governance system is not explicitly obligated to create and sustain contexts of productive learning, what we have now will continue to disappoint and, by any cost-benefit analysis, will remain wasteful in the extreme.

A hundred years ago, John Dewey made two major points in his presidential address to the American Psychological Association: First, that unless the field of education and its problems was conceptualized and embedded in the social sciences, it would go nowhere; its glaring inadequacies would not be understood, let alone ameliorated. And second, that the fruits of theory and research that teachers and other educational personnel needed in order to change and improve practice required a "middleman" who would be the conduit through which those fruits would be made known and become of use to practitioners.

Dewey's presidential address had absolutely no impact. I am probably correct in saying that that seminal paper will not be found in the bibliography of any article or book on education in the post–World War II era, save my own. Psychology labeled Dewey as an educator and, worse yet, a philosopher. Labels are not neutral; they can, unwittingly or otherwise, blind us to the diversity of those upon whom they are pinned. If for no other reason—and there are other reasons—this issue of *Dædalus* gives

me hope because it signals the beginning of the demise of rampant parochialism in matters concerning education.

The field of public education has not been without its historians. Unfortunately, and here the field of education is not atypical, history tends to be viewed as a museum of relics having few or no lineal descendants in the present. May I point out one very important fact in the history of public education in America: From the mid-nineteenth century on, one of the major purposes of schooling was to tame and socialize the children of immigrants. The structure and organization of schools, the curricula, and especially the pedagogical style employed were determined by that purpose. The concept of the individuality of the learner was never considered; it literally was inconceivable. Schools today are lineal descendants of that purpose. They look different, but the modal American classroom is still a place where, rhetoric aside, students are objects to be tamed and socialized.

The most rigorous study done of question-asking in classrooms found that in a forty-five-minute period the average number of questions asked by students was two, and in some classrooms it may have been one student who asked the questions.[14] The number of questions asked by teachers varied from a minimum of forty to well over a hundred. Is it any wonder then that as students go from elementary, middle, and then to high school that they view subject matter negatively and schooling as a kind of legally sanctioned form of child abuse? Someone once said, in regard to the high rate of dropouts in our urban school systems, that many of these dropouts should be seen not as disturbed, unmotivated, or stupid but rather as having a good hold on reality. Blaming the victim is an old story in the history of schooling. To those readers who too easily blame teachers and others for the inadequacies of our schools, I must point out they are blaming the victims. They are well-meaning victims of an educational system that they did not design. And, as I said about the *Challenger* explosion, before we assign blame let us look at the system.

ENDNOTES

[1]Two examples are Seymour Sarason, *Revisiting the Culture of the School and the Problem of Change* (New York: Teachers College Press, 1996; published originally as *The Culture of the School and the Problem of Change*, 1971) and Seymour Sarason, *The Predictable Failure of Educational Reform* (San Francisco, Calif.: Jossey-Bass, 1990).

[2]John Goodlad, *A Place Called School* (New York: McGraw-Hill, 1984); Sarason, *Culture of the School and the Problem of Change.*

[3]The significance of that fact is contained in the recent report of the National Commission on Teaching and America's Future, *What Matters Most for America's Future* (New York: Columbia University, Teachers College, 1996), for which Linda Darling-Hammond was the executive director.

[4]Sarason, *Culture of the School and the Problem of Change.*

[5]Kenneth Wilson and Bennett Daviss, *Redesigning Education* (New York: Teachers College Press, 1996).

[6]Sarason, *The Predictable Failure of School Reform.*

[7]The degree of autonomy varies from one state to another. In Connecticut half of the twenty-four schools would be the responsibility of the state department of education, although the degree of responsibility is unclear. Since *any* charter school has to gain approval from the local board before its application can be studied and approved by the state department of education, that school must explain why "leaving" the local school system would be necessary for it to improve educational outcomes. That the local system may not look kindly on the implicit or explicit criticism of its workings, which may result in compromises in the substance of the application, is not unlikely. We may never know what (if any) consequences flow from such potential dynamics.

[8]Seymour B. Sarason, *Political Leadership and Educational Failure* (New York: Teachers College Press, 1998).

[9]That is a point Darman has succinctly made about diverse federal programs. Richard Darman, "Riverboat Gambling with Government," *New York Times Magazine,* 1 December 1996, 115.

[10]Seymour B. Sarason, *The Creation of Settings and the Future Societies* (San Francisco, Calif.: Jossey-Bass, 1972).

[11]Sarason, *Political Leadership and Educational Failure.*

[12]National Commission on Teaching and America's Future, *What Matters Most for America's Future.*

[13]Seymour B. Sarason, *How Schools Might Be Governed and Why* (New York: Teachers College Press, 1997).

[14]D. Susskind, "Questioning and Curiosity in the Elementary School Classroom," unpublished doctoral dissertation, Department of Psychology, Yale University, 1969.

Karen Seashore Louis

"A Light Feeling of Chaos": Educational Reform and Policy in the United States

FOR MOST OF THIS CENTURY schooling was fiscally and politically a local issue, and educational reform was emphasized in neither national nor state policy. In the 1950s, the launching of the Soviet *Sputnik* satellite caused a brief flurry of concern about science education, while the Great Society reforms of the 1960s brought federal initiatives in compensatory education for poor children, resulting in new funds allocated to schools with large numbers of "children at risk." Yet except for the still controversial court-ordered busing of children to achieve racial desegregation, education was only sporadically "real news."

In the early 1980s, this changed. The National Commission on Excellence in Education issued *A Nation at Risk*, a report that castigated the quality of U.S. schools and called for broad reform, which the commissioners defined as those measures that stimulated more effective education for all students.[1] The report generated far more attention than educators expected; as a result of this, many were heard muttering, "We should take advantage of this interest because it will be a blip on the public's radar—three years at the most." Confounding this reasonable expectation, however, debates about education and public schooling have flourished and expanded for more than a decade and show few signs of diminishing. Controversies over policies, whether about "whole language" versus "phonics" or

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the equity of funding formulas for local schools, are at the forefront of public consciousness to an unprecedented degree.[2]

WHERE IS THE ACTION?

From an outsider's perspective, through its myriad checks and balances the American form of democracy protects individual liberty by doing almost everything the hard way.[3] In most countries only a few major actors dominate policy development: political parties and national parliaments generate policy, while regional authorities of various kinds have more limited influence.[4] This does not mean, of course, that educational policy development in these countries is straightforward. The presence of coalition governments in many countries requires lengthy debates over even minor changes. As one Danish colleague put it, "We don't try to pass an educational policy here until at least fifty percent of the municipalities are doing it already," a remark that could easily extend to other countries as well.

In contrast, educational policy-making in the United States occurs by means of a multilayered and largely decentralized system in which both decision-making processes and the boundaries of authority are unclear. Four levels in the formal governance system have traditional and/or constitutional rights to some decisions: the federal government, the state government, the local municipal government, and the school administration.[5] Some of these levels have broader powers than others (the state is more powerful in most arenas than the local school or the federal government), but the mix of responsibilities and rights is variable. In addition, there is more activity at each level than in other countries: the court systems, legislatures, executive and educational agencies, communities, unions, and professional associations and businesses are all active at some point in attempting to influence policy-making in the schools. This intricate system has all of the attractive and clumsy features that are inherent in our form of democracy; yet it also creates conflicting demands on schools and educational professionals, for which we sometimes unjustifiably hold them responsible.

Ironically, perhaps, most actors and levels in the governance system do not influence learning in the classroom. State legislators cannot select the highest-quality principals; federal courts cannot mandate the conditions of teaching; and state and national unions have limited influence over the actions of their own local affiliates with respect to policy. Thus, although policy-making may occur largely outside the schools, local conditions and policies moderate. Large educational-policy hammers (for example, court-ordered desegregation) are used but appear, frustratingly, not to hit the intended nails (e.g., equality of educational outcomes for minority children).[6] When this occurs, the natural response is often to look for another big policy tool to accomplish the same ends. On the other hand, if additional policies also fail, the response is often to blame the intended beneficiary rather than asking more fundamental questions about the policy instruments themselves.

My intent here is not to dissect the constitutive flaws in the educational policy system and processes but to examine the proposed solutions to "the problem of schools." The point to be kept in mind is the ways in which their conflicting purposes have distracted schools from their primary purpose—enabling the personal and intellectual development of children.

CORE THEMES IN EDUCATION IN THE UNITED STATES

Conversations about schooling are as diverse as the American public. However, three themes are woven into most calls for reform: the need to respond to the changing needs of students and families, the press toward making the educational system accountable for its performance, and the increasing concerns about whether our educational system is preparing us for the "global economy" of the next century. These concerns are not new but are reflected in basic values and traditions in the United States.

Adapting to the Changing Needs of Students

> Education, then, beyond all other devices of human origin, is a great equalizer of conditions of men—the balance wheel of the social machinery.
>
> —Horace Mann

> Education and work are the levers to uplift a people. Work alone will not do it unless inspired by the right ideals and guided by intelligence. Education must not simply teach work—it must teach life.
>
> —W. E. B. Dubois

We enshrine education as a fundamental right in state constitutions. More importantly, however, Americans have always viewed education as a primary mechanism for equalizing opportunity in a diverse society. Although we fall short of our goal, our aspirations have not changed.

The United States is today experiencing the largest wave of immigration since the early part of this century, as well as huge increases in impoverishment among children, both of which further challenge the equity goals of schooling. The notion that today's students are demographically different from those of the 1950s is well accepted, if alarming, as are a host of other purported generational characteristics—students with shorter attention spans, changes in cultural values that make students less responsive to adult demands, and the much-vaunted threats of single-parent families and inattentive parenting.[7] However well or poorly documented these trends are, we are asking that schools develop new approaches to address the needs of today's students. In this context, policymakers, including big-city mayors, state governors, and legislators at all levels, are calling for major educational platforms as part of their campaign strategies.

Accountability

> The eager and often inconsiderate appeals of reformers and revolutionaries are indispensable to counterbalance the inertness and fossilism making so large a part of human institutions.
>
> —Walt Whitman

> If the federal government had improved in efficiency as much as the computer has since the 1950s, we'd only need four federal employees and the federal budget would be $100,000.
>
> —Newt Gingrich

Americans harbor persistent assumptions about lethargy, bloat, and ineffectiveness in public institutions. Earlier in this century

the proposed reform was administrative efficiency—managerial control to counteract the persistent strains toward cronyism and political featherbedding.[8] Current protests are against precisely the "educational bureaucracy" that arose as a consequence of the purported solution of past generations. In addition, a growing sense of the "public's right to know" and even the most intricate, mundane, or sensitive data bearing on the performance of a major public sector guides current approaches to the problem of assuming accountability.

Politicians assume the personal stake of teachers and administrators in the status quo, and their resistance to change. Most educators hold themselves personally responsible for the educational performance of children in their classroom. Yet historically, the U.S. educational system has been designed around local political responsiveness, not performance measures. Thus, although the current round of calls for accountability avoids an "input" model emphasizing professional credentials, focusing on "outputs" or evidence of student achievement, "the system" has no existing capacity to produce such information in a way that permits meaningful comparisons between reform proposals.[9]

Competitiveness

> Intelligence and industry ask only for fair play and an open field.
>
> —attributed to Daniel Webster

> Education is the fundamental method of social progress and reform.
>
> —John Dewey

Education has always been presumed to be a public as well as a private good in the United States. Believing that literacy was foundational to democracy, we were the first country to mandate publicly funded education for all children. The notion that advanced literacy and numeracy are essential to our economic survival is more recent, although built on the presumption that "American ingenuity" was a hallmark of our economic success. Until recently, little data permitted any comparison between the performance of educational systems in different states or countries: The question "How much do students know?" was

essentially unanswerable. This has changed dramatically in the last fifteen years with the beginning of the National Educational Longitudinal Study in the United States and international studies of educational achievement. However flawed, these efforts to look at student achievement have fueled debates about the state of education in the United States.

Although they tell us how much students know, they do not tell us how much students *should* know. Data are subject to multiple interpretations: some view the findings as evidence of educational disaster, while others argue that they show similar levels of educational achievement among the developed countries.[10] Despite varying interpretations, an underlying (but untested) assumption in policy discussions is that preparation for "the knowledge society" requires higher levels of education than were acceptable in the past.

DEMOCRATIC THEORIES AND POLICY INITIATIVES

The three themes of students' needs, accountability, and competitiveness found throughout policy debates on educational reform are linked in different ways to current national and state policy initiatives. As these policy initiatives have emerged over the last decade, their proponents justified them through an elaborate discussion about the relationship between schools and the nature of democratic society in the United States.[11] Most prominent among the many strands of policy proposals are "systemic reform" and "standards"; decentralization and school-based management; and parental choice. While these three strands are potentially compatible, they draw upon alternative explanations of how schools are related to the operations of a democratic society. In addition, their analyses of "what is wrong" and "what we should do about it" differ.

Systemic Reform, Central Standards, and Democratic Theory

The call for systemic reform—typically defined as higher, mandatory standards linked to new curricula and better methods of assessing students' achievement of the standards—has dominated state agendas for over a decade. Bill Clinton, who chaired the National Governor's Council when that body developed its

positions on standards-driven school reform, has made it a central feature of his presidential educational policy efforts, assuring the continuing prominence of systemic reform. Recent visible manifestations of this line of policy development are "Goals 2000," a set of national objectives, and the National Commission on Teaching, which translates the call for higher standards in K–12 schools to similar, standards-based reform proposals for teacher preparation and professional development programs. Scholars, major foundations, and policymakers have embraced systemic reform.[12]

The "standards movement" calls for common definitions of the desired content and outcomes of schooling.[13] Yet centrally defined criteria for curricula, student achievement, teacher preparation, or administrator competence, whether at the state or national level, are at odds with the U.S. tradition of local school control vested in the hands of lay school boards, and in consequence have not been readily embraced by either conservatives or liberals. Not surprisingly, therefore, there has been an elaborate attempt to justify standards by reference to the needs of changing student populations, accountability, and competitiveness.

Whether mandatory (as in many state graduation-standards programs) or voluntary (as in President Clinton's proposed national tests), the enormous variability of student experiences in U.S. schools and in what they know when they graduate is alarming news.[14] Thus, a strong equity argument supports the standards movement: in a democratic society, it is unjust that students of different races, or students who happen to live in rural Louisiana instead of suburban Minnesota, should have disparate educational experiences. Using this reasoning, some policymakers and scholars have called for a set of standards that incorporates an "opportunity to learn"—ensuring that all students are exposed to a similar set of ideas and materials before holding them individually accountable for their performance on a state or national test.[15]

The argument of state responsibility for educational quality is prominent; schools are, it is argued, instruments of the common good whose accountability should be less to the citizens of a small town than to the future of society. State accountability

for both "inputs" and performance has received strong support from court judgments that have found funding inequities between local districts inconsistent with states' constitutional responsibility for a "thorough and efficient" educational system for the whole population. Over the past few decades, the obligation for educational funding has increasingly shifted to state revenues, which in turn has reinforced broader discussion of a familiar theme: "The citizens are paying for it—what are they getting?"

The correlation between economic competitiveness and the quality of education is often assumed in the discussion of standards. Based on comparisons offered by mass-media outlets between the U.S. educational system and that of other countries (notably Japan), much of the public has encountered and accepted the argument that 1) other countries that have strong economies have national curriculum standards and national tests; 2) those countries do better at educating students than does the United States; 3) therefore, the United States should introduce standards and assessments to have an appropriately educated work force.[16] But this comparative discussion is often uninformed and rhetorical. For example, newspapers are quick to give front-page notice to reports that U.S. students do poorly in mathematics compared to Japanese students, but they relegate the superior performance of U.S. students on reading tests to the inside pages.[17] More serious efforts to analyze the relationship between educational policies and student performance in other countries are sometimes hampered by a lack of understanding about how common standards evolve and are maintained in different cultures.[18] Nevertheless, it is incontestable that standards policies at the state and national level are often justified in terms of keeping up with the Japanese, or the French, or any other nation that happens to be on a policymaker's itinerary.

Systemic Reform: What is Wrong? A basic premise of the standards and systemic-reform movement is that the "first wave" of educational reform, which called for more rigorous course-taking standards and minimum graduation requirements (as the *Nation at Risk* report advocated), produced few observable results. The "second wave of reform," which included efforts to

use school-based management and other decentralized means to realize improvements on a national scale, is criticized as uneven and inequitable in its effects.[19] Thus, the present "third wave" would incorporate centralized standards and curriculum with resources for the professional development of teachers, with a view to increasing both the substantial content of their teaching and their pedagogic skills for addressing the specific contexts of the classrooms in which they teach.

The proponents of systemic reform have documented specific problems within the existing educational system that are inimical to improved performance. Among these are an excessive emphasis on basic skills (such as punctuation, math facts, and state capitols) and a lack of attention to more sophisticated applications of knowledge, such as real-world problem-solving and multistage mathematical problems. They also draw attention to the allegedly lower levels of preparation of U.S. teachers and the need for increased preparation and professional-development activities that would enable them to deliver a new, enriched curriculum with well-defined and measurable objectives.

Teachers, however, are rarely viewed as culprits in this perspective. Rather, they are seen as victims of a fragmented social vision about the goals of education—a system in which we require "AIDS-awareness education" but no specific understanding of economic and political geography. Students are educated through exposure to disconnected, locally selected ideas, reinforced by mandated textbooks that are "dumbed down" and made "politically correct" to meet the lowest standards of national markets. No wonder that students and teachers become disengaged from the most meaningful educational goals—gaining competence in manipulating ideas and preparing for continued learning and adjustment to a changing marketplace of ideas and careers.

Setting standards will not lead to educational improvement unless we address basic weaknesses in the educational system. Chief among these is the low professionalization of teachers, who are poorly prepared and insufficiently supported to carry out the complex tasks demanded of them in today's schools.[20] Today's teachers, it is argued, need more initial training and

large increases in continuing professional development if they are to keep up with new demands. Tied to this are outmoded conceptions of learning theory embedded in school organization, textbooks, and classroom practices, which ignore recent research on cognitive development. Traditional pedagogical principles, popular with both educators and the public, disadvantage less-able students—for example, the assumption that a student should not learn algebra until he has mastered the multiplication tables.[21] A "populist" and decentralized educational system provides few incentives for spreading good, research-based standards and practices because of the lack of codified standards and assessments, expectations, and teacher preparation/development programs.

Systemic Reform: What is Needed? Since this analysis focuses on deficiencies in the educational-policy infrastructure, it is not surprising that the recommended solutions focus on remediating the gaps through central policy initiatives. In both the United States and other countries where systemic reform initiatives are prominent, it is generally held that the impetus for meaningful reform must come from the highest administrative body responsible for education; in the United States, this means the fifty states.[22] Among the states, however, the force behind educational policy development is variable, of course: sometimes governors are powerful, while in other cases educational policy is driven by legislatures, court decisions, or state education agencies.

Given the multiplicity of actors, it is not surprising that a core assumption of systemic reform—a coherent vision and goals for education, a firm definition of the "knowledge base," and the related preparation and continued development of teachers—has been hard to achieve. In the most unified of disciplines, mathematics, the National Council of Teachers of Mathematics (NCTM), supported by the National Science Foundation, rallied around a standards-based model a decade ago. New textbooks, state standards, and assessments developed in conjunction with the "new standards project" at the University of Pittsburgh have helped to drive a vision by supplying appropriate vehicles. Even so, NCTM standards are controversial and

have come under attack in some conservative communities for emphasizing "fuzzy math" that ignores the importance of math facts.

A consistent system of instructional guidance—including curriculum frameworks, curricular materials, professional development, and accountability assessments—is fundamental to the systemic/standards policy strand. Although mathematics has, over the past decade, cohered around this task, it has proven more elusive for many other disciplines. As some states, such as Minnesota, have moved away from specific disciplinary standards for "higher levels of learning" and toward broadly defined disciplinary competencies, coming to a common vision of "what students should know" and "how we know if they know" has become even more problematic.[23] The state standards both attract and repel teachers who struggle with these issues. On the one hand, when teachers have collaborated onstandards and assessment most report that it has been arguably the most intense and exciting professional-development experience of their careers; on the other, the specter of being held accountable for a vast experiment in educational policy is daunting in a profession where accountability has typically meant having clearly defined lesson plans for each class period.

At the same time, we are just beginning to discuss the implications of systemic reforms for the system of educational governance. When state-set standards prevail and as state funding increases, the focus of local governance (i.e., school boards and districts) necessarily changes. As historians of U.S. education have pointed out, the early part of this century involved a standardization of local educational governance through a professionalized bureaucratic framework that put a superintendent and an elected school board firmly in charge. What also emerged during this period was a roughly uniform set of structures that could fit most children from ages five through eighteen.[24] Today's changes are minor compared with the rapid demise of the autonomous one-room schoolhouse taught by a single high-school graduate that served most students at the turn of the century.

A major shift inferred by today's systemic perspective is the upgrading and professionalization of teachers, who must have high levels of specialized knowledge both in the delivered content and in the tools of assessment and quality control for ensuring school performance. Most systemic-reform advocates note that standards will not come cheaply: they assume significant investments in both the necessary tools (curricula and tests) and in the management of more sophisticated tools at the school level. Both require increased professional knowledge among teachers. In this regard, the practice of teaching is moving in the same direction as the practice of medicine, in which quality control and standards have emerged from efforts to professionalize yet have also undermined the autonomy of individual physicians and hospitals.

Decentralization, Site-Based Management, and Democratic Theory

The origins of the decentralization movement, often called site-based management (SBM, as it is universally labeled in education circles), are murky. Certainly it is related to the emergence in U.S. corporations of the total quality management (T.Q.M.) concept, job redesign, and "reengineering," all of which focus on reducing bureaucracy and middle management. However, it is also related to democratic theories in historic contention within the United States. In the world of education, site-based management has become associated with initiatives to create more autonomy and communal responsibility within individual schools, while reducing the policy role of local school boards and district offices. The slogan of this movement might be: "Educational results are produced in schools and classrooms, not in the state department of education."

Early efforts to introduce SBM were largely idiosyncratic to school districts but have since become embedded in significant policy legislation in many key states. Initially this was weakly felt in the development of legislation that either permitted or encouraged the development of SBM programs in districts. The SBM policy concept received significant national visibility with the introduction of the radical Chicago School Reform in Illinois at the beginning of the 1990s, which devolved most of the

responsibilities of the district school board—including hiring and firing of principals, and most decisions about discretionary budgets—to individual elected community and teacher boards representing each school.[25]

The school-based accountability movement has strong support at the local level. Public-interest groups in many states have published data on the performance of different schools based on available indicators, and most states now have legislation that incorporates some public accountability at the school level for student achievement results. The notion of school responsibility for improving student performance is controversial but increasingly considered a legitimate arena for negotiation among teacher unions and educational administrators.

Yet the origins of the SBM movement are not in theories of public accountability but in the older democratic notion of locating authority and responsibility at the lowest possible level. SBM arose as a response to the presumed lack of responsiveness of large, bureaucratic school systems with innumerable regulations and reporting responsibilities. How, it was reasoned, could competent professionals meet the needs of their students when regulations and lack of budgetary autonomy hemmed them in? The SBM movement was born not only out of total quality management but also out of the teacher-professionalization movement that emerged from both teacher unions and professional associations beginning in the 1980s.[26] Their cry was a challenge to patterns of centralized control; in return for greater autonomy, professional responsibility, and money for professional development, they vowed to deliver a good school experience tailored to the unique characteristics of their student populations, communities, and staff. SBM cannot be separated, as a point of public policy, from the bedrock U.S. belief in the motivation of individuals and groups to create singularly successful organizations built on critical principles of how best to "serve the customer." In addition, although some critical educational policymakers and scholars disavow the management trappings of SBM, they are still strongly supportive of the idea that individual schools run by impassioned and talented teachers can make a difference for students—especially students from more disadvantaged backgrounds.[27]

The SBM movement is justified in using models derived from the literature of business management, but it also responds in the educational community to a stream of "effective schools" research that identifies specific alterable characteristics of schools—personnel, instruction, and organization—related to student achievement.[28] This research provided at the local level an answer to a long-standing question: How can we better organize to ensure that students achieve? An important component of this research stream was (and is) the idea that different school populations—varied in terms of the balance of rural and urban communities, ethnic groups, range of ability levels, and similar variables—have needs that require different teacher responses and different organizational structures and policies.[29] Thus, the solution to more competitive schools is to return to the classical model of "American ingenuity." In this case, the New American Schools Development Corporation—a "competition" for model schools developed by educational professionals and cosponsored by the federal government and business organizations—exemplifies this inventive spirit.[30]

Decentralization: What is Wrong? A basic premise of the advocates of decentralization is that the educational bureaucracy is a stranglehold on the creativity and inventiveness of local educators. This perspective emerges in part from the community-school nostalgia evoked on a daily basis in U.S. culture. The evolution of schooling during the first decades of this century from a highly decentralized, teacher-parent controlled system to one guided by state regulations and a professionalized administrative structure is well documented, and viewed with suspicion.[31] Another source of support for decentralization comes from the educational profession itself, which has historically been more open to the philosophies of John Dewey than the theories of "good government." Supporters of local government and of the theory that "small is beautiful" argue that control over schools and schooling is better entrusted to community responsibility than to any higher level of civic organization.

Problems with the status quo, according to this perspective, are relatively obvious. Schools are highly regulated at all lev-

els, and their leaders are consequently prevented from making the best decisions about how to organize and meet the needs of the children they serve. Regulations are not the only major problem, however. Both critics and supporters of increased teacher control over local educational decisions agree that, during the period of intensive bureaucratization, teachers have acquired a "union mentality" rather than a "professional identity" that has resulted in an emphasis on teachers' benefits rather than student needs.[32] Critics point to the increasingly hierarchical nature of the profession, in which administrative prerogative rather than professional community, knowledge use, and responsibility for results prevail. Teachers are evaluated according to whether they have filed appropriate forms and reports, and not whether their work inspires students to learn. Thus, decentralization holds an implicit challenge to traditional forms of unionism.[33]

Decentralization: What is Needed? Given this array of arguments, the solutions offered by proponents of decentralization are hardly surprising, beginning with the desire to reduce regulation and to tone down the emphasis on uniformity among schools so central to the standards movement discussed above. Embedded in this perspective, however, is an emphasis on the importance of professionalizing teaching and school-based administration.[34] Arguments for decentralization and deregulation of schools are often logically coupled with the advocacy of job enlargement for teachers, increased pay, and the allocation of final decision-making authority over significant budget, personnel, and curriculum decisions to the school faculty. "Empowerment" is a code word for the responsibility of principals and teachers to make collective decisions based on professional judgment at the school level. Empowerment and responsibility are coupled with the assumption that both teachers and administrators need more training and professional development, but that members of the school community are in the best position to know what new knowledge and skills they need.

The professionalization of teachers in the decentralization model includes their responsibility for developing goals and assessments of student performance that are (at least in part)

individualized and tailored to the needs of the school. Even where decentralization advocates acknowledge the inevitable standardized state test or the importance of the SAT/ACT, decentralized schools have a responsibility for examining their own performance. Perhaps the most frequently cited example is Central Park East Secondary School in New York City, which requires portfolio demonstrations for all graduating students and invites external reviewers from other schools and universities to look at students' work.[35]

In the view of this model, the primary role of higher-level policy decisions is largely to promote local initiative. The notion that education and schools are local responsibilities is nowhere more apparent than in the federally funded program "America Reads," which is built on the assumption that an army of local volunteers in schools will increase student literacy and (hence) achievement. A program of this type would be inconceivable in other developed countries with a much stronger legacy of central government responsibility for schools and learning outcomes.

Decentralization is increasingly joining forces with the accountability movement. A prominent example is Kentucky, which introduced a radical school reform incorporating both state testing *and* school-based responsibility for performance, with authority granted to schools under a system of positive and negative sanctions.[36] Similarly, at a 1997 conference of the Council for Great City Schools, the superintendents of New York, San Francisco, and Philadelphia discussed the criteria for and problems of how to "reconstitute" individual schools—in other words, put them on probation after periods of low performance, and then reopen them with different leadership and teaching staff. The school-based accountability movement has strong support at the local level. Public interest groups in many states have published data on the "performance" of different schools based on available indicators, and most states now have legislation incorporating some public accountability at the school level for student achievement results. The notion of school responsibility for improving student performance is controversial but increasingly considered a legitimate arena for negotiation among teacher unions and the public.

Choice, Alternative Schools, and Democratic Theory

A very different perspective on accountability, competitiveness, and serving student needs is found in the third policy stream: school choice. Choice is both the most contentious and elaborated of all the policy streams, in part because it is foundational to the debate on the enduring questions "To whom do schools belong?" and "Whose interests do they serve?"[37] The United States was the first country to introduce the "common school"—a single building with a curriculum for all students. The common-school principle arose as part of a national desire to ensure that all students in the United States were exposed to certain ideas and values that would make them good citizens. While we have maintained this ideal for elementary and junior-high/middle-school students, it has eroded in high schools with the rapid expansion of students attending school beyond the age of sixteen. By the 1980s, high schools could be characterized by many commentators as "shopping malls," offering a variety of specialized, marginally connected programs designed for different student interests and abilities.[38] Even so, the presumption of a single public school with a core set of experiences for all students has remained the backbone of the U.S. school system.[39] School choice is a radical policy in one regard, proposing the elimination of the "common school" in favor of enlarged opportunities for specialized schools catering to different needs and preferences. Unlike site-based management, in which professionals are encouraged to find the best way to meet student needs within a common goal structure, the proponents of choice argue that each school should also articulate its own goals.

In another sense, school choice is the most motley of all policy alternatives, throwing unlikely individuals on the same side of policy debates and combining antagonistic policy alternatives. Proponents of school choice include advocates of "schools within schools," which would (it is argued) create "small communities of learning" in larger public alternatives; magnet-school advocates who look for academic and vocational themes that can create multicultural groups focused on a common goal; advocates of greater privatization of the educational system;

and the mainstream spokespersons for "charter schools," public schools that are privately sponsored, operating outside district oversight and policy regulation but accountable to the state for their performance.[40]

Like the themes examined above, school choice is not a conservative-liberal debate but draws on different democratic theories to justify why students or the public need "uncommon" schools. On the one hand, traditionalists argue that a primary function of schools in a democratic society is to recognize and support merit and individual capacity. In other words, we should permit students who have specific talents—whether academic or vocational—to choose different paths, and facilitate their choice with different schools. A second argument is that individual communities of teachers, parents, and students "know best" what they need to ensure their children's success, and that accordingly the available resources should be organized in a way that empowers them to design the unique solution for a given population of students. A final group argues simply that democratic societies are obligated to address the question of freedom to choose: imposing a single, uniform school experience is, in this view, inherently statist and antithetical to individual freedom.[41] This latter group includes the advocates of home-schooling and public support for religious or other value-based schools.

Although those who find themselves within this broad coalition emphasize their differences, they share the belief that families should have opportunities and resources to choose and create schools meeting their needs and personal preferences. Although this perspective is premised in American individualism and the assumption that education is a private good, it also comes with a market-oriented hypothesis that private choices lead to a stronger society: If parental choice exists, less attractive or less effective schools will be motivated to change or risk "going out of business" due to declining enrollments. Market reasoning begins with the premise that competition between alternative providers will increase quality. Of course, the different voices within this varied constituency each have different answers to the question of why the quality of educational experiences and achievement will increase as a result of greater

choice, ranging from some that are similar to the decentralization/SBM arguments outlined above to those that assume the market forces inherent in choice will put "bad schools" out of business.

Choice: What is Wrong? Both the systemic-reform and decentralization perspectives already examined assume increased professional control over schooling, albeit at different levels in the system. A different principle underlies the parent- and student-choice stream, namely, that families can best determine the type of education that meets the needs of their children. Choice-based proposals fall into two (sometimes hostile) camps. There are those who advocate more choice within a public school system, a position reflected in the rapid spread of state legislation supporting charter schools.[42] Charter-school experiments have taken off exponentially in the past few years, beginning with a handful of schools in Minnesota, and now including more than five hundred schools enabled by legislation in a third of the states. President Clinton has been a strong proponent of charter schools. In contrast, voucher advocates argue that we should provide funds not to institutions but to all families, funds in the form of vouchers that could be used for any school, whether public or private. A few local experiments (for example, in Milwaukee) have emerged, and public support is increasing, but no significant state legislation to establish voucher programs has yet been passed. The philanthropic business community has become involved in the voucher discussion in some large cities, pledging private funds to allow poor children to attend private schools that charge tuition. At the same time, some private schools are seeking to become charter schools, giving up their corporate independence in return for secure funding with the promise of autonomy.

Choice: What is Needed? A developing set of hypotheses, largely based on economic theory, supports the choice movement. Schools—like other public monopolies—are regarded as institutions that do not benefit from meeting the needs of families and children: they are accountable to the state and not to the customer. Accumulating regulations prevent schools from adapting to specific community and family preferences, and the

resulting lack of variability in schools reduces incentives (and opportunities) for improvement and higher performance. According to the theory, for example, we can usefully contrast the "failure" of urban public schools with the "success" of independent alternative schools and private schools that display higher achievement, because the latter have focused on the educability and needs of the often high-risk students who are there.[43] There is also an underlying appeal to the basic assumption of American capitalism that competition between schools to meet consumer needs must make the entire system stronger. The "strength through competition" argument is indirectly supported by the fact that most other developed countries have traditionally or more recently permitted public subsidies for privately organized schools.

Opposition to choice is based on value-based commitments to the "common school" (each child should receive the same educational opportunities) and on practical issues (moving to a voucher system would increase the cost of education because it would provide new public subsidies to students whose parents currently pay for private education). Suspicion is endemic on the part of state and national professional associations, who see charter and voucher proposals as undermining hard-fought battles to establish professional influence over content and pedagogy. The Minnesota Education Association, for example, withheld 1998 campaign-funding support from the Democratic Party because of the party's support for a Republican governor's proposal for tuition tax credits for families using private schools. Finally, of course, a predictable "separation of church and state" argument arises because some charter schools and voucher programs may indirectly subsidize religiously based education.[44]

Barriers to the spread of choice options, even with enabling legislation in many states, are substantial. Policy alternatives related to parental choice involve a most unusual assortment of political bedfellows, depending on how parental choice is defined. The perspectives are largely based on different definitions of the degree to which there is public (i.e., state) responsibility for ensuring real choice and monitoring school quality, and the complexity of the "market" being proposed. The sim-

plest alternatives suggest that parents should be able to choose any *public* school they wish, while the most complex assume public funding of "real alternatives" coupled with the ability of each family to allocate their child's "education dollars" to an unrestricted educational setting of their choosing.

A LIGHT FEELING OF CHAOS

Each of the policy streams examined here is imbued with a range of expectations about the educational enterprise and its outcomes. All policies are a compromise between the hope that changing structures will *quickly* make schools work better (largely unrealistic, particularly given the divergent assumptions about what constitutes a better school) and the reality that school cultures and practices must change. As I frequently point out, it took fifteen years and substantial public investment to turn around the feeble performance of the Chrysler Corporation, which is clearly a less complex industry than education. Why should we then expect school reform with little or no additional funding to work in the three-year cycle preferred by politicians?

If the major policy themes appear somewhat confusing, it is because they carry internal contradictions that are largely unarticulated. They are partially disconnected in public discourse; for example, President Clinton's administration advocates both charter schools and national standards but has not spoken about how we can logically connect these to the same improvement goals. The disjuncture between different strategies means that *potentially* compatible reform proposals are not linked in ways that make their congruence visible. Schools are caught in competing policies: more uniformity of results, with less uniformity of practice; more responsibility for personnel, curriculum, and finances, but with less money; more responsibility for curriculum development, but with more accountability on tests. The average public-school teacher (who has virtually no time other than a thirty-minute lunch break to talk to colleagues) has neither opportunities nor incentives to weave alternative legislative or professional reform initiatives into a personal vision of how they should organize their school and

conduct their work.[45] Instead, they struggle to incorporate "graduation standards" into an existing mishmash of mandated curriculum objectives, and they despair about their school's ability to reach out to parents and students very different from the students they once prepared themselves to teach. Lacking a solid vision and integrated theory, there may be no demonstrable difference between "regular public schools" and the alternative charter schools.[46]

Each vision is incomplete, but in different ways. Systemic reform programs carry too much baggage: we hope that by changing goals and tests the processes in classrooms will change, although there are no existing professional development programs or strategies that ensure this connection. System-wide standards may help to reduce the enormous variability in the "opportunities to learn" that are provided to U.S. students, but there is little evidence that they will necessarily raise the average performance. Indeed, opponents—pointing, for example, to New York state's experience with "Regents Examinations"—argue that national standards for all students may "dumb down" the curriculum for the most able students rather than fostering individual excellence.

Decentralization, both in the United States and in other countries, may be motivated more by the need for "legitimation" by tired central governments who have run out of ideas than by any clear vision of democratic theory or what schools and educational institutions should look like. Great hopes for the consequence of small shifts in responsibility and authority seem misplaced, particularly when such shifts occur at a time of financial cutbacks. The evidence of research on school-based management suggests that it is difficult to carry out and often fails to touch the classroom. Under some circumstances it is associated with better teaching, but the evidence is hardly sufficient to argue that it is a basis for broad reform.

The choice strategies, on the other hand, are only now gathering much popular steam. Although the charter-school alternatives have been around in some states for at least five years, the proportion of new schools that are not focused on a "special population" (school dropouts, for example) is limited. The problem with choice is that *parents*, while often dissatisfied with their

educational options, have not coalesced around choice as a solution, although public-opinion polls suggest that there is support. In other words, the evidence of a market press is unconvincing. In other countries that have recently introduced choice programs—Sweden and France, for example—fewer parents than expected were interested in participating. Thus, choice seems more of a "relief valve" that allows an exit for dissatisfied families and limited opportunities for experimentation than a reform paradigm. Public reactions are also contradictory within communities: some surveys indicate that African-American parents are strongly in favor of choice, but their representatives have more often voiced strong support for traditional school structures with common funding and curricula.

Returning to the discussion of the complexity of the policy-making process in the United States with which this essay began, we may further observe that none of the above policy themes has simplified the rich mix of the country's educational policy-making process. In fact, the calls for education reform have stimulated activity among dormant actors. Policy initiatives are increasingly occurring outside regular policy-making entities. Individual academic entrepreneurs with research-based models for school reform are emerging, as are efforts of individual citizens (supported, for example, by the Annenberg Foundation, with its major Urban Challenge Grants), teacher professional associations (which are increasingly demanding a substantive role at the reform-policy table), and local business groups (who are sponsoring charter schools and voucher programs).[47] Ancillary policy actors have become more important to schools than previously, making the policy process even more complex.

Do we know what makes schools work? The increasingly fractious policy environment must be contrasted with an increasing information base that permits valid experimentation within the educational enterprise. Twenty years ago educational research could provide few solid answers to questions about "what works." Today the research base—whether from basic cognitive-science studies or applied work in early literacy programs—is exploding. Not only do we know more about how children learn, we also know how best to provide adults (teach-

ers) with learning experiences that will improve their practice. Educators are also increasingly intrigued with the potential of research for practice and school improvement and the notion that teachers can be researchers, collecting data on their own practice and comparing it to academic research results. Science—even social and educational science—searches for order and regularity and is moving rapidly toward a level of knowledge at which we might contemplate an incomplete but improved "science of educational change."

Do we have the mechanisms to move rapidly toward a system of schools—whether public or private—that embody these structures and practices? The answer is clearly no. American democracy is not scientific: it encourages and values divergence rather than consensus. This characteristic is not "bad"; it may impede coherence, but it also promotes experimentation and learning. Making schools less subject to democratic processes is theoretically an option, but not one that is seriously considered by educators or policymakers.

The implication for school reform is that we must accept that any "science of educational change" will need to draw more on chaos theory than on traditional models of cumulative improvement. Educational change will, at least in the foreseeable future, continue to be characterized by disorder, discord, disconnection, and turbulence. In turn, being Americans, we need to embrace the optimism of this eclectic mix of actors and ideas, which will help to move us in the direction of "schools for the twenty-first century."

ENDNOTES

[1]National Commission on Excellence in Education, *A Nation at Risk* (Washington, D.C.: U.S. Department of Education, 1983).

[2]A ludicrously false debate according to most classroom teachers, who routinely use multiple methods to teach reading. One example is a recent *New York Times Sunday Magazine* article on the planned community of Celebration, Florida, which focuses on the controversies related to elementary-school pedagogy and curriculum. See Michael Pollan, "Town-Building is no Mickey Mouse Operation," *New York Times Sunday Magazine,* 14 December 1997, 56–63.

[3]Seymour Martin Lipset argues that American democracy is premised on a unique ideology that is different from that of other developed countries. His analysis is compelling, but he also assumes that there is a great deal of variation in implicit democratic theories within the United States. See Seymour Martin Lipset, "Balancing the Individual and the Community: Canada versus the United States," *The Responsive Community* 6 (1996): 37–46.

[4]Two exceptions to this are Germany and Switzerland, which, like the United States, have strong federal systems.

[5]An exception is Hawaii, which has a single state system.

[6]For a historical perspective on the search for equal opportunity and outcomes, see Jeffrey Mirel and David Angus, "High Standards for All? The Struggle for Equality in the American High School Curriculum, 1890–1990," *American Educator* 18 (1994): 4–42.

[7]Most of these changes in student characteristics are not well documented and may be more consistent with the tendency of each generation to view the next as alarmingly illiterate and uncooperative.

[8]David Tyack and Elisabeth Hansot, *Managers of Virtue: Public School Leadership in America, 1820–1980* (New York: Basic Books, 1982).

[9]To explore this issue in more detail, see Fred Newmann, Bruce King, and Mark Rigdon, "Accountability and School Performance: Implications from Restructuring Schools," *Harvard Educational Review* 67 (1997): 41–74; and Diane Massell, Michael Kirst, and Michael Hoppe, *Persistence and Change: Standards-Based Reform in Nine States* (Philadelphia, Pa.: Consortium for Policy Research in Education, University of Pennsylvania, 1997).

[10]David Berliner and Bruce Biddle, *The Manufactured Crisis: Myths, Fraud, and the Attack on America's Public Schools* (Reading, Mass.: Addison Wesley, 1996).

[11]Lipset, "Balancing the Individual and the Community."

[12]Most notable is the work of Lauren Resnick and her colleagues, who have been involved for more than a decade in developing and promoting a model of school reform that is based on clear grade-level subject-matter standards and related assessments. See Daniel P. Resnick and Lauren B. Resnick, "Assessing the Thinking Curriculum: New Tools for Educational Reform," in *Changing Assessments: Alternative Views of Aptitude, Achievement and Instruction*, ed. Bernard R. Gifford and Mary C. O'Connor (Boston: Kluwer, 1992).

[13]What constitutes a "good standard" is even more contentious. Proponents of standards ranging from the American Federation of Teachers to conservative policy activists have recently rated the actual frameworks developed by the various states as wanting.

[14]The performance of U.S. students on standardized tests indicates that the variations between state and region are greater than between most developed countries. Minnesota students, for example, do better in mathematics than students in most Asian countries; students in some southern states perform hardly better than those in developing countries.

[15]Andrew Porter, "The Uses and Misuses of Opportunity-to-Learn Standards," *Educational Researcher* 24 (1995): 21–27.

[16]There is a strong research base underlying this argument. See Harold Stevenson, "Why Asian Students Still Outdistance Americans," *Educational Leadership* 50 (5) (1993): 63–65.

[17]Gerald Bracey, "The Seventh Bracey Report on the Condition of Public Education," *Phi Delta Kappan* 79 (1997): 120–136.

[18]Karen S. Louis and Bert Versloot, "High Standards and Cultural Diversity: Cautionary Tales of Comparative Research," *Educational Evaluation and Policy Analysis* 18 (3) (1997): 253–261.

[19]This draws on Michael Smith and Jennifer O'Day, "Systemic School Reform," in *The Politics of Curriculum and Testing,* ed. Susan Fuhrman and Betty Malen (Briston, Pa.: Falmer, 1991), 233–267.

[20]Linda Darling-Hammond, "What Matters Most: A Competent Teacher for Every Child," *Phi Delta Kappan* 78 (1996): 193–200.

[21]This assumption would have left the author a mathematical illiterate if she had not been adept at covering up her inability to memorize the multiplication tables beyond the sixes.

[22]Note that the states vary in terms of which branch(es) of government is responsible for education.

[23]Minnesota, for example, has twenty-four competencies in its "Profile of Learning" standards for the higher attainment levels expected of graduating high-school students. Examples of the competencies range from art to citizenship and mathematics. Massell et al., *Persistence and Change,* suggest that in most states the trend over the past few years has been to decentralize responsibility for the definition of specific standards to the district, which may create "ownership" but pose problems for uniformity of purpose.

[24]Tyack and Hansot, *Managers of Virtue.*

[25]Jeffrey Mirel, "School Reform, Chicago Style: Educational Innovation in a Changing Urban Context, 1976–1991," *Urban Education* 28 (1993): 116–149.

[26]Gary Sykes, "Inspired Teaching: The Missing Element in 'Effective Schools,'" *Educational Administration Quarterly* 24 (1988): 461–469.

[27]Deborah Meier, *The Power of Their Ideas: Lessons for America from a Small School in Harlem* (Boston: Beacon Press, 1995).

[28]Charles Teddlie and Sam Stringfield, *Schools Make a Difference: Lessons Learned from a 10-year Study of School Effects* (New York: Teachers College Press, 1993).

[29]A consistent research finding is that less-advantaged students benefit from smaller schools, more consistent and limited curricula, and more personalized but rigorous expectations about social behavior. See, for example, Valerie E. Lee and Julia Smith, "High School Size: Which Works Best and for Whom?" *Educational Evaluation and Policy Analysis* 19 (1997): 205–227.

[30]Gerald Sroufe, "New American Schools Development Corporation: Open for Business," *Educational Researcher* 20 (1991): 26–27.

[31]Tyack and Hansot, *Managers of Virtue.*

[32]See, for example, Myron Lieberman, *The Teacher Unions: How the NEA and AFT Sabotage Reform and Hold Students, Parents, Teachers, and Taxpayers Hostage to Bureaucracy* (New York: Free Press, 1997); and Charles Kerchner, Julia Koppich, and Joseph Weeres, *United Mind Workers: Unions and Teaching in the Knowledge Society* (San Francisco: Jossey-Bass, 1997).

[33]Kerchner, Koppich, and Weeres, *United Mind Workers.*

[34]See Gary Sykes, "The New Professionalism," in *The Handbook of Educational Administration,* ed. Joseph Murphy and Karen Seashore Louis (San Francisco: Jossey-Bass, in press).

[35]Meier, *The Power of Their Ideas.*

[36]Massell et al., *Persistence and Change.*

[37]*The New York Times Sunday Magazine* recently captured this controversy. See Michael Winerip, "Schools for Sale," *The New York Times Sunday Magazine,* 14 June 1998, 42–49.

[38]Arthur Powell, Eleanor Farrar, and David Cohen, *The Shopping Mall High School: Winners and Losers in the Educational Marketplace* (Boston: Houghton Mifflin, 1985).

[39]This stands in contrast to most European countries, where students are asked to choose a technical, vocational, or university-preparatory track at about the point where the U.S. students would be entering middle school.

[40]Penny Wohlstetter, "Charter Schools in the United States: The Question of Autonomy," *Educational Policy* 9 (1995): 331–358; Maryann Raywid, "Choice Orientations, Discussions, and Prospects," *Educational Policy* 6 (1992): 105–122; and Joe Nathan, *Charter Schools: Creating Hope and Opportunity for American Education* (San Francisco: Jossey-Bass, 1997).

[41]This argument has been prominent in a number of other countries that have established publicly supported alternative-schools systems, notably the Netherlands, Denmark, and France.

[42]Nathan, *Charter Schools.*

[43]Evidence of the success of private and/or alternative schools is somewhat sketchy, largely anecdotal, and often limited to small experiments and/or extreme populations—the wealthy or the very poor.

[44]A 1996 survey of charter schools indicated that 15 percent of them were networks of parents involved in home-based schooling, much of which is motivated by value differences with public schools. In addition, some charter schools have been accused of promoting specific religious values, even when they are not denominationally affiliated. It is interesting to note, however, that the United States is the only remaining Western country that does not permit the subsidization of religiously based schools under any circumstances.

[45]The number of classroom hours worked by U.S. teachers is higher than in many other developed countries where the school year is longer. In other words, U.S. teachers are "front and center" and have little time for professional development.

[46]Research in the Netherlands, which has had a voucher/charter system for more than fifty years, suggests that only about 15 percent of all schools offer a real choice of instructional or curricular alternatives.

[47]James Comer at Yale University and Robert Slavin at Johns Hopkins University are prominent among these.

Daniel W. Bromley

Expectations, Incentives, and Performance in America's Schools

THE SETTING

IMAGINE A GOING CONCERN for which the ultimate purpose is both unclear and contested, the connection between inputs and outputs is difficult to identify, there is controversy about what precisely constitutes the inputs and the outputs, the quality of both inputs and outputs is difficult to measure, incentives for improved performance are largely missing, the performance of the going concern is dominated by circumstances beyond its control, and managerial direction is dispersed among four or five different points of the system in which this particular going concern is embedded. This going concern is said, by many who claim to understand it, to be a failure—both in comparison with similar going concerns in Europe and Asia, and in terms of what its primary clients expect of it. Finally, the causes of this putative failure are in much dispute, as are the desired and necessary solutions. More seriously, the number of remedies is exceeded only by the number of studies suggesting their seeming futility. Imagine the American public school.

Recent evidence from the U.S. Department of Education seems to support those who are dismayed by American schools. The financial situation of America's schools is only average (or below average) for the fourteen nations studied in the National Center for Education Statistics (NCES) report *Education in States and Nations.*[1] While the United States has the highest per capita gross domestic product (GDP) of all the countries in the

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NCES study, the support given American schools is relatively low. For instance, "Overall support for primary and secondary education, as a percentage of GDP, places the U.S. 9th of 14 nations. The United States is also 9th of 14 when we consider public expenditure per student as a percentage of GDP. American teachers . . . are paid less than teachers in 6 countries and more than those in 11."[2]

In addition, America's schools must deal with social conditions that are far more serious than elsewhere. For instance, "The percentage of American children 17 and younger living in poverty (21%) in 1991 exceeded *all* of the other 17 nations for which data are available."[3] American students are less engaged in studying outside of school than the children in practically any other nation: "The 29% who spend 2 hours or more doing homework daily ranks them below 14 other nations and ahead of 4. They also rank high (5th of 19) in the amount of time they spend watching television."[4]

While there is rather universal concern about the quality of America's public schools, recognition should also be given to the fact that our schools have done a rather admirable job of coping with profound changes in America's socioeconomic circumstances since the end of World War II. While per-pupil spending has increased dramatically over this period, some important indicators have shown improvement: more children are staying in school longer (school participation rates have risen and dropout rates have fallen); SAT scores have remained stable when controlled for demographic shifts in the test-taking population; and an increasing proportion of America's youth are continuing on to post-secondary education or training. In 1970, only 38 percent of the three to five year olds were in preschool programs compared with 60 percent by 1990. Between 1980 and 1990 the percentage of high-school graduates enrolling in colleges and vocational schools increased from 49 to 60 percent.[5]

Despite these modestly encouraging signs, urgency about America's schools is driven by two phenomena: a general sense that tax burdens in general—and educational expenses (largely supported by the highly visible property tax) in particular—are now excessive, and the fact that the new global economy will

require a higher-quality work force than hitherto. The first is concerned with value-for-money from public expenditures. The recent interest in "reinventing" government, and in fostering greater accountability from public-sector agencies, captures this problem. The second is concerned with the overall performance—the adequacy—of the educational system in educating students for a rapidly changing future. So the issue we must address is what, precisely, is wrong with schooling in America.

There are two possible directions such an inquiry could take. First, we could plumb the international comparisons in an effort to assess the nature and extent of the alleged failures in America's schools. Second, we could explore the system that gives rise to these performance indicators to assess whether there are obvious structural flaws. The first approach seeks to assess America's educational system in terms of external empirical data; the second seeks to assess the educational system in terms of its conceptual coherence quite apart from its actual performance on an international basis. The first approach is best left to those from within education with a well-informed reference point for assessing international comparisons; the second lends itself to assessment by those who study incentives, choice, hierarchical systems, and the connection between inputs and outputs. I will pursue the second approach.

As we start the discussion, it seems useful to note that much of the literature on educational reform can be classified into two broad categories. The first, dealing with the outcomes and processes of education, originates within the educational community and looks at the learning enterprise in terms of outputs (scores on various tests) and processes (how to teach effectively). That is, this literature is concerned with what students know, or should know, and how best to teach that body of knowledge. The second originates within the economics community and examines the efficiency of the educational enterprise, with particular emphasis on the individual school. Here, there is less concern with what students should know at various grade levels and more concern with the way that the educational process is organized—and motivated—for improved efficiency.[6]

The economic literature on the efficiency of public schools starts from the classic production function in which the depen-

dent variable is some measure of performance by students (standardized test scores, grade-level abilities) and the independent variables are such things as classroom size, years of experience of the teacher, total spending per student, and (perhaps) average teacher salary. This approach springs from the view that the school is akin to a firm in which rather standard efficiency and incentive properties need to be introduced in order to create the proper signals for attentiveness to "market" conditions. The problem, as seen by this literature, is that the signals for efficiency within schools are missing because of a host of "market failures"—teachers' unions, bureaucratic administrators, meddling school boards, and oppressive state departments of education.

This literature begins with the metaphor of the individual firm struggling to combine inputs in an efficient manner so as to maximize profit. However, the flaw in this traditional economic model is that there is no absolute measure of efficiency within the firm. Rather, firms learn how they are performing by observing what other firms are doing.[7] In the language of education, the managers and owners of *all* firms are forced to grade themselves on the "curve," where the relevant population is other firms in the same industry; firms manage by watching each other. Equally important to this assessment of efficiency is that there is no absolute measure of the contribution of the several factors of production—but especially labor—to the value of total output at the margin. In the absence of that indication, firms are forced to pay approximately what other firms pay. In other words, they do not let their wage and salary structure get too far out of line from that of their competitors; this is called paying what the market dictates. In point of fact, a less flattering characterization is that wages are set by a process of rolling simultaneity among similar firms.

With this in mind, we are forced to admit that the idea of allocative efficiency within the private firm, the metaphor that seems to motivate many assessments of the efficiency of particular schools, is itself a somewhat elusive and contrived concept. Yet these production-function studies tend to constitute the staple economic response to school reform. In commenting on this tradition, John Bishop observes:

> Much of the economic research on elementary and secondary education has employed a production function paradigm. Conventionally, test scores measuring academic achievement are the outputs, teachers are the labor input, and students are the good in process. Even though I have written papers in this tradition myself, I am concerned that many of the inputs that conventionally appear on the right in these models are really endogenous and that severely biased findings may result. . . . This paper points in different directions. Schools are viewed as worker-managed organizations producing multiple products. In the classroom/school team production unit, students are as much workers as the teachers. Students are also consumers who choose which goals or outputs to focus on and how much effort to put into each goal. The behavior of each of the system's actors—teachers, administrators, school board, students, and parents—depends on the incentives facing them. The incentives, in turn, depend on the cost and reliability of the signals that are generated about the various outputs of the system. The discussion above demonstrates the relevance of agency theory, game theory, signaling theory, and other elements of economic theory to the understanding of how schools and students operate, but it only scratches the surface.[8]

While not dismissing incentives, Bishop suggests that we must cast a broader net. Are there other mental models and heuristic guides that might prove useful in assessing educational processes? The question is fundamental to the pursuit of coherence in assessing educational reform. After all, if we think of social processes in terms of the metaphor of the market we are then led to analyze problems—and to propose solutions—in market terms. This tendency can be seen in the profound fondness in some quarters for vouchers, so that a dose of bracing "market competition" might be introduced into public schools said to be otherwise dominated by bureaucratic lassitude. On the other hand, if we view social processes in terms of an organizational metaphor, the guiding principles tend to downplay competition and stress cooperation and teamwork. One metaphor sanctifies the threat of failure; the other sanctifies the prospect of success. Which is the more helpful? [9]

The way in which we characterize our mental picture of the pertinent analytical model will obviously determine how we see alleged "problems" and how we then conjure "solutions." We

see different things depending upon the conceptual lens through which we view the world around us. To quote G. L. S. Shackle, in "natural science, what is thought is built upon what is seen; but in economics, what is seen is built upon what is thought."[10] When most economists contemplate the complex realm of education, what is seen is indeed built upon what is thought. We tend to see the school as a firm in need of some hard-edged management advice. And that management advice will usually take the form of the need to overcome the dead hand of bureaucratic inertia (and, incidentally, teachers' unions) so that individual initiative can be liberated. One does this with economic incentives: good teachers must earn more than bad teachers, good administrators must earn more than bad administrators. The market will sort out the good from the bad and before long all surviving schools will be good, since the bad ones (the inefficient firms) will have disappeared. The market will have worked its magic.

Yet those who understand education—and not just those in teachers' unions—will suggest that things are not so simple. This is not, to be sure, meant to discount the profound role of incentives in guiding human behavior. But it does, I believe, caution us that monetary incentives—at least as economists tend to think of them—may be of equivocal necessity in reforming educational performance, and such incentives are almost certainly insufficient.[11] Hence, I shall adopt a somewhat different point of departure. The task I set myself here shall be to offer a way to think about *schooling* rather than about *schools*. Schools include students, teachers, and administrators, while schooling entails all of these plus parents and various life experiences. This perspective may help us to determine whether it is America's schools that are failing or whether the problem is really one of "schooling" in America. Having said that, most schooling indeed takes place in schools, and so the bulk of attention will fall there.

PERFORMANCE VERSUS ACHIEVEMENT

There is a general sense that schooling in America is more complex than it is in any other contemporary society. Two

reasons make this proposition seem probable. First, the heterogeneity in American society, coupled with the expectation that all children belong in school until the age of sixteen, gives most schools a student body of wildly disparate backgrounds, motivations, and commitments to the task at hand. Other societies with a similar level of heterogeneity—Brazil and India come to mind—do not have a similar commitment to universal education and so schools there face a vastly different challenge. Second, America's schools have, over the past several decades, been forced to provide increased levels of nonacademic services that render them quasi-social-service organizations. In some school districts the actual teaching faculty is said to comprise approximately one-half of the total staff on the payroll. Counselors, social workers, administrators, nurses, curriculum planners, aides, and other sundry staff provide needed skills and services—but they do not teach students.

Therefore, when I say, as I did at the outset, that America's schools have unclear and contested purposes, I had this point in mind. Do schools exist to serve this broad spectrum of social services? Or do schools exist to provide earnest educational opportunities to children? The answer is that schools in America exist for both purposes. We see this most clearly in the discussions about what schools *should* be about. E. D. Hirsch is quite clear:

> The readiness-to-learn principle operates grade by grade. . . . From the standpoint of effective policy, the readiness-to-learn principle must be an annual one, requiring some degree of yearly monitoring and compensatory learning for those who may have drifted below the readiness plateau for the upcoming grade. . . . The policy implication of such grade-by-grade monitoring must be the introduction of grade-by-grade accountability and incentives for everyone concerned with schooling: parents, the children themselves, teachers, schools, districts. Without clear and specific definitions of what, for example, readiness for second grade means, it is not possible to monitor and rectify deficits in a timely way. Under our current arrangements, and under those now implied by multiyear standards, there is never a specific point when a child, a teacher, or any other participant is responsible for a shortcoming. When a deficit does blatantly manifest itself, it is always possible, and usually accurate, for a teacher or a child to complain that the

> deficit should have been remedied long ago in an earlier grade. The multigrade approach to accountability is essentially an unmonitored system that offers no fair or enforceable incentives for any participant, including the child.[12]

From this it seems clear that the author regards schools as task-oriented and accountable on those tasks. But we also know that others have a somewhat different purpose in mind for America's schools.

> Schools have many functions, but their fundamental purpose is to teach students their moral and intellectual responsibilities for living and working in a democracy. It is not to be efficient, effective, or accountable, nor is it to prepare docile unquestioning workers who will go blindly into roles assigned them in the great struggle to dominate the world economy, or, in the words of Tocqueville, to be a "flock of timid and hardworking animals."[13]

Compounding this problem of contested purposes, schools must face the challenge of trying to educate children with severely divergent skills and motivation, and with varying degrees of distractions. This disparity in the student body complicates the assessment of precisely how much teachers and schools are actually contributing to the education of the students who present themselves at the door. When some first-graders show up knowing how to read while others lack this basic skill, it becomes very difficult to measure the performance of the teacher and the school. At the end of the first year some students will have advanced a great deal (if they indeed learned to read) and others will have progressed but little (since they already knew how to read). Have the school and its teachers done their job?

This problem brings us to the subject of *value-added indicators*. The idea here is to try to assess the contribution of the school (or the teacher) to a particular student outcome (say, scores on a standardized test). In the words of Robert H. Meyer:

> It is not widely appreciated that properly constructed school performance indicators differ greatly from simple aggregate indicators such as average test scores, in part because test vendors have tended to focus attention on measuring student achievement rather than school performance. Increasingly, however, schools, states,

> and other groups are interested in assessing the performance of schools as well as students through standardized tests. It is therefore important to draw a sharp distinction between school performance indicators and simple aggregate indicators based on test scores.[14]

The statistical problem here is to isolate the contribution of schools (and teachers) from other sources of student achievement. As Meyer observes, "This is particularly important in light of the fact that differences in student and family characteristics account for far more variation in student achievement than school-related factors."[15] The obvious implication of this issue is that average test scores across schools tend to indicate a generally poor performance by those schools with a larger proportion of academically disadvantaged students. However, in terms of value added, such schools may well be doing a better job than schools in the wealthy suburbs where presumably students show up better prepared in the basic skills of reading and simple arithmetic. The key, therefore, is to concern ourselves with both student *achievement* as well as school (and teacher) *performance.*

My focus in what follows shall remain, however, on performance. When analyzing the performance of systems or subsystems, we must address two important dimensions. The first concerns how well the system performs in its explicit task of, for instance, educating students. Think of this as *goal performance.* The second dimension concerns how well the system performs in its implicit task of remaining focused, agile, and committed to excellence. Think of this as *process performance.* Process performance concerns whether or not the system has built-in mechanisms and processes for recognizing weaknesses and correcting them quickly. We might think of goal performance as dependent on process performance. The key question is how schools might be reformed to achieve process performance so that goal performance is assured.

The management literature suggests that excellence arises from organizations that are purposeful, resolute, and decisive. Such organizations create high expectations, and they understand the critical role of incentives in achieving those expectations. The problem for educational reform is to reconstitute

educational systems so that they have an incentive to establish high expectations and the commitment to follow through on those expectations. Schools must figure out how to generate expectations for themselves that transcend those that emanate from parents and school boards. To paraphrase Stringfield—who draws from the literature on High Reliability Organizations—exceptional schools will have the following traits:[16]

1. They will have clear goals, and will not tolerate failure of people or equipment;
2. They will be alert to the unexpected and be prepared to adapt;
3. They will constantly monitor performance and act quickly to correct failures;
4. They will employ logical decision analysis;
5. They will recruit extensively and train constantly;
6. They will take performance evaluation seriously throughout the system;
7. They will strive to keep the confidence of others;
8. They will not cut corners in their pursuit of excellence.

How might we envision a transition to schools with this level of commitment to excellence? To answer that question, we must address the system in which schools are embedded.

THE SYSTEMIC CHALLENGE

The consistent theme among those who write about schooling in America is one of serious *systems failure.* Of course, there are exceptional schools, inspired teachers, committed principals and supervisors, and dedicated school boards. However, there is apparently no recognized process whereby all of these essential ingredients are brought together in enough settings at any one time to have any effect on the overall performance of America's schools and the achievement of its students. Ironi-

cally, these exceptional educational situations—when they exist—should not be a cause for celebration; all schools should be this good. After all, it is not that they are so marvelous on an international scale; it is simply that the vast majority of America's schools are so aggressively mediocre that the very good ones seem to be doing the impossible. So they are called exemplars, and they become shrines to which educational researchers and reformers go for inspiration and celebration. But these exemplars stand alone, and, paradoxically, that is their real failure.

That failure arises from their apparent inability to diffuse that which is good about them; indeed, the exceptional schools may have an incentive not to diffuse their very special "recipe" in that they will lose their uniqueness.[17] Some exemplars are autonomous creations of dedicated and charismatic administrators and equally resolute school boards.[18] Other exemplars are the creations of educational reformers who bring creativity and dedication to schools that are, seemingly, without a clue about how to improve. At least they do seek to be better. That so many schools cannot improve without external technical assistance is the most telling indicator of what is wrong with America's schools. Why are so many schools mediocre? Why can they not right themselves? Is the motivation there? Are the incentives right?

To the relative outsider, coming to the analysis of America's schools without many predilections, it soon becomes apparent that here is a system without high expectations for itself or for those it pretends to serve. It seems as if many schools see themselves as places to which students come—partly to learn some life skills, and partly to learn a little about the world in which they live. Few schools, to judge from their behavior, seem to believe that a relentless commitment to excellence and hard work is an essential ingredient of schooling in America. In simple terms, middling expectations cannot possibly yield other than middling outcomes.

It is, I gather, widely known that American schoolchildren spend less time on homework than pupils in many other countries in the world, and they also are said to have a world-class affinity for television. These circumstances, combined with their continual movement over the course of a school day and the

relatively brief length of the day, suggest that going to school in America—for the vast majority of students—is a form of collective leisure at the taxpayer's expense. It is apparently a way to spend time with one's friends without having one's parents around. The issue here is not to document the embarrassing quality of America's schools; that has been done. The purpose is, rather, to ask how things came to this pass. And for that we must turn to the topic of incentives.

First, it seems that the majority of parents hold rather indifferent expectations of their school-age children. Of course, they want them to stay out of trouble, but, with some notable exceptions, parents in America do not seem to put much pressure on schools to make their children work hard.[19] Otherwise, how would one explain the virtual absence of homework and the prodigious commitment to television and other leisure activities cultivated by most schoolchildren? It is known that some parents do not expect their children to go to college and others actively discourage college altogether. Others know that their children will manage to get into *some* college, since the higher-education industry in America is now configured so that those who can afford the fees will be able to find a college that will take them. Indeed, many mediocre colleges compete for seriously indifferent students and are loathe to hold them to high standards while in attendance; such colleges merely repeat the high school experience for their students. The widespread democratization of higher education in America means that much of the first two years at many colleges and universities is devoted to remedial work that the high schools seem quite unable to provide. According to David Cohen and James Spillane:

> The consumption patterns of American colleges and universities send mixed but generally weak signals about the importance of strong academic performance. Only a small group of highly selective colleges and universities has demanding admissions standards, so only a few students can enter them. A much larger fraction has very modest requirements; students need only a thin record of academic accomplishment in high school, often only a "C" or low "B" average, to be acceptable for admission. Only high school graduation is required for admission in still another large group of institutions, and not even high school graduation is required for

> another large group. There is something to celebrate in this, for many students have a second and third chance to make good despite previous failures. But these arrangements also signal that it is irrational for most high school students to work hard in order to get into college or university.[20]

Cohen and Spillane go on to point out that a similar situation exists for students who intend to enter the work force. Few employers seek transcripts or letters of recommendation, and many high schools apparently refuse to release transcripts or provide such letters. This lack of interest on the part of employers sends a signal to students that performance in high school is unrelated to subsequent job prospects. A commitment to academic excellence is, therefore, quite unnecessary for future life prospects for a significant fraction of America's youth.

It seems obvious that only the seriously doting parents apply the kind of pressure that produces hard work and excellence. These are usually the parents who place their children in the extraordinary schools—either in exclusive suburbs or in private (or religious) schools—so that the indifferent parents and their often-languid children have the rest of the educational landscape to themselves. The results, in terms of academic performance, are precisely as one might predict. If parents have low expectations for schools, is it rational for school boards and administrators to set standards and work habits that are at odds with those of the parents? If members of school boards insist on excellence—which often costs money—they run the risk of being voted out of office. If administrators seek excellence, they run the risk of losing their job. Then there are the teachers. They operate near the bottom of a hierarchy in which all of the parties above them—parents, school boards, administrators—seem to have largely eschewed the relentless pursuit of excellence. What hope is there for a teacher who seeks to assign homework that is out of line with community norms? And finally there is the student. While the youngest of them tend to approach school with an open mind and often with some eagerness, by the early years of middle school it is received doctrine that nerds and teacher's pets are objects of ridicule from their peers. So at this level, where high expectations ought to be instilled, the system seems to have produced a set of

incentives that militate against hard work and excellence, harming students in the long run. We know, as well, that this pressure works differently on young men and young women, usually to the detriment of the latter.

In economic terms, education (schooling) is a nested hierarchical system with many "principals" and many "agents." Indeed, within this hierarchy, most participants are at once both principals and agents.[21] School boards are agents with respect to parents and the citizens in the community, but they are principals with respect to the administrators. School administrators are agents with respect to the school board, but principals (both literally and figuratively) with respect to teachers. Teachers are principals with respect to students, but agents with respect to school administrators. This nested hierarchy of principal and agent is useful as we think about the incentive structure in America's schools. All through the hierarchy, incentives are confounded and perverse.

The trouble with low expectations is that they deaden the current educational experience, and they work against innovation over time. That is, low expectations dull the incentives that might otherwise operate in schooling and thereby ratify inertia and caution, which then become the guiding principles for survival. As with all systems, the problem starts at the top. Few parents want their children to be the guinea pigs for new educational initiatives. Members of school boards, often successful in the local community, will credit the local schools for their self-proclaimed success and thus resist educational initiatives. Many parents, similarly pleased with themselves, endorse this form of inertia. School administrators must therefore be cautious. At the same time, this caution is compounded by the constant lurching from one alleged innovation to the next. If an administrator does manage to introduce change, once that person leaves there is an incentive for the next person to adopt some other innovation.[22] After all, what administrator wants to be known for continuing the innovation of her predecessor? Turnover, rather than fostering innovation, becomes the enemy of coherent and sustained innovation. While it seems that changes are being introduced, they are too idiosyncratic to have any lasting effect—or to allow any reliable data to be collected on

their effect. These erratic lurches create, in a sense, a new and pernicious form of inertia.

Teachers are cautious for the same reason their superiors are cautious. There is no commitment to excellence and hard work through the hierarchy, and so a bright and enthusiastic teacher soon learns that innovation and risk taking are not seriously appreciated. Why does this happen? A number of answers seem plausible, but I nominate one: the costs of a *poor* K–12 education are now so low that few of the participants—parents, school boards, administrators, teachers, students—have any meaningful incentive to behave otherwise. The path of minimal necessary effort is too compelling to resist, and the penalties associated with this strategy are too small to warrant concern.

A correlated explanation is that those for whom the cost of a poor education is deemed to be unacceptably large—and for whom the financial means lie ready at hand—have managed to "privatize" K–12 education. They have explicitly privatized education by sending their children to highly selective schools that teach homogeneous populations of motivated children. Or they have implicitly privatized education by migrating to the affluent neighborhoods and enclaves where socioeconomic homogeneity produces selective schools by default. As Albert Hirschman reminds us, the withdrawal of those parents with high expectations of their children and schools deprives the remainder of schools of the vocal element that will put pressure on teachers and administrators to deliver first-rate performance.[23] Exit robs precarious organizations of the pressure from those for whom high performance is important, and such organizations subsequently descend to the quality expected of them by the indifferent (or optionless) patrons left behind. School choice does not assure quality; it only concentrates it in a few places where the discriminating congregate, and others reap the hindmost.

In the face of the resulting widespread mediocrity, we see repeated flourishes of interest in "school reform," also called new educational policies. Some commentators are not optimistic. According to William Clune:

> Traditional educational policy is incapable of producing major gains in student achievement. This is the fundamental reason for

all the contemporary interest in educational reform. Consider these problems:

> · Educational reform and rhetoric have been more or less constant for some time, but student test scores have remained relatively stable. . . .
>
> · Twenty-five years of research have shown that many educational practices are unrelated to achievement. . . .
>
> · Many of today's goals for education will require massive, coordinated change in educational practice and delivery systems.
>
> · Educational policy is extremely fragmented and ineffective, producing a great volume of uncoordinated mandates, programs, and projects that provide no coherent direction, increase the complexity of educational governance and practice, and consume a lot of resources. The United States produces the largest quantity of educational policy in the world, and the least effective.
>
> · Education for the urban poor has reached such a state of crisis that well-designed and coordinated supplementary educational and social services will be required as the foundation for the regular academic program. Yet social and educational policies aimed at poor school-age children are presently fragmented and poorly coordinated.[24]

There is indeed one central idea that must be entertained: the problem with American education is that education is seen as a *policy* problem rather than as a matter of getting the incentives right throughout the nested hierarchy that constitutes the governance system of schooling. As Clune observes above, "the United States produces the largest quantity of educational policy in the world, and the least effective." If this is true, the blame transcends schooling narrowly defined and sweeps over American universities and their schools of education. It is here that future teachers are trained, and it is here that policy research flourishes. I will return to this subject below.

THE PROFESSIONALIZATION OF SCHOOLING

The discussion so far has addressed problems of expectations and incentives throughout the system in which individual schools are embedded, stressing that the problems in schools and schooling

are systemic in nature and not attributable to just a single participant—whether administrators, teachers, students, or, as is often alleged, the dead hand of unions.[25] Having said that, it is important that we spend some time focusing on the one participant who is clearly so central to the performance of students, and thus the performance of schools—the teacher. I focus attention here because the important matter of expectations and incentives comes to bear on the nature of the interaction between teachers and students. But it is the teacher who defines the nature of that interaction, and it is the teacher who has the power to structure that relationship in a way that will increase the probability of desirable educational outcomes. In the words of Seymour Sarason, "If contexts for productive learning do not exist for teachers, they cannot create and sustain that context for students."[26] How does one create "contexts for productive learning" for teachers as well as students?

We know that expectations and incentives can be largely external to the individual participant in a system, or they can be largely internal to that participant. In the case of an hourly worker in a factory, the bulk of the motivation comes from the expectations of the company and the worker's supervisor. Similarly, the primary *means* of motivating the hourly worker tend to be the economic incentives associated with various levels of work effort and attention to the quality of that effort. At the other end of the continuum is the salaried worker whose emotional association with the going concern is usually stronger than that of the hourly worker. Indeed, salaried workers have a more secure future with the going concern, so it is not surprising that their commitment to the organization is stronger than those paid by the hour. With salaried workers, monetary incentives are often but a part of the total compensation received.[27]

There is, it seems, a presumptive relation between those who are paid a salary and those who are regarded as "professionals." However, it is a mistake to accept this association; the nature of remuneration may be suggestive, but it is not decisive. I wish to explore the question of whether or not teachers in America, in the current setting, are members of a *profession.* The answer is important because the existence of a profession is a necessary, though not sufficient, condition for the creation

and maintenance of *autonomous incentives* for self-improvement and the pursuit of excellence. Indeed, professions exist for precisely those reasons.

A profession is often defined as a field of endeavor, the entry to which is predicated upon considerable education and training, with the subsequent mention of law, medicine, or engineering. Or it will be said that one belongs to the "teaching profession." The problem with these definitions is that they are both static and passive in nature. They are static because they speak to *having acquired* an education (or training) in law school, medical school, or engineering school. They are passive because they simply address the matter of *belonging* to some group engaged in a similar activity (i.e., teaching). We need a more coherent definition of a profession.

I define a profession as an association of individuals united by the continual pursuit of the mastery of a core set of ideas and/or practices, as well as by the steady upgrading of the mastery of those ideas and practices. Mastery of these core concepts and behaviors is dynamic (ongoing) in nature rather than static (in the past), and it is this continual pursuit that I suggest gives rise to excellence on the part of the individual member of the profession. To be a professional is to be engaged in an activity in which the incentives for improved performance are always present and acted upon. Those performance incentives are, for the most part, provided internally and by one's peers rather than by someone in a position of authority over the individual. To return to the principal-agent model, a profession is a system in which—to the greatest extent possible—the principal and the agent are combined in one individual. Professions solve (or try to solve) the principal-agent problem. The antithesis of a profession is that of boss-worker, owner-employee. In a profession, the "worker" is also, to some extent, the "boss."

This idea of teachers being members of a profession goes much beyond mere passive belonging to a group of individuals who teach. Being a true professional makes teaching less an activity that delivers materials to students and turns it into an activity in which the teacher and the student are united in a team effort. The student and the teacher work jointly toward a set of goals. The idea of a teacher as a professional means that

the teacher is not a prisoner to generally accepted behavioral norms but is instead motivated by the norm of discovery and excitement on the part of the student. In other words, education becomes dominated not by method but by substance.

The essence of professional behavior is that one is constantly seeking to improve under the relentless—though not necessarily rancorous—evaluation by one's peers, whether lawyers, doctors, engineers, or college professors. While not always enjoyable to receive, the evaluation by one's peers provides the most constant and constructive means for self improvement and the steady pursuit of excellence. Yet it seems apparent that K–12 teachers are largely protected from this practice; some apparently regard such practices as "unprofessional." Indeed, there is considerable hostility towards the recent move by the National Education Association to implement a limited form of peer review.[28] And that very hostility stands in the way of teachers being professionals. As long as teachers see themselves in a vocational role rather than in a professional role, all the educational "policy" reform is a waste of time and money.

When teachers become professionals, the need for hierarchical control diminishes. When teachers become professionals, it will be the mastery of subject matter, not the mastery of methods, that will drive teaching. "Every teacher needs a firm grounding in the particular subjects she/he teaches. . . . Persons who are not capable of acquiring that grounding should not be admitted to or permitted to continue in teaching."[29] Indeed, according to Lortie:

> Research on teachers and their work conducted over the past two decades indicates that processes of professionalization have been significantly truncated. This is particularly the case with the *infrastructure* of teaching and with processes for conserving, developing, diffusing and implementing *effective practices*. Such gaps retard the flow of ideas and the capacity of teachers and schools to improve their performance.[30]

Continuing, Lortie observes:

> The kind of individualism we find in teaching leads people within it to see their work in primarily personal ways and to define its content in terms of their private experience as students and, having

> become teachers, as learned through trial and error in the confines of their classrooms. Where colleague relationships stand at the heart of medicine, for example, teaching features sporadic rather than steady and casual rather than serious interchanges among fellow teachers. Few see themselves as partaking of a shared body of practical knowledge, knowledge which specifies "the state of the art." Many decades of working in "self-contained shops" (classrooms) associated with infrequent contact with other adults have contributed to a view in which colleagueship—and knowledge shared with colleagues—plays a minor role. Physical isolation has inhibited processes of sharing and working together to develop better practices.[31]

Indeed, the essence of being in a profession is that individuals are expected to upgrade their knowledge and practices continually and further that kind of renewal by providing facilities and programs toward that end. Unlike the situation in many progressive sectors, there are no structured and sustained mechanisms to spread good educational practices. Unlike in medicine, there is no canon, and there is no striving to be the best in the world.

TOWARD A SUSTAINABLE KNOWLEDGE BASE

The literature suggests that there is precious little use of research-based knowledge in schooling. Teachers are isolated in classrooms, are often discouraged from innovating, and seem to have very little time for reflection and serious professional improvement.

New knowledge arises from a process with four distinct stages. First, there is the process of *invention*, the "idea" stage. But not all good ideas have applicability, and so such ideas must go through a process that in business is called *development.* It is here that good ideas get transformed into a "product" that will have some appeal in the world at large. This product need not be a physical object; it can be a method of doing something. The process of development is necessary before the gradual process of *innovation* can occur. By innovation we mean the gradual uptake of the new "product" by a few early adopters ("innovators"). It is here that many new creations stall. A few

innovators might come aboard, but word may not spread far beyond them. The literature on education suggests that this may well be the case with many educational innovations. The last stage is that of *diffusion.* It is here that the new product (the new "idea") becomes the industry standard; it is incorporated into the canon.

The professionalization of schools and schooling, by which I mean a quite radical reconstitution of education in a systemic sense, is a necessary condition for the diffusion and incorporation of research-based knowledge in schooling. When this process operates within the paradigm of a profession, then we will have succeeded in making innovation endogenous in schools and in schooling.

A FEW MODEST PROPOSALS

America's schools are mediocre because of the low expectations of parents and school administrators and because of an associated incentive structure throughout the nested hierarchy that runs from parents to school boards to school administrators to teachers and finally to students. State departments of education also play a role in this flawed incentive structure. At a fundamental level, teachers are regarded by all participants—including themselves—as mere employees. Teachers will often refer to themselves as "professionals," but their behavior belies that label. And of course their behavior follows from the incentive structure that treats them not as professionals but as vocational workers. No wonder our schools are so inferior. One will search in vain for declarations throughout this system that America's schools strive to be the best in the world. Taxpayers appear uninterested in funding such schools, and parents appear indifferent much of the time; hence those who run our schools—being perceptive—act accordingly. America has precisely the quality of schools it appears to want, and that is the abiding surprise and disappointment.

Can schooling in America be rescued from mediocrity? If we are to have hope, reform must start in an unlikely place—schools of education in American universities. One way to initiate reform would be for the top ten schools of education to

raise their admission standards to that required by the schools of business, engineering, and law in their universities. This would have two effects. First, it would immediately restrict the supply of teachers over the next four to six years, thus driving up starting salaries—and eventually the salaries of all teachers. Second, it would lead to an increased interest in a career in education among brighter undergraduates. This would happen because teaching would suddenly be more selective (hence more prestigious), and teachers would suddenly earn higher salaries.

The evidence seems to suggest that salary is not a factor for individuals *entering* teaching but that it is important in terms of individuals *leaving* teaching.[32] At the entry level, this could suggest two things: starting salaries for teachers are not that much below other jobs for similarly situated college graduates, or students who choose a career in teaching are not motivated by income. However, once an individual is involved in teaching, the situation seems to change. If starting salaries are competitive, then those for whom salary is important find that "salary compression" over time leaves them behind in terms of earnings expectations, and they decide to leave teaching. If they entered teaching allegedly unconcerned about salary, then perhaps the nonmonetary aspects of a teaching career cease to be enough to compensate for the other job-related difficulties, and they decide to leave. Either way, the current situation seems to attract students of somewhat average quality to teaching careers, and the lifetime earning potential of teachers is not commensurate with most other careers for which a college education is required.

The above reform would have the long-term effect of pushing up teacher's salaries across the board. In terms of annual increments for work performed, it is very difficult—and entails high transaction costs—to develop and implement a compensation system that can accurately reward "good" teachers and penalize "bad" ones. The information problems are simply too formidable. Moreover, the true effects of a good or a bad teacher may not be known for a long time—long after the students have left that particular classroom. However, if one starts with a more feasible goal there is hope for progress on this front. I would reform the system so that it is easier to make

sure that the clearly bad teachers are shown the door. Stories abound about how difficult it is to fire bad teachers, and that reality undermines the integrity of the entire system. The teachers themselves ought to be the most outraged by the current system; they should be able to see its effects on their professional reputation among the general public. More importantly, teachers will easily figure out who their bad colleagues are. When compensation schemes do not reflect the knowledge that teachers have but are reluctant to share about their colleagues, then cynicism and indifference creep into a faculty. The attitude becomes one of distrust of the entire compensation scheme, since it seems to reward both good and bad teachers alike.

A program of serious faculty (and administrator) review, perhaps every five years, could become a means to rid schools of subpar teachers and administrators, and it would have a profound impact on the morale and commitment of the better teachers. Good teachers and administrators, committed professionals, do not fear such reviews—in fact, they welcome them. Only the incompetent will have something to fear from reviews by peers and administrators. That is a part of what it means to be a professional.[33]

Yet another reform would entail a national testing and licensing program for teachers along the lines of exams for aspiring lawyers, accountants, or doctors. It seems odd that a career as important to the future of the nation as teaching should be left to the whims of hundreds of schools of education—all of whom have a vested interest in securing jobs for their graduates, regardless of their quality. If the suspect "social promotion" in our nation's K–12 schools is also practiced in the academy where future teachers are trained and socialized, then it is difficult to imagine a more serious incentive problem in education.

As for students, national tests to leave middle school and high school should be introduced. This would certainly imbue the current practice of keeping all students in school with new meaning. Instead of the current practice of social promotions to the next grade level regardless of performance, students would be kept in middle school (and then high school) until they could

pass the national tests. This would align the incentives of teachers and students in a most profound way.

Local school boards present a particular problem. If the above reforms were put in place, school boards would have their roles redefined in some respects. I leave it to others to ponder the role of such boards in a regime of serious peer review, national testing of teachers and students, and aggressive dismissal of mediocre teachers. In line with this change, I would continue to move more of the financing for schools away from the local level and concentrate it at the state level. Local control of schools, including their financial support, is a quaint holdover from an earlier era. Education in a "global economy" is too important to be left to the idiosyncratic whim of local entities, and its core financial support must be divorced from this same influence of local communities.

Are these modest reforms sufficient? It is hard to tell. Are they necessary? I believe the answer to that question is a resounding yes.

ACKNOWLEDGMENTS

Without implication, I am grateful to Constance Barsky, William Clune, Allen Odden, and Ken Wilson for comments on an earlier draft.

ENDNOTES

[1]National Center for Education Statistics, *Education in States and Nations,* NCES 96–160 (Washington, D.C.: U.S. Department of Education, Office of Educational Research and Improvement, 1996).

[2]In terms of purchasing power American schools do much better than this ranking would imply. Daniel Lortie, personal correspondence, 28 September 1996, 3.

[3]Ibid., 2.

[4]Ibid.

[5]Rebecca Maynard and Meredith Kelsey, "Public School Partnerships: Community, Family, and School Factors in Determining Child Outcomes," in *Improving America's Schools: The Role of Incentives,* ed. Eric A. Hanushek and Dale W. Jorgenson (Washington, D.C.: National Academy Press, 1996), chap. 8.

[6]There is yet another branch of economics literature concerned with the financing of public education. I will not address that matter.

[7]Richard R. Nelson, "Assessing Private Enterprise: The Exegesis of Tangled Doctrine," *Bell Journal of Economics* 12 (1981): 93–111; Richard R. Nelson and Sidney G. Winter, *An Evolutionary Theory of Economic Change* (Cambridge, Mass.: Harvard University Press, 1982).

[8]John H. Bishop, "Signaling, Incentives, and School Organization in France, the Netherlands, Britain, and the United States," in *Improving America's Schools,* ed. Hanushek and Jorgenson, 142–143.

[9]While we tend to think of America as a "market economy," it is, in the words of Herbert Simon, an "organizational economy." Herbert Simon, "Organizations and Markets," *Journal of Economic Perspectives* 5 (2) (1991): 25–44. The difference is fundamental.

[10]G. L. S. Shackle, *Epistemics and Economics* (New Brunswick, N.J.: Transaction Publishers, 1992), 66.

[11]Jane Hannaway, "Management Decentralization and Performance-Based Incentives: Theoretical Considerations for Schools," in *Improving America's Schools,* ed. Hanushek and Jorgenson, chap. 6.

[12]E. D. Hirsch, Jr., *The Schools We Need: Why We Don't Have Them* (New York: Doubleday, 1996), 228.

[13]Roger Soder, "American Education: Facing up to Unspoken Assumptions," *Dædalus* 124 (4) (1995): 163.

[14]Robert H. Meyer, "Value-Added Indicators of School Performance," in *Improving America's Schools,* ed. Hanushek and Jorgenson, 199.

[15]Ibid., 200.

[16]Sam Stringfield, "Underlying the Chaos: Factors Explaining Exemplary U.S. Elementary Schools and the Case for High Reliability Organizations," in *Restructuring and Quality: Problems and Possibilities for Tomorrow's Schools* (London: Routledge, 1998).

[17]Do successful firms share their secrets with competitors?

[18]Notice that I identify the excellence of such schools not in terms of the teachers, but in terms of the administrative structure that recruits and rewards (encourages) such teachers. I will have more to say on this later.

[19]We see a hint of the role of expectations in the generally exceptional performance of Asian-American children at all levels of education. Unless one accepts the canard that intelligence is a function of race or ethnicity, it seems irrefutable that such children excel because of expectations in the home, such expectations being manifest in terms of hard work and agreeable outcomes. It is also the case that collaborative learning in teams seems to be more common among Asian-American students. The question remains, to which I do not have an answer, whether these traits are dissipated in subsequent generations.

[20]David K. Cohen and James P. Spillane, "Policy and Practice: The Relation Between Governance and Instruction," in *Designing Coherent Educational Policy,* ed. Susan H. Fuhrman (San Francisco: Jossey-Bass, 1993), 72.

[21]In economics, the "principal-agent" problem is one in which incentive alignment among participants in a system is compromised by virtue of the position they hold. An owner of a firm is a "principal" while an employee is an "agent." The economic problem is to get the agent (the employee) to behave as if she were a principal (owner). The old homily "if you want something done right, do it yourself" is precisely concerned with the problems of "agency."

[22]It is my understanding that the average tenure for school superintendents is on the order of three to four years.

[23]Albert O. Hirschman, *Exit, Voice, and Loyalty: Responses to Decline in Firms, Organizations, and States* (Cambridge: Cambridge University Press, 1970).

[24]William H. Clune, "Systemic Educational Policy: A Conceptual Framework," in *Designing Coherent Educational Policy*, ed. Fuhrman, 126–127.

[25]Indeed, it is possible that we see here a case of confused causality. In other words, one must ask whether unions are the *cause* of the problems in schooling, or are unions the *result* of the systemic problems identified earlier.

[26]Seymour B. Sarason, "Governance, Systems, Charter Schools, the Creation of Settings, and the Wailing Wall," mimeograph, July 1997, 19.

[27]See Ben-Porath for a discussion of these issues. Yoram Ben-Porath, "The F-Connection: Families, Friends, and Firms and the Organization of Exchange," *Population and Development Review* 6 (1) (March 1980): 1–30.

[28]Indeed, when the matter was discussed at the 1997 NEA Convention in Atlanta, teachers from four of Wisconsin's largest cities walked out in protest. The reason according to one Madison teacher, "That's management's job. That's not good union behavior." *Wisconsin State Journal,* 8 July 1997.

[29]Lortie, personal correspondence, 28 September 1996, 4.

[30]Ibid.

[31]Ibid., 5.

[32]Allen Odden and Carolyn Kelley, *Paying Teachers for What They Know and Do* (Thousand Oaks, Calif.: Corwin Press, 1997).

[33]We see this emerging in universities where faculty are now subject to post-tenure reviews, often on a five-year schedule.

Robert L. Hampel

A Generation in Crisis?

ENDLESSLY CRITICIZED AS IMPRECISE, educators in recent years have gathered reams of statistics and dozens of "indicators" of "the condition of education."[1] The numbers come from state and federal agencies, and their aggregate impact reaches beyond scholars to a large audience interested in how schools are doing.

One subset of these indicators is drawing particular interest, namely, the "well-being" of children and adolescents. Conditions that jeopardize the healthy development of youth—crime, drugs, alcohol, cigarettes, inadequate medical care, pregnancy, family poverty, and the like—are scrutinized. The numbers are carefully collected, spanning several decades; none are too arcane to grasp. To make bold assertions about America's youth without considering these indicators would be an unfortunate and avoidable mistake.

Indices of well-being usefully complement the academic scorecards generated by other indicators that focus on achievement. It is necessary to know what is going on in the lives of youth outside school in order to understand their performance in school. By age eighteen, a high-school graduate has spent less than 10 percent of his waking hours in school. Not surprisingly, the way in which the other 90 percent has been spent either enhances or weakens the power of the school to make a difference. Even if it had no effects on learning, the well-being of youth would matter enormously to anyone interested in the prospects of the next generation.

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This essay focuses on the lives of children and teenagers outside school. A review of the best-known indicators of wellness will caution against declaring a crisis on the basis of trends in recent years. Conditions may not be what anyone would like to see, but it is questionable that either the rate or direction of change is worsening. Furthermore, the essay will look at three pursuits that fill the weeks of many youth—part-time work, friendships, and electronic media—but have not been featured as indicators of well-being. These activities, if not constituting a crisis, nevertheless merit more concern than they have received.

FRIGHTENING FACTS?

According to the received view of the indicators of well-being, growing up in this country is difficult, especially in comparison to thirty or forty years ago. Family life is supposedly more precarious as divorces, remarriages, unwed motherhood, economic fluctuations, and career demands all increase. Illicit drugs, alcohol, and cigarettes are consumed to excess and, along with too much junk food and too little exercise, undermine good health. Crime is accelerating, whether gauged by the juvenile arrest rate, homicide among minority youth, or weapon possession in school. Births to single teens, sexually transmitted diseases, and child abuse are distressingly common. And then there are the startling rates of homelessness, suicide, low birth weight, infant mortality, and emotional disorders, to name just a few.

Each of those topics can be dramatized by individual cases, as newspapers and magazines often do; but the statistics themselves are commonly featured by the media. Indeed, there is a widespread fascination with the figures. Reports with fresh data are newsworthy even without lurid particulars. The raw numbers are big, larger than most readers know or could have guessed: thirteen million children in poverty, one million pregnant teenage girls annually, 135,000 students carrying weapons daily. The rates can be just as jolting: every two hours a child dies of a gunshot wound, each day forty teenage women give birth to their third child. So are the increases over time—from 1960 to 1988, gonorrhea quadrupled for ten- to fourteen-year-olds.

Compiling the grim numbers in lists seems to clinch the case for the youth-in-peril argument. One head of the American Educational Research Association (AERA) included fifteen "frightening facts" in her presidential address.[2] A prominent psychologist began one of his books with the claim that "practically all of the indicators of youth health and behavior have declined year by year for well over a generation," with ten indicators reviewed in the next six pages.[3] Urie Bronfenbrenner and his coauthors recently filled a book with 150 charts, including twenty on youth, to show the "increasing social chaos, which threatens the future competence and character of this generation and the next."[4]

The litanies of indicators need more careful scrutiny than they usually receive. For many measures, it is not clear whether data-gathering methods may have changed over the years. Is it not likely that fewer illegitimate births were reported at mid-century? Certainly fewer schools were obligated to report acts of violence within their building. Even the ways in which respondents answer questionnaires is changing: considerably more youth admit to illicit drug use in computer-based surveys than in paper-and-pencil ones.[5] A word of caution is appropriate when there have been shifts in data-collection procedures underlying some of the indicators. Moreover, lists often include either a number or a rate, but giving just one or the other can be misleading. For example, the divorce rate is certainly higher now than it was in the 1960s, but as the life span lengthens, more couples will celebrate a fortieth wedding anniversary than ever before.[6] Conversely, a given raw number may be stable—say, teen pregnancies from the mid-1950s to 1980—as several related rates fell (babies given over for adoption) and rose (contraceptive use, out-of-wedlock births).[7]

Even with reliable and consistent statistics, the interpretation of the available numbers as bad news is not self-evident. I believe that at least four considerations belie declarations of chaos and crisis. The point is not to claim that everything is fine (especially because few of the indicators of well-being chart changes in the American family—a vast topic beyond the scope of this essay—or shifts in attitudes and beliefs of the young). Well-founded concerns are in order; jeremiads are not.

First, there are few benchmarks by which to judge what the numbers mean. Is it heartening or disheartening that one in eight adolescents either thought of or attempted suicide in the past year? That one in six seventh and eighth graders has had sexual intercourse? That one in four adolescents smokes?[8] An article in the *Wall Street Journal,* summarizing the study that provided those figures, concluded that "large proportions of teenagers still engage in risky behaviors," then gave four examples in which the figures were 3.5 percent (suicide attempts), 25 percent (smoking), 16 percent (junior-high sex), and "almost half" (high-school sex).[9] The implicit benchmark is that none of this should happen at all. Any risk behavior is too much.

From another perspective, genetic wiring guarantees predatory and reproductive behavior in the young. "If teenagers had not been programmed to be boisterous, aggressive, and sexy, we would not be here now."[10] That standard suggests a different, more lenient benchmark akin to the notions of one journalist who, after following eight suburban teens for three years, concluded that being good meant doing bad things only occasionally, not abstaining entirely.[11]

In the absence of common benchmarks, contrasts are made. Some commentators rely on international comparisons, especially to America's largest trading partners, without determining if the cultures differ so much as to invalidate the comparisons. They sometimes juxtapose two rates against each other, as President Clinton did when he said that "high school seniors are more likely to take weapons to school than to take calculus in school."[12]

What is not common, surprisingly, is a comparison with what adults do. Statistics on crime, drugs, alcohol, cigarettes, suicide and health could all be juxtaposed against the adult rates. Equal numbers should not be expected, but what of the rate of increase or decrease? Are they comparable? On some measures they are trending in tandem; on other measures they diverge markedly.[13]

Second, the benchmark that *is* commonly used—comparison over time—does not span the century, with fifteen to thirty years the usual range for which reliable statistics are available. There are several pitfalls in using a decade or two. Short

timespans understate the great improvements in health across the century. Prenatal care, health-insurance coverage, childhood immunizations, and dental care are all better now than at mid-century and before. In 1900, more than 18 percent of infants died before their fifth birthday; today far fewer than 1 percent do.[14] One potentially misleading result is that the rates of some handicaps have not improved even as medicine has. As more children survive who previously would have died, some grow up with a once-fatal handicap; yet some similarly handicapped youth benefit so much from medical advances that they reach adulthood totally healthy.[15]

By not including the late 1960s and early 1970s, many trendlines miss a crucial period. There was probably more change in adolescent conduct between 1968 and 1978 than between 1978 and 1998. For example, the easier availability of illicit drugs, contraception, and abortion made adolescent behavior seem less innocent than ever before. Previously, cigarette smoking, beer drinking, constant dating, and hosting unchaperoned parties explored but rarely exceeded the limits of a "stop short after overstimulating yourself" code of respectable middle-class conduct. "Going steady" (which two-thirds of parents disliked—it was too close to an engagement) allowed kissing and then some, but that was all. Knowing when to stop had been a norm through the mid-1960s, and teen girls who flouted it invited scorn as lower-class tramps. By the mid-1970s, the old "bad girl" label had largely vanished, and dating customs became more flexible, less constrained by adult expectations, more variable from couple to couple. Behavior that had been at the margin edged into the mainstream, and did so earlier in adolescence.[16]

If the changes that took place around 1970 were as crucial as many historians believe they were, then it is possible that the risk-takings of the past quarter-century have been the aftermath, the legacy, of those watershed years. If the paradigm shift occurred *before* most of the timespan covered by the indicators, then the risky behaviors are the predictable consequences of a redefinition of what it means to be young that took place thirty years ago. Seeking the causes (and the solutions) only in recent economic, social, and political forces overlooks the earlier roots of the current conditions.

If recent years mark an unprecedented crisis, why are so many trendlines flat or even improving since the late 1970s? Alcohol use peaked then, and regular drinking (more than twice within a month) declined from 50 percent of twelfth graders in 1980 to 31 percent in 1995. Substance abuse also fell (with some increase in the 1990s reversing larger declines in the 1980s), with slightly smaller decreases in cigarette smoking. The trendlines are level that gauge children in poverty (20 percent), children with health-insurance coverage (86 percent), the white teen birth rates (23 per 1,000 girls aged fifteen to seventeen), and "detached youth" (that is, sixteen- to nineteen-year-olds neither in school nor at work). Some indicators worsened, to be sure—from 1985 to 1994, there were increases in victims of violent crimes (up 70 percent), families headed by a single parent (up 18 percent), teen deaths by accident, homicide, or suicide (up 10 percent), and low birth-weight babies (up 7 percent). (On those indicators, and several others, impoverished minorities fared particularly badly.) On the other hand, there were improvements in infant mortality, child death, prenatal care, and child hunger.[17]

A third reason why the crisis perspective is misleading is the array of services designed for the nonacademic needs of children and youth. Schools have not ignored the physical and emotional complications and misfortunes of students. There are more specialists available for help than a generation ago, and more services available within and outside the school. There are many different adults a student can talk to, including counselors, social workers, nurses, peer counselors, and administrators. School-based health clinics often provide pregnancy tests, immunizations, personal counseling, birth-control information, and referrals to local agencies for more services. Some health centers also offer infant care, parenting skills, employment counseling, group counseling, and substance-abuse workshops.[18]

Responsiveness to the nonacademic complications of growing up is not confined to wellness centers and specialists. Within many states the intervention reaches youth not yet in danger but moving through phases of life considered particularly crucial for healthy development. A well-known case in point is the surge of support for early childhood programs, whether the

expansion of kindergarten, quality-control standards for day care, or wider eligibility for Head Start. If the preschool years are one crucial point of prevention, another is early adolescence. Middle schools try to revamp the junior high schools in several ways that bring them closer to elementary schooling than their customary model, the high school. One goal is for teachers and students to talk about the physical, emotional, and social changes an eleven- or twelve-year-old is beginning to experience. Through team teaching, advisory groups, and block scheduling, it is hoped teachers can know each student well enough to identify and discourage unconstructive risk-taking.

But not every teacher can comfortably and competently be a good advisor, at any grade level, and some teachers deplore risk behaviors as delinquency. In their opinion punishment, not treatment, is the appropriate response. They disparage colleagues and administrators as too soft, claiming that they coddle the rowdies who a generation ago would have been expelled. Such teachers generally see themselves as facing the thankless task of working with unmotivated students who do not value education, and they regard most kids (especially poor and minority kids) as distracted, ornery, or indifferent. What is noteworthy is that this group in most schools is fairly small. Usually teachers do not write off a significant fraction of the class as beyond hope. They are willing to work hard to help the at-risk students who at least show up and try. Rather than a faculty dumping ground, the special programs for at-risk students often attract talented and committed staff.[19]

A fourth reason for questioning the crisis perspective is "resilience," the ability to confront hardships and survive, endure, even succeed. One report notes, "Only a small percentage of all the children exposed to risk will develop serious problems. Stress resistance rather than maladjustment appears to be the norm."[20] There are many "protective factors" that reduce the likelihood of harmful outcomes, with "connectedness" (caring, closeness, feeling wanted, being involved) to family and school being especially important.[21] Children of divorced parents do not fare quite as well as children from intact families, but the majority pull through. "Most do not drop out of school, get arrested, abuse drugs, or suffer long-term emotional duress."[22]

Four out of five adolescents do not have mental-health problems (a prevalence similar to that of adults).[23] Three out of four do not smoke cigarettes, seven out of eight have not smoked marijuana in the past month, and 99,483 out of 100,000 were not arrested last year for a violent crime.

Is there no one in crisis? Of course not. The indicators of well-being for urban minority male teenagers are horrendous. Temporary improvements for them rarely seem to last. Stable trendlines for all categories of youth are discouraging in light of dozens of intense reform initiatives—all that effort and money, and so few enduring gains. Toning down the crisis rhetoric is no reason for complacency.

FACTS THAT SHOULD BE MORE FRIGHTENING

In comparison with the attention to indicators of academic achievement and well-being, there is not as much known about the ways children spend their time outside school. As one federal report noted, "There are sources of data on the amount of time they spend on certain activities, such as watching TV, but there is no regular source of data on the whole spectrum of children's activities."[24] Few researchers specialize in that field. Yet youth devote a large part of each week to other interests and pursuits, particularly work, peers, and leisure. From the 1950s to the present, television has claimed twenty-plus hours per week. By the time a child is six, he has spent more time watching television than he will spend in his entire life talking with his father. Teen viewing averages at least two hours on school nights, and twice that on weekends. Young children view more than teens; early adolescents watch more than older adolescents, whose consumption of music, movies, and videos increases faster than their television viewing decreases.

Friends claim at least as much time as television, often more. For preteens, physical activities—sports, bicycling, playing outdoors—are the favorite pursuits, much more so than games or hobbies.[25] Friends take up more time for ninth graders than for fifth graders (as time spent with parents is almost halved). The extra hours are often spent on the telephone—a fourteen-year-old girl is nearly three times as talkative as a ten-year-

old.[26] In high school, socializing with their closest friends or with a small group ("cliques" of six or so) occupies almost 30 percent of teens' waking hours, about twice as much as the time in contact with parents.[27]

By graduation, nearly 80 percent of high-school students will have worked during the school year. Their average workweek is approximately twenty hours (with 10 percent clocking thirty-five or more hours weekly), which is considerably longer than the average teen workweek thirty years ago, when half as many high schoolers held part-time jobs. Boys put in slightly more hours than girls, and teens from single-parent homes work more than other youth. Family affluence has remarkably low correlation with the employment status of kids, or with how long they labor if they do hold a job. Furthermore, twenty-nine states place no limits on the hours that students can work during the school year, while another thirteen permit forty hours or more. Only eight states cap the workweek, and just two of those limit it to twenty hours.[28]

Allocations of the after-school hours are less relevant than the effects of that time on an academic work ethic. Each of the three pursuits can hamper performance in school, and that jeopardy affects far more youth than are imperiled by most of the indicators of well-being reviewed above. Nearly everyone has friends, watches television, or works, unlike the incidence of suicide, crime, early pregnancy, and other misfortunes.

Part-Time Work

Part-time work offers meager educational benefits. Being a store clerk or a McDonald's cashier entails "little task variety, highly routinized activity, and the constant repetition of fairly uninteresting tasks."[29] There is little chance to learn from adult supervisors, and independent decision-making is rare. The skills acquired in school are not prerequisites for satisfactory job performance, and only half of high-school seniors ever discuss work in class or get ideas from class to apply on the job.[30]

Part-time employment rarely enhances academic achievement. Students working more than twenty hours each week hurt their grade-point average, regardless of whether their grades were good, average, or poor before they began working

(shorter workweeks of ten hours or less do not seem to affect grades). Not surprisingly, 60 percent of employed teens acknowledge that working interferes with course reading and writing, and over half say that working makes it harder to stay alert during class.[31] And part-time employees do not develop greater responsibility. As the workweek increases, so do cigarette smoking, alcohol use, illicit drug use, interpersonal aggression, theft, trouble with police, arguments with parents, lack of sleep, and lack of exercise.[32]

Admittedly, some adolescents learn from their jobs, acquiring such marketable skills and valued work habits as self-discipline, punctuality, dependability, and self-confidence. That has been the case throughout the century. Early on, chores on the family farm, if monotonous, built pride in contributing to the household's welfare. Jobs in prestigious neighborhood stores brought local status to a chosen few.[33] Less selective jobs, such as caddying at the local country club, offered rewards. For a good "A" caddy at a posh country club, carrying two bags (a step up from the one bag allowed to "B" caddies) every day in the summer could earn a working-class black youth as much money as many adults he knew.[34]

If the part-time jobs go beyond humdrum routine to more complexity, the developmental outcomes are more favorable (as they are for youth who work shorter hours and for savers who set aside most of their paychecks for college). When younger teens baby-sit or when older teens work only in the summer, much less harm ensues. Adolescent workers tend to describe their jobs positively, as a chance to earn, learn, be helpful, and feel challenged.[35] In light of the menial tasks, however, that satisfaction is worrisome, not reassuring, as are the other aspects of teen labor reviewed above.

Peer Pressure

It is easy to exaggerate the impact of peer pressure. Even the word "pressure" is misleading, in that most youth are rarely pressured by their friends; in picking their close friends, they choose pals who reinforce rather than alter their previous beliefs and behaviors. Furthermore, teens usually share rather than reject the political and religious views of their parents. In planning their future, they rely most on mom and dad.

But friends certainly matter. The status of different groups—"crowds" to which dozens of students feel allegiance—consumes much time and energy. As writer Joyce Maynard remembered popularity, "I recognized the results of it every time we chose up teams in gym, every time there was a dance or a field trip. One could tell from where we sat in the lunchroom . . . we all knew our places, which seats we were destined to sit in."[36] Another writer recalled how she and her friends refused to associate with "the loners, the stupid ones, the fat ones. We had absorbed already by sixth grade a set of careful and cruel distinctions."[37] It would be nice if the ending of the movie *The Breakfast Club* ("What we found out is that each of us is a brain, athlete, basket case, princess, and criminal") were universally true, but it is not.

Different crowds exert different effects on academic effort and achievement. Alienated students, such as "grits," "metalheads," and "burnouts," usually spurn high grades and hard work. They look outside the school for their sense of achievement. Some ethnically defined groups value academics; others do not. The "brains" obviously do, yet they are the *least* satisfied with their crowd identification—nearly half yearn to be elsewhere.[38] The attitudes of the elites, especially athletes, extracurricular stars, and the most popular, seem to set the norm that is followed not only by them but by others on the fringes of their groups or "in between" kids with a few friends in several groups: "to do moderately well, to strive for academic *adequacy* rather than academic *excellence*."[39]

Another word to underscore is *strive*. Good grades are not necessarily unacceptable. Many popular and athletic kids earn high grade-point averages. What is taboo is striving too hard, too transparently, to earn those grades. As Veronica boasts in the movie *Heathers*, "I use my grand IQ to decide what color gloss to use and how to hit three keggers before curfew." If there is blatant effort, it should be confined to Advanced Placement classes or exerted at home (and alone—only 1 percent of American teens study with peers, in contrast to 19 percent of Japanese and Chinese youth).[40] Too much overt effort invites social ostracism, the fate of one salutatorian in a Texas high school: "No matter how many books he read, no matter how

exquisite his arguments in government class about gun control or the *Sandinistas* or the death penalty, he never got the latest scoop on who was having the weekend parties."[41]

Television and the Electronic Media

It is also easy to exaggerate the effects of television and other media. There is an old tradition of blaming delinquency and crime on television—and on comic books, radio, movies, and other products of mass culture.[42] Even pre–World War I silent movies were controversial, with crime films criticized for leading youth astray.[43] But few viewers imitate exactly the behaviors shown on the screen. A show as offensive as "Beavis and Butt-Head" may be deplorable for many reasons, yet very few delinquencies are directly attributable to its twisted morality.[44] Different kids react in a range of ways to what they see and hear. "What children get out of television depends heavily on what they bring to it."[45] For instance, "heavy metal" music, videos, and concerts seem at first glance to promote nihilism. The sounds are deafening and the lyrics bleak. Bands like Slayer, Rigor Mortis, Metallica, Megadeth, and Judas Priest "portray the world as a dangerous, corrupt, despoiled place." At concerts, members of the audience "mosh" (slam into one another intentionally) and take turns "stagediving" (jumping into the crowd) in order to "crowd surf" (be carried hand-by-hand over the throng). But most fans swear the music actually calms them. Listening purges rather than heightens their anger. "Instead of yelling and throwing things, you can turn something up real loud," one metalhead explained.[46] Even so, aggressive thoughts, words, and actions are not disconnected from television, where more than 60 percent of the shows contain violence. The impact of television violence on youthful viewers has been thoroughly studied, and there is a small but statistically significant causal relationship between aggressive behavior and television violence. Part of that risk is the danger of becoming desensitized to violence, on television and in everyday life. Only 3 percent of all shows include antiviolence messages, and 71 percent of the violent scenes fail to show any punishment of the perpetrator.[47]

How does pop culture affect academic achievement? The habits it encourages are at odds with the skills necessary for

thoughtful analysis and understanding. The pace of television is too rapid for reflection. The image on a television screen changes every nine seconds, on average, and on MTV it switches every four seconds. The patience and attention span required for serious academic work is greater than thirty or sixty minutes (and nearly half of all viewers change channels before a show is over). Pictures of all kinds "can never describe what the [printed] word can. The word lassoes the thought," admitted Otto Bettmann, who spent his life collecting millions of vivid pictures.[48] Not only is sustained thought not required of television viewers, it is rarely seen on the shows themselves. "On television, every moment has to be arousing, every event attention-getting."[49]

Television is antithetical in other ways to what is necessary to use one's mind well. If learning is often sequential and linear, viewing has no prerequisites, no progression of skills after the simple processing of pictures and sounds is acquired. If learning is a type of apprenticeship with close oversight by a knowledgeable adult, coviewing of shows with parents is uncommon. If learning thrives with confidence that the world is a safe place to explore and master, television heightens apprehension of the perils and dangers awaiting the unwary in a "mean world."[50]

Subtlety of reasoning suffers. Many shows suggest that there are two (and only two) sides to any issue. Many viewers judge the morality of actions on the basis of whether they like or dislike the character. "The good people can do no wrong; the bad people can do no right."[51] For younger children, the raft of shows linked to the toy industry encourage fantasies in a play world far from adults, unlike the old erector sets and toy trains that imitated everyday life and invited parents to join the fun. "Toys that seem to prepare children for adult life have become harder to find" as play today "simulates activities more familiar in movies and television than at home or office."[52]

WHY ARE EDUCATORS NOT MORE FRIGHTENED?

Most public high schools are officially neutral in regard to peers, electronic media, and part-time work. Decisions about the best ways to use time apart from teachers are up to the

individual; in exchange for seven hours or so of attendance in school, educators cede the remaining hours. It is a big enough job to keep kids orderly and productive during the day, let alone oversee the rest of their lives. There is no tradition of public school supervision of late afternoons and evenings, and many schools are hard-pressed to justify a modest expansion of what they do *during* the day—the widespread adoptions of statewide curricular frameworks, "high stakes" testing aligned with those frameworks, senior projects, and more credit hours all restrict the variety and choice students (and teachers) exercised throughout the 1970s and 1980s. But schools are, unofficially, an integral part of the decisions youth make in regard to friends, work, and leisure.

An influence on social groups is hardly surprising in light of the constant opportunities for socializing when hundreds or thousands of youth fill a building every day. School size is a nontrivial context of peer groups, with larger schools more likely to contain many different and often antagonistic groups. Regardless of size, anything that bears on when and where students get together will affect socializing. Can students pick the teachers and sections they prefer in "arena scheduling"? Are students grouped by ability? Do all the varsity athletes take gym last period to permit early outs in season? Even the design of the school is crucial, making it easy or hard for small groups to gather in the courtyard, parking lot, lunchroom, entrances, and hallways, staking out favorite areas and shunning others.[53]

The extracurricular activities and sports teams that powerfully shape adolescent crowds and cliques, particularly the "jocks," depend on sponsorship by the school. The school provides the money that buys space, equipment, transportation, and coaching (parent and "booster club" fund-raising can be substantial, but those dollars supplement, not supplant, the school's budget). A more subtle but equally crucial contribution is the accommodation in the master schedule for the most popular pursuits. For instance, many junior high school principals build the schedule around the needs of music, especially the band and the chorus.

Schools not only make it possible for some cliques to exist, they repeatedly heighten the visibility and prestige of those

stars. Public-address announcements, pep rallies, "letters" for varsity athletes, trophy cases in the main hallway—there are many forms of in-school recognition of afterschool achievement. In a large high school (public urban secondary schools in this country average approximately 1,100 students) where students come from different elementary and middle schools, the spotlight shines on the few who are special, distinctive, accomplished. As the school honors their achievements, it also unwittingly enhances their social cachet.[54]

Educators regret that so many youth work to buy cars, clothes, and music, but the schools help make employment possible. The brief time required for homework (the national average is approximately four hours per week) leaves many hours for paid work. The time demands in senior year, one of the two years in high school when nearly everyone is eligible to work, can be particularly light if students have earned almost all the credits needed for graduation or have been accepted to college. Some schools accommodate the seniors' priorities by allowing an "early out" at or before noon for workers.

Furthermore, schools could hardly oppose part-time employment when a fraction of their own teachers hold second jobs. One-quarter of public-school teachers hold nonschool jobs in addition to teaching, and one-third earn extra money from their school districts for coaching, teaching evening classes, or advising clubs.[55] Even if no teachers worked, educators would not intervene as long as parents refuse to tell their children how much to work. Most parents feel they should not influence either the decision to work or how the paychecks are spent. "As long as the adolescent is not in any danger, there is no apparent need for parental intervention."[56] A strong stand by the school against unlimited teen employment would strike most parents as hypocritical (all those working teachers!) and intrusive (we're not alarmed, so why are you?).

Electronic media are also hard for educators to challenge. In fact, teachers usually prefer to accept and capitalize on the media that kids like. Showing filmstrips in school is an old familiar practice, with some movies apt and instructive, others bland and shallow. But electronic media today exert more influence than an occasional movie. In many schools kids can

wear headphones. In many class discussions references to, and digressions about, television shows abound. In place of writing, some assignments offer the choice of making a video. The content of the mass media might be worrisome, but the form is readily accepted by most schools.

Why do so few educators fight the pernicious effects of part-time employment, peer pressure, and the media? If so many youth are distracted from mental exertion in their out-of-school lives, why do reformers not take on those anti-intellectual forces with the same energy they devote to curricular and pedagogical innovations? To rephrase the question: why must the out-of-school problems invade the school before educators will react? Schools do respond when peer pressure spawns gangs—at that point, a dress code might ban all gang-related clothes, require see-through book bags, or forbid gold chains. Some educators complained when Channel One inflicted commercials on thousands of schools. California's superintendent called it the worst idea in the history of American education and vowed to withhold state aid for the minutes students spent watching the advertisements.[57] In Kentucky, an urban district beseeched employers to send kids home before 10 P.M. during one week of "high stakes" testing that would influence whether or not the schools met the targets established by the state. But why do educators not resist when the dangers are less blatant?

One reason is the awareness that more severe risks await many youth after school. In place of a job, some kids confront such dismal poverty that $6.75 an hour at Wendy's would be a blessing. Instead of peer pressure not to study, some kids face peer pressure to fight, steal, or take drugs. Sitting in front of a television eating chips keeps some youth out of greater mischief.

Another reason is the nonjudgmental attitude with which schools respond to the risk behaviors discussed above. The names of many special programs are acronyms that avoid invidious labeling, and the jargon prefers nonevaluative shorthand—emancipated youth, reconstituted homes, families in process. Social-service staff are more likely to speak of "value systems" than "morals."[58] If that is the approach to acute woes like drug abuse, how could schools be more assertive when the menace from part-time work, television, and friends is less transparent?

A third reason is the competition within the educational world among different approaches to improve schools. The choice between phonics and whole language, heterogeneous or homogenous ability grouping, back to basics versus teaching for understanding—these are just a few of the many divisions that frame the discussions about improving teaching and learning. The advocates of a particular approach aim their fire at colleagues within the profession rather than fight outsiders. When "California Goes to War over Math Instruction" was on the front page of the *New York Times* on November 27, 1997, the newsworthy "war" was an internecine battle over different ways to teach math, not a crusade against those indifferent or hostile to mathematical literacy. What gets overlooked is the common ground both sides share *and* the common enemies they face. For instance, proponents of small-group discussions and traditionalists who value lectures both need to know their fields, feel passion for them, hold high expectations of students, and more. Both are under siege whenever pop culture, peer pressure, and part-time employment challenge reading, thinking, writing, and even talking.

Furthermore, the dissatisfied can exit and place their children in private schools where there is more forthright opposition to the nonschool forces that undermine mental exertion. The time demands of substantial homework and mandatory participation in sports discourage afterschool employment. The peer culture is not absent, but it usually encourages rather than discourages hard work. Rejection by friends can stem from *not* taking school seriously. "The peer culture supports a willingness to work that many students say is more important than the capacity of teachers to motivate them to work."[59] Many private schools challenge pop culture and leisure preferences, although this is a hard battle often lost.[60] The schools make no apology for being a place apart from the wider world, defending certain values and habits, including musical tastes. Private schools strive to defend the "walls—physical and metaphorical—which properly separate them from those parts of the outside world hostile to their work."[61]

If public schools have various reasons to think twice before questioning the personal pursuits of students, educators ignore

them at a price. Their reasons for not fighting those threats to mental exertion are not foolish, but educators tacitly condone part-time employment, electronic media, and peer pressure. They have taken a stand, tolerating risks that deserve to be better measured, better understood, and better combated.

ACKNOWLEDGMENTS

For comments on earlier drafts, I am indebted to James Crouse and Sylvia Farnham-Diggory at the University of Delaware and Jeffrey Mirel at Emory University.

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Lauren B. Resnick and Megan Williams Hall

Learning Organizations for Sustainable Education Reform

THE MOST STRIKING FEATURE of the education-reform movement in America today is that it is still with us. During the twentieth century, the country has seen many education-reform efforts come and go with disappointing results. Usually, proposals are made in response to some immediate perceived crisis—a war, an economic downturn, a moment of scientific or technological competitiveness such as *Sputnik*—that sparks a short-lived period of education "alarm." When the crisis passes from public attention, so does interest in education.

This time things are different. Some fifteen years after the publication of *A Nation at Risk*—despite the end of the cold war and the recent upturn in the economy—the country is still gripped by concern for its education system. Responding to the public mood, governors and mayors, like Congress and the president, are declaring education to be a priority. Everywhere, the rhetoric of higher standards for education is heard. And in some places there are at least halting steps toward making the rhetoric a reality, whether by adopting tougher graduation requirements, investing in developing the teaching force, pouring technology into the schools, or creating new forms of governance.

Why is education reform still alive? One reason is the fundamentally changed nature of the economy in the information

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age. Although U.S. business is booming and productivity is rising, growing numbers of employers continue to call for better educated, more highly skilled workers, claiming that there are good jobs with career prospects going unfilled because of a lack of adequately prepared young people. As intelligent machines take over a growing array of routine business functions, the work left for humans is increasingly the nonprogrammable tasks: those in which surprise and variability must be accommodated, where only adaptive human intelligence can make the evaluations and decisions needed. These economic and technological factors are visibly changing the job market, creating a broad awareness among Americans that their children need more and better education.

Given the continuing sense of urgency about education, why is education reform taking so long? The causes most often cited are substantial public resistance to the reform agenda and the difficulty of overcoming organizational constraints, including the special interests of professional educators and their unions. Both of these are real enough. There is a growing public backlash against education reforms that seem too "child centered" and undisciplined (witness the recent fights over the academic content of standards in California). In addition, many people call first and foremost for carefully screened opportunities for their own and other "talented" children rather than for a more rigorous education that focuses on thinking and problem solving for all students. And sluggish response to demands for change on the part of educators is leading more and more citizens, including minority advocates, to push for charter and voucher programs that would create a schooling "market" in which parental choice would build incentives for better schools.

But there is something even more fundamental at stake. The history of education reform in the United States is largely one of tinkering with institutional arrangements—such as practices of grouping, reporting, accountability, governance, and management—that have little impact on established patterns of teaching and learning.[1] Reform has rarely penetrated the "educational core" of how knowledge is defined; how teachers' and students' roles are defined in the process of teaching and learning; how students are grouped for purposes of instruction; how

teachers' work is defined vis-à-vis other teachers and instructional staff; how much time is allocated to various subject matters; and how students' progress is assessed and evaluated.[2]

The tendency to focus on structure and management is in part due to what American tradition treats as the proper role of education policymakers. Details of what children should learn and how they should be taught have been viewed as matters for local decision making, and they have received little official guidance. De facto policies on curriculum and instruction have arisen from the training that teachers receive at colleges and universities, from the textbooks and standardized tests that districts adopt, and from a general tendency for educators to teach children in the same way they themselves were taught. Parents and the public likewise tend to expect schools to look and feel like the ones they attended as children.

Movements to change pedagogy have usually been linked very weakly to official policy structures. Most work that was done earlier in this century to develop "progressive" teaching strategies was done in private or laboratory schools; it never penetrated the heartland of American school systems.[3] In recent years, many public-school teachers have joined subject-matter reform networks (for example, the Writers Workshops and regional sections of the National Council of Teachers of Mathematics [NCTM]) that support practitioners in the acquisition of greater expertise, both in new content and in approaches to teaching core subject matters.[4] But although these networks have profoundly influenced the individuals who have become active in them, the participants' new pedagogy affects only their own classrooms, sometimes even in opposition to official policy.

Only with the recent movement for standards-based education has America begun to explore the potential of designing policy structures explicitly to link testing, curriculum, textbooks, teacher training, and accountability with clearly articulated ideas about what should be taught and what students should be expected to learn.[5] Many of the state and district standards that have been developed over the past several years, as well as those of national standard-setting groups—for example, the NCTM Standards, the National Research Council's

Science Standards, and New Standards—carry with them implications for pedagogy as well as for the content of instruction.[6] To meet math and science standards of problem solving or communication, for example, requires that new forms of mathematics be taught in the school program—forms that are foreign to most of today's teachers and not easy to learn.[7] There is, however, emerging evidence that sustained professional development efforts geared to the new standards can change pedagogical practice in public-school classrooms.[8] These developments suggest that it may now be possible for education-reform efforts to go beyond institutional tinkering to challenge some of the core assumptions that have shaped the American public-education system.

WHAT IS THE "CORE" THAT NEEDS TO CHANGE?

We have inherited an education system designed in the early part of this century. This "one best system" was oriented toward good educational management, and its assumptions about how to manage education were consonant with the leading "efficiency" theories of the day.[9] More importantly for the present analysis, its espoused curriculum and teaching norms were based on prevailing scientific assumptions concerning the nature of knowledge, the learning process, and differential aptitude for learning. Although they have been profoundly challenged by the past three decades of research in cognitive science and related disciplines, the assumptions of the 1920s are firmly ensconced in the standard operating procedures of today's schools. These procedures, and the theories and assumptions they embody, form the core that needs to change if today's reform goals are to be met.

Core Theory of Learning

The easiest way to characterize the theory of learning that still lies at the core of American educational practice is to begin with an account of the work of Edward L. Thorndike. Thorndike was an experimental psychologist teaching at Columbia University (Teachers College) early in this century who became actively involved in educational work. Because he moved be-

yond scholarly papers and psychological theory to develop useable educational tools—including textbooks, tests, curricula, and teacher training—Thorndike has had and continues to have an enormous influence on education practice. His name may no longer be a household word among educators, but his legacy endures in much of what they think and do.

Thorndike's *associationist* theory of learning was shared by notable psychologists of his period and succeeding decades. According to the associationists, knowledge consists of a collection of bonds: links between pairs of mental entities or between an external stimulus and an internal mental response. Learning is a matter of changing the strengths of the bonds: increasing the strength of "good" or correct bonds, decreasing the strength of incorrect ones. This strengthening or weakening occurs through practice in which correct bonds are strengthened by rewards and incorrect ones are weakened through punishment or the absence of rewards. The theory of bonds and rewards grew out of extensive laboratory research, much of it on animal learning. In practical application it led to a technology of organized practice to enhance the "stamping in" of correct bonds and the "stamping out" of incorrect ones.

Following naturally from the associationist theory of learning was an associationist theory of instruction, which called first for analyzing the knowledge domain into its component bonds. Thorndike himself undertook this analysis for the domain of school arithmetic.[10] His book entitled *The Psychology of Arithmetic* broke the various operations of arithmetic down into hundreds of separate bonds. Figure 1 provides an example of the analysis for one arithmetic operation, column addition. The next step was to arrange for felicitous practice of the bonds. This included both groupings and sequencing of bonds and arranging for appropriate rewards. Thorndike took education engineering seriously enough to involve himself in preparing a new series of textbooks. Figure 2, an excerpt from one of the textbooks, shows the careful attention he and his colleagues gave to the question of rewards and motivation generally. In this example, they used team competition to stimulate attention to both speed and accuracy of the responses.

Figure 1. Thorndike's Analysis of Column Addition into Bonds.

Learning to keep one's place in the column as one adds.
Learning to keep in mind the result of each addition until the next number is added to it.
Learning to add a seen to a thought-of number.
Learning to neglect an empty space in the columns.
Learning to neglect 0s in the columns.
Learning the application of the combinations to higher decades may for the less gifted pupils involve as much time and labor as learning all the original addition tables. And even for the most gifted child the formation of the connection "8 and 7 = 15" probably never quite insures the presence of the connections "38 and 7 = 45" and "18 + 7 = 25."
Learning to write the figure signifying units rather than the total sum of a column. In particular, learning to write 0 in the cases where the sum of the column is 10, 20, etc. Learning to "carry" also involves in itself at least two distinct processes, by whatever way it is taught.

Source: Edward L. Thorndike, *The Psychology of Arithmetic* (New York: Macmillan, 1922), 52.

Associationist instructional theory further called for frequent testing, in order to determine which bonds had and had not been learned, and suggested continued practice specifically on the bonds not yet mastered. Thorndike and other psychologists of his time turned to test development, establishing a pattern still in use today—that of tests made up of many separate items of information. This kind of testing, of course, made perfect sense within a theory that decomposed knowledge into lists of separate bonds, with no organized way of accounting for conceptual relationships or for strategies of problem solving and sense making.

In addition to testing, other aspects of associationist instructional theory have been absorbed into the core pedagogy of American schools. Textbooks, especially in elementary schools, still mainly offer lots of practice on minimally connected bits of information; workbooks support this kind of practice. (Most modern computer-supported instruction is basically a sophisticated form of the associationist workbooks and practice programs.) Teachers use a form of recitation that consists of terse questions directed at individual students, evaluation of the in-

Figure 2. A sample drill lesson designed by Thorndike. Note the use of a "team race" approach, one way of strengthening bonds through reward. For this particular race, children were to complete one hundred problems in ten minutes.

A Percentage Race

Each row of pupils is a team. The teacher gives out printed problems, or uses those on these pages, or writes problems on the blackboard. All start together and write the missing numbers or answers as quickly as they can without making a mistake. At the end of 10 minutes all stop. The pupils interchange papers, mark with a cross each wrong result, and count the number of correct results. A pupil's score is the number of right answers with 2 off for each one wrong. The row with the highest average wins. Each pupil who makes any mistakes corrects them at home or during the study hour. Practice with this and the following page until you can make a good score.

1. 15% of $1.50 = . . .
2. 12% of $2.15 = . . .
3. 20% of 80¢ = . . .
4. 4% of $300 = . . .
5. 3 1/2% of $16 = . . .
6. 1/2% of $400 = . . .
7. 105% of $90 = . . .
8. $14 = . . . % of $20.
9. 39 = . . . % of 70.
10. 56 = . . . % of 60.
11. 16 = . . . % of 25.
12. 5 = . . . % of 7.
13. 8 = . . . % of 9.
14. 16 = 20% of . . .
15. $30 = 4% of $ . . .
16. $75 = 5% of $ . . .
17. $5 = 10% of $ . . .
18. $12 = 6% of $ . . .
19. 6% of $2000 = . . .
20. 4 1/4% of $24.50 = . . .
21. 1 1/2% of $6000 = . . .
22. 76 = . . . % of 380.
23. 22% of 25 mi. = . . .
24. 4 = . . . % of 11
25. 1/2% of 600 = . . .
26. 3% of 16 mi. = . . .
27. 15% of 8 hr. = . . .
28. $25 = . . . % of $130.
29. $32 1/3 = . . . % of 40.
30. 15 = 75% of . . .
31. 2 1/2% of $450 = . . .
32. 3/4% of $760 = . . .
33. 45 = . . . % of 80.
34. 72 = . . . % of 80.
35. 140 = . . . % of 215.
36. 122% of $64.50 = . . .
37. 18 = . . . % of 40.
38. 1/8% of $1000 = . . .
39. 21 = . . . % of 40.
40. 21 = . . . % of 15.

Source: Edward L. Thorndike, *The Thorndike Arithmetics: Book Three* (Chicago: Rand McNally, 1924), 31.

dividual response, and then a move to another, unconnected question asked of another student. Most of the motivational and reward processes introduced by Thorndike are still in use, now incorporated into much more modern-sounding practices such as cooperative learning. Associationist theories, in other

words, have become the basis for the pedagogical standard operating procedures of schools. These are the familiar practices that teachers continue to use and that families and communities still recognize.

With associationist pedagogy comes a familiar theory of organization, one that treats teachers as semiskilled managers of practice programs largely designed by experts external to the schools; it neither calls for nor allows much intellectual engagement or autonomy of thought. The associationist classroom is also appealing to citizens who seek order and discipline in the classroom, so it is valued for reasons other than the learning it is able to produce. Thus, the pedagogical core and various aspects of institutional organization are closely linked in practice.

Core Theory of Aptitude

Accompanying associationist pedagogy at the instructional core of education is a theory, also inherited from the 1920s, about who can learn and what different groups of students need to learn. Building on then-dominant theories of inherited intelligence and social Darwinism, the preferred schools of the 1920s worked on the assumptions that aptitude is paramount in learning and that it is largely hereditary. They aimed to distinguish the naturally able from the less able and to provide each group of students with differentiated programs thought suitable to their talents.

Today, our schools still function largely as if we believed that the "bell curve" is a natural phenomenon that must necessarily be reproduced in all learning results, and that effort counts for little.[11] IQ tests or their surrogates are used to determine who has access to enriched programs for the gifted and talented, a curriculum that is denied to other students who are judged less capable. Most of our so-called achievement tests compare students with one another rather than against a standard of excellence, an approach that makes it difficult to see the results of learning and that actively discourages effort. (If one is going to stay at about the same relative percentile rank no matter how much one has learned, what is the point of trying?) Schools group students, sometimes within classrooms, and formally or

informally provide different curricula to the different groups. As a result, some students never get the chance to study a demanding curriculum with high expectations. College acceptance depends heavily on aptitude-like tests that have little to do with the curriculum studied. Like IQ tests, they are designed to spread students out on a scale rather than to define what one should work at learning. Remedial instruction takes place in "pullout classes," forcing students who need extra instruction to miss some of the regular learning opportunities. Finally, we expect teachers to grade on a curve in the belief that, if everyone gets an A or B, standards must be too low. We seldom assume that uniformly high grades mean everyone worked hard and succeeded in learning what was taught.

These commonplace features of the American educational landscape are institutionalized expressions of a persistent belief in the importance of inherited aptitude, and the larger system they are part of is a self-sustaining one. Hidden assumptions about aptitude are continually reinforced by the results of practices based on those assumptions. Students who are held to low expectations do not try to break through that barrier; they, like their teachers and parents, accept the judgment that inborn aptitude is what matters most and that they have not inherited enough of that capacity. Not surprisingly, their performance remains low. Children who have not been taught a demanding, challenging, *thinking curriculum* do poorly on tests of reasoning or problem solving, confirming many people's original suspicions that they lack the talent for high-level thinking.[12]

Countervailing Voices

Throughout the century there have been reform voices challenging associationist pedagogy and proposing alternatives. Some of the challengers' names are far better known today than is Thorndike's. As the historical research cited earlier documents, none has managed to influence education practice in the sustained and widespread way that associationism has. Nevertheless, as we consider today's reform prospects, it is important to know what has been proposed or tried in the past and to reflect on why these earlier efforts have largely disappeared from widespread use.

In the earliest years of the century, coterminous with the period of Thorndike's work, the Child Study Movement put forward a theory of education aimed at nurturing children's growth in accord with known patterns of child development. The Child Study psychologists had the most to say about preschool and early-childhood education, and that is where they had the greatest influence. Indeed, today's modal preschool program, with its predominant emphasis on social and emotional development and its organization into play stations punctuated with group activities such as story reading and music, derives largely from the ideas of the Child Study Movement. Ideas derived from the Child Study Movement are still current in the country's largest professional association of preschool and day-care educators, the National Association for the Education of Young Children. However, the Child Study ideas never took hold in the schools themselves, except in some kindergartens.

John Dewey is probably the best-known education theorist of the twentieth century. He offered a decidedly nonassociationist vision of both knowledge and pedagogy. Rooted in philosophical pragmatism, Dewey called for transforming schools into microcosms of society in which children could learn, in contextualized and practical form, both the knowledge and the forms of reasoning and social interaction that would make them good democratic citizens. Dewey's ideas were put into practice in a myriad of private or "lab" schools, many associated with progressive teacher-training institutions such as the University of Chicago and the Bank Street College of Education. In their best implementations, these schools engaged students in complex, extended projects that embodied substantial intellectual challenge. But most implementations fell considerably short of this ideal, and "progressive schools" became associated in the public eye with lack of discipline, excessive following of the child's interests, and an emphasis on the process of learning without due attention to its content. One can point to short periods and some places in which progressive practices gained a foothold in public schools; however, despite Dewey's writings being a staple of Foundations of Education

course reading lists everywhere, such practices never really spread.[13]

A third set of contrarian voices were those of Piaget and Bruner, both developmental psychologists who focused centrally on cognitive and intellectual development. Piaget's research on cognitive development, carried out in Geneva, created a complex and elaborate body of theory and knowledge about the presumably "natural" course of cognitive development, especially in the years up to age ten or eleven. Piaget emphasized the *constructive* nature of cognitive development; that is, children did not just absorb information given to them but instead used their developing logical structures and reasoning capacities to build coherent personal interpretations of phenomena, especially physical and mathematical relations. Many educators in America interpreted Piaget as proscribing direct instruction. They developed strategies for setting up classrooms in which a rich and carefully chosen body of physical materials would allow children to induce basic mathematical and scientific principles.

Orthodox Piagetians were reinforced in their anti-instructional stance by Piaget's rather virulent response to Bruner's efforts to use cognitive developmental research as a basis for a much more interventionist education.[14] Bruner's idea was to focus education on fundamental scientific and mathematical concepts in a way that could, he believed, speed up general cognitive development.[15] However, even Bruner's much more content-rich approach to instruction, which was linked to the National Science Foundation curricula of the late 1960s and 1970s, never gained a firm foothold in public schools. Coming up against decades of associationist instructional engineering that accommodated weak subject-matter knowledge on the part of teachers, the new science and math curricula were underengineered and did not provide adequate teacher training. Various forms of professional and political opposition drove them out of widespread use. Like Dewey, Piaget and Bruner are today required reading in teacher-education programs, but their ideas have only marginally penetrated the standard operating procedures of mainstream American schools.

WHAT IS THE NEW "CORE"?

The repeated failure of child-centered and antidisciplinary alternatives to the core associationist pedagogy laid down in the 1920s suggests that something new is needed if American schools are ever to break out of their aptitude-centered, drill-and-practice traditions and make it possible for the vast majority of our young people to acquire the kinds of competencies they need for productive and fulfilling lives in the information age. There exists today a new core of learning and social theory that carries within it the seeds of an educational vision that could help us break the associationist paradigm and supplant it with a sustainable alternative. We will briefly sketch this core theory here and then, in the final section of this essay, consider the kinds of institutional structures and practices we would need to make this core into the foundation of a new set of standard operating procedures for our schools.

Knowledge-based Constructivism: The New Learning Theory

Since about 1960, beginning with the publication of Newell and Simon's landmark studies of human problem solving,[16] a body of cognitive-science research has focused on the nature of the mental processes involved in thinking and learning. Hundreds of scholars have been involved, using varied methods and examining cognitive processes in people of all ages and social conditions. Despite the variety of approaches and the many theoretical differences among cognitive scientists, it is possible to outline a few important points of fundamental agreement that we can take as a new core theory of learning.[17]

Broadly speaking, cognitive science confirms Piaget's claim that people must *construct* their understanding; they do not simply register what the world shows or tells them, as a camera or a tape recorder does. To "know" something, indeed, even simply to memorize effectively, people build a mental representation that imposes order and coherence on experience and information. Learning is interpretive and inferential; it involves active processes of reasoning and a kind of "talking back" to the world—not just taking it as it comes. Competent learners engage, furthermore, in a great deal of self-management of

their cognitive processes, that is, in forms of cognition known as *metacognitive* and *self-monitoring*.

This much sounds like the child-centered, process theories of education. Early on, however, cognitive scientists found that they could not account for problem solving and learning without attending to what people already *knew*. Vast knowledge of possible positions in a chess game, they found—not a superior ability to "think ahead"—was what distinguished chess masters from merely good chess players. In every field of thought, cognitive scientists found that knowledge is essential to thinking and to acquiring new knowledge—in other words, to learning. So, for example, people who knew something about baseball learned much more new information by reading a story about baseball than did people who knew nothing at all about the game. Fourth graders could not make sense of or remember a textbook chapter about the Boston tea party if they did not already know something about the colonists' desire to have a say in the taxes imposed upon them.

These repeated findings about the centrality of knowledge in learning make perfect sense for a constructivist theory of learning, because one has to have something with which to construct. But they turn out to be almost as much of a challenge to Piagetian or Deweyan theories of pedagogy as to Thorndikean ones. This is because they insist that knowledge—*correct* knowledge—is essential at every point in learning. And they make it impossible to suggest seriously that education for the information age should not trouble itself with facts and information, but only with processes of learning and thinking. What we know now is that just as facts alone do not constitute true knowledge and thinking power, so thinking processes cannot proceed without something to think about. Knowledge is in again, but alongside thinking, indeed, intertwined with it, not instead of thinking. So although it is essential for children to have the experience of discovering and inventing, their experience must be one of disciplined invention—disciplined, that is, by knowledge and by established processes of reasoning and logic.

Knowledge-based constructivism, taken seriously, points to a position that can moderate the century-long polarity between passive drill pedagogies and child-centered discovery pedagogies.

We can see this particularly clearly in the case of the "reading wars." At this moment there is a battle going on in many parts of the country over how reading should be taught. States are adopting legislation or regulations that seek to control details of pedagogy. At issue is whether children should first be systematically taught the print-to-sound code (the "phonics approach") or be immersed initially in a rich environment of books and writing and allowed to induce the code over time (the "whole language" approach). In the minds of many politicians and much of the public, the two approaches are totally incompatible.

In the popular image, phonics teaching consists of Thorndike-like drills, with every sound-spelling pattern being taught and practiced. Spelling drills accompany the reading drills, and, when children write (which is rarely), all errors in spelling, punctuation, and other elements of usage are noted and contribute to lowered grades. In this "basics first" approach, attention to reading comprehension and composition skills is mostly delayed until children have mastered the code. In contrast, the popular image of whole language equates it with a radical, romantic, child-centered approach to teaching. Children are given lots of children's literature. No one tells them how the alphabetic principle works in writing; they must induce it from experience. They are encouraged to write often, but there is no discipline involved. Spelling errors are not just tolerated but welcomed because they bespeak creativity and allow children to express themselves without being bothered by rules and formalisms. The popular imagery, fostered by the way in which debates on reading are portrayed by the press, feeds a political version of this educational fight in which phonics is championed by social conservatives who value discipline and order in the schools and whole language is cast as the favorite of "soft" liberals.

These portrayals are both far from what knowledge-based constructivism would prescribe. Cognitive research on reading makes it very clear that phonemic encoding is essential to fluent reading (i.e., skilled readers make fluent use of the alphabetic code; they do not go directly from print to meaning) and that many children have trouble learning the code without direct

instruction in it. So some form of phonics instruction is called for. The research also strongly suggests, however, that if children are taught the principles of the code (how the speech stream can be parsed into separate sounds, or *phonemes*; how letters map to the phonemes), they do not have to be taught and drilled on every individual spelling pattern. Instead, after they learn some basic print-sound correspondences, they will puzzle out the rest, relying on inference and intelligent management of their own cognitive resources. The puzzling will, as all constructivist processes do, produce some errors in the early stages (such as phonetically regular spellings rather than conventional spellings), but these are expected to disappear quickly as more and more of the puzzle is solved. *Constructivist phonics* teaching, then, would not look much like the Thorndike drill books. Differences between advocates of language-based and code-based approaches to teaching reading turn out, within the constructivist-phonics view that some leading educators are now adopting, to be small. They amount to different proposals for how to organize practice so it enhances the puzzling process, not fundamental debates about whether or not the alphabetic code should be taught.[18]

What about the literature and language-comprehension aspects of reading? Cognitive study of comprehension and learning from texts shows that there are identifiable skills for actively comprehending a text. These involve inferencing, "unpacking," creating relationships—within the text, between texts, and between text and life experiences. They can involve emotional and intellectual reactions, a kind of arguing back and questioning the author that is sometimes called *accountable argumentation*.[19]

These skills are learnable, but they have to be taught systematically. At the same time, comprehension strategies cannot be taught in packaged, drill-like form. Instead, intelligent interaction with texts appears to be learnable by engaging in certain kinds of semistructured talk, including talking back and arguing accountably. This talk needs to be teacher-guided so that the analysis and arguing strategies are systematically learned and practiced. Thus, constructivist reading-comprehension instruction would be a far cry from both associationist drills and

the free-floating image of whole-language instruction that its detractors put forward.

Effort-based Learning: The New Aptitude Theory

The kinds of talk that seem to work in building reading comprehension capabilities (and also to teach effectively a deep understanding in other subjects as varied as math, science, and history) amount to learning how to engage in intelligent, accountable conversation. Indeed, knowledge-based constructivism seems to carry with it the implication that people can learn to be intelligent, that our 1920s theory of inherited aptitude that limits how much and what people can learn need no longer guide educational practice. What kind of theoretical and empirical basis exists for such optimism?

Over the decades, various students of intelligence have tried teaching whatever cognitive skills have been central in their theories—the skills that are directly tested on IQ tests, such as techniques for recognizing or generating analogies, Piagetian logical structures, and metacognitive strategies.[20] There was a repeated pattern in the results of these experiments. Most of the training experiments were successful in producing immediate gains in performance on the kinds of tasks taught. However, participants in the studies ceased using the cognitive techniques as soon as the specific conditions of training were removed. In other words, they became *capable* of performing the skill that was taught, but they acquired no general *habit* of using it or capacity to judge for themselves when it was useful. Subsequent interventions, more extended and ambitious than the laboratory training studies, have begun to show better results.[21]

The early failures to generate sustained rises in intellectual performances, along with the more promising recent results of interventions that immerse students in demanding long-term intellectual environments rather than teaching them specific isolated skills, suggest a new conceptualization of intelligence and its development. If we want to see a general ability to learn easily develop in students, we need a definition of intelligence that is as attentive to robust habits of mind as it is to the specifics of thinking processes or knowledge structures. There is a body of research dealing with the factors that seem to shape

these habits—factors that have much to do with people's beliefs about the relation between effort and ability. People differ markedly in these beliefs, and their beliefs are closely related to the amount and, above all, the kind of effort they exert in situations involving learning or problem solving.[22]

Most research on these differences has been carried out by social developmentalists interested in *achievement goal orientation.* Different kinds of achievement goals can affect not only how much effort people put into learning tasks but also the kinds of effort. Several classes of achievement goals have been associated with different conceptions of success and failure and different beliefs about the self, learning tasks, and task outcomes.[23] Two broad classes of goals have been identified: *performance-oriented* and *learning-oriented.* People with performance-oriented goals strive to obtain positive evaluations of their ability and to avoid giving evidence of inadequate ability relative to others. Performance goals are associated with a view of ability as an unchangeable, global entity that is displayed in task performance, revealing that the individual either has or lacks ability. This view of ability or aptitude has sometimes been termed an *entity theory of intelligence.* In contrast, people with learning-oriented goals generally strive to develop their ability with respect to particular tasks. Learning goals are associated with a view of aptitude as something that is mutable through effort and is developed by taking an active stance toward learning and mastery opportunities. Learning goals are associated with a view of ability as a repertoire of skills continuously expandable through one's efforts. Accordingly, this view of aptitude has been labeled an *incremental theory of intelligence.*

When people think of their intelligence as something that grows incrementally, they tend to invest energy to learn something new or to increase their understanding and mastery of tasks. But it is not just effort that distinguishes them from people who think of intelligence as an entity. Incremental thinkers are likely to apply self-regulatory, metacognitive skills when they encounter task difficulties, to focus on analyzing the task and trying to generate and execute alternative strategies. In general, they try to garner resources for problem solving wher-

ever they can: from their own store of cognitive learning strategies, and from others from whom they strategically seek help. In general, these individuals display continued high levels of task-related effort in response to difficulty. Thus, whereas performance goals place the greater effort necessary for mastering challenging tasks in conflict with the need to be regarded as already competent, learning goals lead to adaptive motivational patterns that can produce the sort of task engagement and commitment to learning that fosters high levels of achievement over time.

The achievement goals that individuals pursue also appear to influence the inferences they make about effort and ability. Performance goals are associated with the inference that effort and ability are negatively related in determining achievement outcomes; hence, great effort is taken as a sign of low ability. Learning goals, by contrast, are associated with the inference that effort and ability are positively related, so that greater effort creates and makes evident more ability.

Socializing Intelligence

This body of research on achievement goal orientation shows that beliefs about the nature of intelligence and learning and intelligent habits of mind are associated. It shows, furthermore, that there are individual differences in beliefs about the nature of intelligence and in associated practices. Where do these beliefs come from? How are the habits of mind acquired?

Persistent habits and deeply held beliefs about the self and human nature in general are not what one learns from direct teaching, and certainly not from typical school lessons. They are, instead, acquired through the processes that developmentalists usually call *socialization.* Socialization is the process by which children acquire the standards, values, and knowledge of their society. It is a process that begins as soon as a child is born and through which the individual is incorporated as a member of a community. By guiding, challenging, and arranging the environment and the tasks encountered within it, adults and knowledgeable individuals in the child's life contribute to the child's socialization.

Socialization proceeds not so much through formal instruction, although there are instances in which direct instruction or tutoring occurs. Rather it proceeds via social interaction, through observation and modeling, cooperative participation, and scaffolding. It depends, furthermore, on the negotiation of mutual expectations. We readily acknowledge the socialization process, its function and products, in informal, everyday, out-of-school settings such as the family. But with few exceptions, we often fail to recognize its role in intellectual functioning in more formally organized, distal sociocultural contexts such as schools.[24]

The appropriate pedagogical tools for socializing intelligence are the very ones that our theory of knowledge-based constructivism suggests for teaching reading comprehension, math and science concepts, and other subjects: accountable talk, grounded in knowledge. Children develop cognitive strategies and effort-based beliefs about intelligence—the habits of mind associated with higher-order learning—when they are continuously pressed to raise questions and accept challenges, to find solutions that are not immediately apparent, to explain concepts, justify their reasoning, and seek information. When we do not hold children accountable for this kind of intelligent behavior, they take it as a signal that we do not think they are smart, and they often come to accept this judgment. The paradox is that children become smart by being treated as if they already were intelligent. This is a hallmark of knowledge-based constructivist pedagogy.

ORGANIZING FOR KNOWLEDGE-BASED CONSTRUCTIVISM AND EFFORT-BASED EDUCATION

We have outlined a proposed new pedagogical core that holds out hope for escaping the revolt-and-backlash cycles of past education-reform efforts. Even this brief sketch of the pedagogical demands of knowledge-based constructivism makes it clear that a lot will be demanded of educators, much of which they are unprepared for by the associationist education they have themselves experienced. Therefore, if there is to be any chance at all of success for the proposals outlined here, a massive new effort at professional development will be needed—

for professionals already working as well as for teachers in preparation.

The logic of the new core—knowledge-based constructivism and effort-based learning—will create a new level of demand for instructional expertise throughout our schools. Students in effort-oriented school systems will have something that has been missing before: a right to expert instruction. Effort-oriented education promises to each student—regardless of the kind of measured ability he or she may show at the outset—as much instruction, of the highest quality, as he or she needs to meet a set of achievement standards that will not be compromised.

To honor every child's educational right to expert instruction, it will be necessary to create enhanced instructional expertise throughout the teaching force, so there is enough expertise to go around. Educators in knowledge-based constructivist schools will need a thorough familiarity with content and pedagogy, as well as an effort-oriented belief system, to take them beyond the associationist paradigm. They will need to know how to create classroom environments that motivate effort, socialize intelligent habits of mind, and foster talk that is accountable to established knowledge and accepted standards of reasoning. Because few teachers or principals have been prepared to function in an effort-oriented system grounded in knowledge-based constructivism—much less to be held accountable for the high levels of student achievement that are expected in such a system—they too will have a right to expert instruction. For educators, expert instruction should take the form of ongoing professional development driven by the same core learning and aptitude theories, as well as the same effort orientation, proposed as the new core for our schools.

To this end, it will be necessary to create *learning* organizations: organizations capable of improving their performance by creating new ways of working and developing the new capabilities needed for that work. The organizational context in which educators work deeply affects what happens in classrooms. Teachers and professional developers cannot go very far with an instructional idea unless the whole school is on a compatible course; practices that are consonant with the new

core become distorted or diluted when they are filtered through Thorndikean techniques. Schools also need a unified direction at the district level, because conflicting agendas will consistently pull them back to conventional practices. An education system that is a learning organization must treat the upgrading of instructional competencies as a key part of its definition of professionalism. It should be structured to inspire—and, when necessary, require—continuous learning on the part of everyone in the system, from teachers to senior administrators.

Such a system currently exists in New York City Community School District #2, a district with a high proportion of poor and non-English-speaking students that, under the leadership of superintendent Anthony Alvarado and deputy superintendent Elaine Fink, has organized itself to promote and sustain a continuous upgrading of teaching practice. Over the past ten years, the teaching quality in the district has improved substantially, and a variety of indicators show rising student achievement. District #2's organizational approach serves as the model for a particular form of learning organization that appears to be suited to the conditions of our large public-education systems; this concept is referred to as *nested learning communities.* District #2's success provides an existence proof that nested learning communities can produce the kind of instructional improvements called for by the proposed new pedagogical core. Variants of the District #2 model are currently being developed through the Institute for Learning, a national effort headquartered at the Learning Research and Development Center at the University of Pittsburgh, in partnership with a number of urban school districts that are attempting to create permanent professional-development systems consonant with the nested learning-communities concept.

In nested learning communities, not only students but also all education professionals are learners. Teachers, principals, and central-office administrators form communities of adult learners who are focused on improving their practice and becoming increasingly expert as conductors of learning communities in the classroom, the school, and the district. Schools become places where learning is the work of both students and professional educators and where continuous learning in pursuit of

educational improvement is the norm. Because children's learning depends heavily on how well adults learn how to teach them, every adult is responsible for his or her ongoing professional growth. Nested learning communities thus derive from the incremental theory of intelligence characteristic of a learning orientation to achievement goals; that is, they are built around the core belief that ability is learnable through effort and that an active, self-regulated approach to professional growth produces high levels of achievement over time. In short, nested learning communities are an expression at the professional level of the effort-based education idea proposed as part of the new pedagogical core.

This way of thinking necessitates a redefinition of the term *professional.* Traditionally, a professional is considered to be someone who has acquired a body of expertise that she or he then delivers or makes available to others. The size and substance of that body of expertise fixes the person's value as a professional. Although professionals in many fields are required to participate in a certain amount of continuing education in order to keep their licenses or certificates current, educators often perceive the admission that one is still learning to be an announcement of professional weakness. This understanding of professionalism suggests a performance-goal orientation and the associated view of ability as immutable. In the effort-based environment of nested learning communities, where ability is seen as an expandable repertoire of skills and habits, professionals are defined as individuals who are continually learning rather than as people who must already know. Their roles include both teacher and learner, master and apprentice, and these roles are continually shifting according to the context. For example, an individual may be a teacher of her students; a student of her classroom coach and other professional developers; an apprentice to master teachers in the district; and, on occasion, a mentor to her peers. When a professional is defined as someone who is continually learning, and learning is seen as a function of effort more than of aptitude, it is the willingness, initiative, persistence, and individual responsibility a person demonstrates toward the rigorous process of instructional improvement that defines his or her professional value.

The professional's workplace, the school, is redefined as a place where both students and professional educators participate in learning communities. It is an environment that fosters learning-oriented achievement goals and socializes robust habits of mind. In the reformed workplace of a nested learning community such as District #2, accountable talk and listening are the norm, and all voices are heard. Varied learning opportunities abound, enabling every adult to improve constantly his or her practice. The willingness to participate in professional-development activities and to seek continually new knowledge—the mark of the new professional—is encouraged and rewarded.

The purpose of nested learning communities is to enhance the knowledge base and instructional expertise of all education professionals—teachers, principals, and administrators alike—by making student learning the dominant focus of daily activities at every level. As a recent report on District #2 noted:

> When educators focus on learning—their own as well as their colleagues' and students'—they cannot remain isolated in classrooms or hierarchies. The intensely active, highly public process of learning for the sake of a systemwide goal takes place only through continuous and varied human interactions. Isolation gives way to dialogue, questioning, experimentation, evaluation, and demonstration. . . . People relate to each other *through* their learning, *as* learners, *so that* children can learn. A sense of community grows from everyone's interactions around learning and instruction.[25]

The primary community of learners for practicing teachers is other teachers, especially those in their own school. Because teachers share responsibility for the quality of the education that each student receives in their school, they have to work together to improve and coordinate their individual instructional practices in ways that raise the quality of student work. School-based learning communities can produce improvements in student achievement when they develop individual teaching capacity and when they facilitate a common learning culture in a school as a whole. Interactive classroom coaching, common meeting times during the school day, opportunities to visit other schools and classrooms where excellent instructional practices

are modeled, floating adjunct teachers who make such intervisitation possible, collegial conversations about instructional improvement and the quality of student work—these are some of the professional-development techniques and types of interaction that characterize a teachers' learning community like that of District #2. So are standards study groups, book talks, and participation in university course work. All are part of an integrated professional-development system—built around the new core of knowledge-based constructivism and effort-based education—that offers teachers regular opportunities for learning, troubleshooting, and voicing concerns.

While teachers find their primary community of learners among their peers, it is the interaction *between* role groups that constitutes the nesting feature of nested learning communities. Thus the orchestrator of the school-based learning community for teachers is the school principal. In this role, District #2 principals observe and evaluate classroom practice, arrange professional-development opportunities, work out improvement goals with teachers, and assess whether goals are being met. This means being able to identify both teaching practice and student work that meet the expected standards. By charge, the principal is responsible for the learning of the entire student body of a school. Indeed, current accountability models that lay out sanctions and rewards for schools based on student achievement operate on the assumption that a school is a unit capable of changing its communal practice under the leadership of its principal.

In nested learning communities, instruction, management, and professional development are joined in a single set of aspirations, and the principal plays a pivotal role in the instructional-improvement process. In District #2, "Through frequent, substantive contact with administrators, [principals] come to understand and help shape the vision that informs the district's work. They are then responsible for motivating teachers and holding them accountable in implementing the vision." At the same time, principals become amplifiers for the voices of teachers. "Because principals' frequent contact with faculty puts them in touch with their concerns and insights, they can incorporate these into policy and new strategies."[26]

The implicit contract in many schools leaves matters of instruction to teachers, with principals carrying out largely ritualized evaluation functions and seldom visiting classrooms except on special occasions. Thus, for most principals in districts moving toward the new core of knowledge-based constructivism and effort-based learning, there is a complex new role to be learned. Principals need to be students in their own district-wide learning communities, participating in study groups, university programs, and targeted learning activities; conferring regularly; visiting each other's schools; and routinely drawing on one another's expertise—as well as that of professional developers and senior administrators—to become more effective instructional leaders. When educators observe each other and allow themselves to be observed, they move back and forth between teacher and learner, developing their knowledge core and pedagogical intelligence in the process. Walking through a school where classroom doors are open and visitors are expected allows principals to learn about teaching and teach about learning.

Learning communities for principals are facilitated at the district level by superintendents and other district leaders. As the ones responsible for the teaching and learning in all of the area schools, these senior administrators set the district's instructional agenda and priorities through their decisions about programs, policies, personnel, and resource allocation. In District #2, "Central administrators . . . are accountable to everyone else in the system. They must communicate the district's vision in detail and through clear and equitable strategies. They must invite the insights of principals, staff developers, and teachers. They must orchestrate a plan for change. And they must make sure that all who are expected to put the plan into practice have everything they need in order to do so."[27] Superintendents work with individual principals to negotiate improvement goals, personnel decisions, and budget allocations for each school year and to enable the district-wide professional development and intervisitation opportunities that constitute the principals' learning community.

The process of "bilateral negotiation" of improvement goals—between teachers and principals, and between principals and

district administrators—represents a special form of two-way accountability that is an essential aspect of learning organizations.[28] Teachers are accountable to their principals for making real changes in their instructional practice and for effecting measurable learning gains in students; principals are accountable for delivering to teachers the professional-development resources they need in order to learn and improve and for insuring that external constraints do not hinder teachers' work. A similar understanding holds between principals and the superintendent and deputy: In order to develop workable plans for improvements in teaching and learning throughout their schools, principals should be in agreement with the senior administration on explicit goals and the standards by which the achievement of those goals will be assessed. Plans that come out of these bilateral negotiations are relatively short-term and sharply focused on specific instructional targets. Goals for school improvement integrate the particular needs of students and teachers with the collective ideals and assumptions of the district:

> The administrative team can know what is needed at the school level only by listening well, because no two schools will need the same things. All must seek the same outcome—the improvement of instruction and learning; but individual principals and teachers must discover how best to serve the variable needs of their own student populations under the conditions that prevail in their own schools and neighborhoods.[29]

Thus the concept of nested learning communities suggests a way of organizing that balances top-down and bottom-up influences and creates "a powerful 'middle-out' component, a sort of clearing house of substantive and strategic information processed through the role of the principal. This balance of energies and authority is meant to create a stable system in which the work of instruction can proceed and improve without serious misunderstandings."[30]

CONCLUSION

In typical American school districts today, instruction and learning are not the common currency of daily activity beyond the classroom. If senior administrators are to function effectively as conductors of nested learning communities—to define clear standards for what constitutes good teaching and build a professional-development system that prepares teachers and principals to meet those standards—they may need to join with their peers from other districts to form learning communities of their own. Working with each other as well as with their own administrative teams, school boards, and local union representatives, district leaders must sharpen their focus on instructional practice so that the day-to-day work of everyone in each district is about teaching and learning. They will need to deepen their knowledge of the core theories of learning and aptitude and find ways to break the century-long associationist paradigm. And they will be obliged to develop workable plans for institutionalizing the new core of knowledge-based constructivism and effort-based learning.

Several of the partner districts of the Institute for Learning have already begun this process, creating their own variations of the nested learning community model that has proven successful in New York. These efforts represent the first steps in taking the nested learning community concept to scale—the challenge that the Institute has set for itself in the coming years. The senior architect of the District #2 program, Anthony Alvarado, is now moving on to another of the Institute's partner districts, where he plans to implement a similar program. Deputy Elaine Fink, who designed the details of many District #2 practices, including how senior administrators work with school principals, is expected to stay on in New York, so District #2 should continue to thrive.

America's children are counting on the public-education system to prepare them to function effectively in our complex world. It is increasingly evident that the methods we have been using for the past seventy years no longer suffice and that the disappointing cycles of education reform must stop. There is an urgent need to change our standard operating procedures in

ways that reflect the new core theory of teaching and learning. Creating effort-based systems grounded in knowledge-based constructivism—systems that allow all students to reach high standards of achievement—will require significant changes in classroom practice, and implementing those changes will require equally significant changes in the ways that schools and districts function. By building learning organizations around this new core, we will be working toward education reform that is both radical and sustainable.

ENDNOTES

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Victoria J. Marsick

Transformative Learning from Experience in the Knowledge Era

"The future now belongs to societies that organize themselves for learning."
—Ray Marshall and Marc Tucker
Thinking for a Living[1]

ADULTS ARE FACING UNPRECEDENTED CHALLENGES in almost every sphere of life, and the consequences for learning are real and dramatic. They are stretched to learn continuously, and transformatively, in a world that demands higher-order thinking. In an earlier, more predictable era, people could more easily build on existing frames of reference, supported by their education, to understand and respond to changes. Today, adults need to transform deeply held frames of reference to make sense of their experience in ways better suited to increasingly complex demands.

Students, too, need to experience transformative learning to prepare for their future as adults. Thus, schools need to change fundamentally to provide this experience. Teachers play a pivotal role in these changes, and, as such, face a dual challenge as adult learners. They need to prepare students differently for new demands. And to do so, they must often transform their own ways of being and working, often within institutions they are helping to reinvent.

School-reform advocates argue that teachers can best meet these demands by learning together from their experiences as

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they face new challenges. But it cannot be assumed that teachers can do so without additional support. Their professional development must also be radically revised. Drawing on experience with organizations, I describe an emerging strategy—Action Learning—that offers insight into how this might be done.

BIRTH OF LIFELONG LEARNING . . . BUT ARE LEARNING MODELS ADEQUATE?

Today's demands on adults require a new model, that of lifelong learning. It is a model foreseen for the last quarter of a century by various policymakers and educators. But systems for lifelong learning are not new. According to Phil Candy, nineteenth-century England was a "fascinating social laboratory" of adult learning. "Newspapers began to proliferate; public libraries sprang up in towns and villages throughout the country; labor unions coalesced out of friendly societies; adult Sunday schools were established, especially by many nonconformist denominations; mechanics institutes and scientific and literary societies flourished; and universities made their first tentative forays into extramural and extension work."[2] A similar phenomenon took place in the United States, motivated by values that emphasized democracy and social progress. Learning opportunities abounded, although they were not typically labeled as education. Self-improvement was a dominant theme. In England, Samuel Smiles published a noteworthy book on *Self Help*; in the United States of that era, "*self culture* was the preferred term."[3]

At the end of the twentieth century many avenues are open to the adult who wants to pursue learning for credit or noncredit purposes. Adult education in business and industry has grown so large that a system of corporate colleges has emerged through which people are able to get the equivalent of industry-specific college degrees.[4] Unions have developed a parallel system to ensure that rank-and-file workers receive funds and opportunities for education.[5] Community colleges have proliferated. Institutions for postsecondary education of all kinds often have more adult learners on campus than young precareer

students. Specialized adult-learning fields have grown up around many needs: family life, health, English as a second language, religion, prisons and rehabilitation efforts, museums, senior-citizen and retirement needs, hobbies and recreational activities.[6]

Contemporary adult education in the United States grew out of early roots in community development, agricultural extension, libraries, and night schools. Because of the nature of America's "melting pot" of immigrants, adult education often focused on remedial and "second chance" courses: basic education, literacy education, the General Equivalency Diploma (G.E.D.), and citizenship education for immigrants. Today, by contrast, the decline of industrialized production and the increasing demands for professional services of high quality have resulted in significantly increased demands for intensive lifelong learning. While adult education and services have expanded, questions are being raised about the adequacy of the learning models on which they are based.

THE IMPACT OF THE KNOWLEDGE ERA

Technological change and globalization are the twin interactive forces that have fueled our jump into the "knowledge era," a mental landscape charted very early by authors like Peter Drucker and Alvin Toffler.[7] Within the short space of some twenty-five years, intelligent technology has revolutionized life and catalyzed dramatic changes in the way in which many individuals access and generate knowledge.

A look at new demands at work illustrates the world that young people are entering. One report forecasts that more than half the jobs created between 1984 and 2005 will require education beyond high school. Another suggests that from 1970 through 1990 alone, "the number of jobs requiring cognitive skills increased 11 percent; those requiring interpersonal skills increased 19 percent. The jobs requiring motor skills decreased 4.5 percent."[8] New jobs require greater ability to read technical information and to write reports. But according to a 1993 National Adult Literacy Survey, 90 million adults in the United States are unable to read and write to an adequate standard.

"Such adults would have trouble adding up checks on a bank deposit slip, making inferences from printed material, and writing compound sentences. Yet more than one-third of the 90 million were employed full-time."[9] Others report the strong relationship between education levels and wages; young people with less education are less likely to find work and are likely to earn less. In 1993, male college graduates might expect to earn 89 percent more than their counterparts with a high-school diploma, up from a 49 percent differential in 1979.[10]

The way people work has been radically transformed by technological advances. The need for computer literacy in managers and professionals rose 35 percent between 1990 and 1993, and it was a requirement in over 70 percent of all management positions.[11] Furthermore, computers have fundamentally altered the kind of thinking demanded of many. In interviews with workers and managers over several years in high-tech paper-making plants, bank and insurance offices, a telecommunications company, and a pharmaceutical company, Shoshana Zuboff identified the alternatives created by the widening use of technology. In contrast to "automating," which often results in the de-skilling and elimination of jobs, computers can be used to "informate," a word Zuboff coined to speak to the ability of technology to make underlying processes as visible as the data themselves. Informating demands higher levels of procedural reasoning, logic, and abstract thinking. Zuboff illustrates this with a quotation from one of the employees experiencing the transition: "Before computers, we didn't have to think as much, just react. . . . Now, the most important thing to learn is to think before you do something. . . . You have to know which variables are the most critical and therefore what to be most cautious about, what to spend time thinking about before you take action."[12]

The nature of the psychological job contract has changed in significant ways. Few people work for many years in the same organization; many are part-time, temporary, or contract workers. Jobs in the industrialized world require the development and application of knowledge work. A small number of very highly paid workers are avidly sought; routine and unskilled work is shifting to parts of the world where wages are lower.

Life in many institutions is very different from what it was when work tended to be more routine and predictable. In the past, people higher up in the hierarchy took greater responsibility for understanding and laying out the work that others below carried out without much questioning. Most people were not expected to think in very complex ways; they were expected to follow orders and rules. Tasks were clearly defined and often carried out without much interaction across boundaries. Today, work is performed through virtual connections around the globe and around the clock. Hierarchies have been flattened, placing greater responsibility in the hands of employees closest to the task. Frontline workers often participate more fully in decision making and problem solving. The nature of work often requires employees to work in teams; in the past, industrial culture rewarded individual effort. Today, teams require new capabilities in collaboration and conflict resolution.

The need to think in more complex ways extends far beyond the workplace; there is the need to make choices about a child's education, to take on greater levels of responsibility for understanding one's own health needs in the face of the HMO's emphasis on the bottom line, to analyze political choices, to deal with fundamental differences in a highly diverse society, and to sift through competing choices as a consumer. Many decisions, if not made well, can have serious impact on one's life. Choices related to health care, schooling, or career preferences may demand considerable independent research and multiple consultations with specialists or experts.

NEW WAYS OF LEARNING

Graduates of school systems may be able to pass examinations, but it is not at all obvious that they have strong skills in "learning to learn" in the new knowledge era. Test taking may emphasize the recitation of facts more than the ability to think. Yet it is just this need to think and learn that many institutions now demand of their adult workers.

Learning in the past was suited to a more predictable era, which involved memorization and the practice of what experts had discovered. By contrast, intelligence and invention—once a

prerequisite only for highly educated professionals—are today often demanded from all employees in many workplaces. Even the simplest job may require fairly complex judgments. Work is mediated by abstract data that has to be visualized in concrete operations, manipulated by the use of logic and mathematics. Few supervisors are available to provide detailed direction, to recognize the linkages between one task and the entire system. Employees are expected to see how their job contributes to attracting and keeping customers, saving lives, or creating a better product. A person on the shop floor often interprets highly technical instructions, uses college-level mathematics, fixes computer glitches, and participates in self-directed work teams. An accountant, clerical worker, engineer, or computer technician needs to see the impact his decisions will have on the work flow and the end result. Customer-service representatives need to identify and report on shifting market demands. Employees and managers need to know more about industry trends in order to shape their choices to make them align with the company's strategic vision.

Adults frequently seek formal education to reshape their careers, to meet new demands arising from health care or parenting. Learning is self-directed. Adults cannot look passively to others to take the lead for their learning; they are obliged to learn from their own experience. And learning is today available through an increasingly broad array of choices, many of which come via cyberspace.

But more information may be confusing if individuals are unable to make sense of, and master, this information. Emphasis in the past was on "paradigmatic" knowledge that might be characterized as "analytic, general, abstract, impersonal, and decontextualized." Scholars today affirm that much knowing depends on situated cognition and is more often understood as "narrative," that is, "specific, local, personal, and contextualized." People actively construct their realities. They do so in real time as they make sense of the new situations they encounter.[13] Men and women are expected to learn from their experience, but what sense can they make of this bewildering array of new information?

CHANGING FUNDAMENTAL VIEWS OF THE WORLD

Individuals use existing knowledge to interpret new experiences. Given the gap between today's challenges and yesterday's lessons, it is easy to see how people may misinterpret their experience, using an inappropriate or distorted lens. Also, it is difficult to change fundamental views even when they are outmoded. To do so requires digging below the surface, an analysis of taken-for-granted meanings that are assumed to be true. When learning from experience, adults benefit greatly if they are able to engage in this deeper level of critical reflection, but many factors make this type of learning difficult.

Jack Mezirow's work on transformative learning provides a window into how to change fundamental views. His thinking grew out of a study in the 1970s of women who had returned to higher education after raising their families, and who came to reassess societal views of women that they had internalized and accepted uncritically.[14] Mezirow's theory revolves around the realization that adults filter all of their experience through "frames of reference that define their life world." These "structures of assumptions . . . selectively shape and delimit expectations, perceptions, cognition, and feelings . . . [and] set our 'line of action.'"[15] Frames of reference are broad, comprehensive "habits of mind" that show up in different situations as specific "points of view" that shape interpretation of a specific event. Habits of mind and points of view can be psychological, political, social, cultural, economic, or epistemological.

Uncovering strongly held assumptions, beliefs, and values that shape action may be difficult and painful, but also powerfully catalytic. People able to see how their actions are shaped by their views—leading often to unwanted results, often wholly contradictory to their intentions—learn from that experience. While it is not always easy for people to change their beliefs or actions, the first step is to recognize their existence. Mezirow believes that all adults can see and challenge their own assumptions, given the opportunity and appropriate educational assistance, but research on adult development suggests that many adults cannot easily step outside their worldview.

"IN OVER THEIR HEADS"?

Developmental theory, while not without its critics, helps us understand that the challenge of educational systems, and of learning more generally, goes far deeper than simply providing information through new delivery systems. These theories suggest that as adults mature, they can develop the capacity to see the world more contextually and critically, though they do not always do so.

Transformation is not simply the adoption of techniques or styles of thinking. Developmental psychologists hold that adolescents and adults pass through stages characterized by a dominant way of understanding and relating to situations they encounter, no matter what the nature of the situation. Stages are deep organizing templates for experience, influencing what individuals actually take in through the senses and how they interpret the selected data. This dominant way of viewing the world shows up in a person's thinking, the ways in which a situation is interpreted. Changing this perspective requires much more than altering a particular view.

Stages generally progress toward increasingly complex ways of thinking and acting in the world. Although theorists differ in significant ways, they generally agree on what greater capacity means. People become increasingly autonomous and independent over time. Although they are able to empathize with others and develop close relationships, they are also in a position to separate their feelings and opinions from those of others. They do not take on the views of others uncritically. They set goals for themselves that contribute to their self-defined progress, and they are able to see how their actions impact on the systems in which they work and live. They balance and choose among conflicting priorities and may, at some point, transcend local self-interest. They acknowledge their role in co-constructing the reality in which they find themselves.[16]

Robert Kegan, whose theory focuses on cognitive complexity, argues that the mental demands of modern life leave many adults feeling overwhelmed. Kegan, reviewing the literature on changing work relationships, concludes that people often find it difficult to act as they are expected to do. He contrasts the

more "modern" mind-set that often underlies expectations of employees today with the mind-set they often bring:

1. *To invent or own our work* (rather than see it as owned and created by the employer).

2. *To be self-initiating, self-correcting, self-evaluating* (rather than dependent on others to frame the problems, initiate adjustments, or determine whether things are going acceptably well).

3. *To be guided by our own visions at work* (rather than be without a vision or be captive of the authority's agenda).

4. *To take responsibility for what happens to us at work externally and internally* (rather than see our present internal circumstances and future external possibilities as caused by someone else).

5. *To be accomplished masters of our particular work roles, jobs, or careers* (rather than have an apprenticing or imitating relationship to what we do).

6. *To conceive of the organization from the "outside in" as a whole; to see our relation to the whole; to see the relation of the parts to the whole* (rather than see the rest of the organization and its parts only from the perspective of our own part, from the "inside out").[17]

A person able to think as described by these italicized phrases is more likely to handle effectively many of the complex challenges of modern life. Such an individual has a sufficient level of autonomy to think through goals, to see the system within which various forces interact, to be able to trace causes and effects, and to see the underlying assumptions that influence actions. Adults with higher-order capacity can take their subjective stands as an object of reflection, and thus avoid becoming enmeshed in a point of view that leaves them blind to alternative, more encompassing viewpoints. They ask deeper questions about the way they come to see things.

The knowledge era has raised the threshold of demand for complexity in understanding and relating to one's world. Adults are increasingly pushed to challenge their own thinking, to eschew order for invention, and to think differently about their own experiences. Teachers need to effect these changes in their

own lives as adults, and need to prepare young people for the demands on learning that such changes require.

IMPLICATIONS FOR EDUCATIONAL REFORM

Empirical analyses of the new workplace are underway in order to glean clearer insights into the adult world that young people are likely to face.[18] Given the rapid rate of change in so many facets of society, even with such analysis it may be difficult to envision fully the shape of organizations and social institutions in which young people will live and work. The analysis in this essay, however, suggests that many more adults experience organizations that have become flatter, networked, and decentralized. Technology will continue to bring people together across distances, enabling them to share information and create knowledge without ever seeing one another face-to-face. Employees today are being invited to take on more initiative at work, although there are still limits to the sharing of power. They are being asked to work more collaboratively across boundaries; and they are rewarded more, at least in principle, for their intelligent contributions than for their physical labor.

Today's schools were designed to create good citizens in an industrial era dominated by physical capabilities and by bureaucratic, command-and-control organizations. Schools are now socializing young people for a workplace that no longer exists, a practice that society should vigorously question so that new forms of work and organization can more easily evolve. The challenge is great. Schools are highly developed systems that have been created over many years to support efficiency in the current way of doing things. Entrenched systems resist change; they mold individuals to habitual ways of doing things without their being consciously aware that this is happening. Individuals cannot act alone to change these systems without being ostracized. Reinventing schools demands that many stakeholders—teachers, administrators, parents, and children—rethink their mental models, acting in concert to redesign learning.

While certain goals can be attained by fine tuning, this is not the case in education; designs from the past will only recreate

and reward outmoded thinking. One clear lesson from looking at today's workplace is the need to enable young people to act independently and autonomously, yet with some awareness of how their actions can affect entire systems and have long-term, interactive consequences. To do this, young people need a safe laboratory, one that is sufficiently "messy," interactive, and evocative of real-world experience.

Real-world challenges should be brought into the classroom as the starting points for learning, around which course content can be integrated. Problem-based learning, for example, begins with a multidisciplinary, complex challenge. Instruction is designed around unpacking it.[19] Working in teams to address the problem, students look for knowledge from many potentially useful fields for its solution. They are able more easily to see the relevance of knowledge, and may be more motivated to delve deeply into what might otherwise seem abstract. Members of the team may receive individualized coaching, as needed, and ought to be able to draw on interactive technology.[20] Problem-based learning suggests alternate designs for curriculum, for progressing through school outside the graded movement of age-based cohorts.

Work-based learning, which has been somewhat accelerated in the United States by the School-to-Work Opportunities Act, involves some secondary-school students in real-world challenges through apprenticeships. So, too, do service learning opportunities through which young people become involved in volunteer community work. Such experiments today involve very small proportions of the school population. Parents fear that children who engage in this kind of learning will be disadvantaged when applying to college. Somewhat surprisingly, research has not yet demonstrated that students learn more through such experiments.[21] Since schools are not designed to allow for and take advantage of learning from experience, teachers may not have the models and skills to enable them to draw out lessons learned or to evaluate outcomes. Colleges do not assess or reward the fruits of such knowledge. Questions such as these need to be addressed, given my observation that adults learn more effectively from their work.

Students might be given greater responsibility in setting their own learning goals, in making choices about how they reach them at earlier ages. They can be helped to think critically about those choices. Yet there is a limit to how much autonomy young people can assume if we believe studies on their cognitive and emotional development. Still, teachers can support students at their current levels of development and simultaneously challenge them so that they build the capacity to set and achieve their own specific goals.

It is easy to romanticize the workplace, which is often a limiting environment in which adults are unnecessarily constrained.[22] If new forms of organization open up greater opportunities and possibilities for learning, workplaces are still governed, fundamentally, by power relationships and negotiated contracts that contribute to the owners' bottom line. There are dangers and risks inherent in organizations where it is difficult to challenge people in power. That is why schools need to play a greater role in legitimizing criticism in helping young adults to examine the assumptions they recognize in their environment, in the way work is organized. By reason of their age and social status, young people are typically socialized into accepting the norms of their elders, thereby perpetuating and passing on accepted social rules for success. It may be difficult to question assumptions central to an emerging identity. But by paying attention to how one thinks and not merely what one is supposed to think, teachers can help students be more conscious of their assumptions and the consequences of their beliefs. Teachers can engage young people in a dialogue about work and society that may build healthy cognitive and emotional development, honing skills that foster critical thinking and transformative learning. This is the challenge for educators confronting an exponentially more complex world.

CONTINUING EDUCATION FOR TEACHERS THROUGH ACTION LEARNING

How can teachers, who are also adult learners, be helped to effect all these changes? A centerpiece of reform recommendations is that teachers learn from their experience while solving

specific problems. Such learning does not come naturally for many people. Teachers, and the institutions they serve, need to develop their capability in learning how to learn.[23]

Many educators are familiar with various forms of Action Research, in which teachers join together to conduct research on their practice.[24] A parallel movement has mushroomed in nonschool settings. A common form that holds promise for the professional development of teachers is Action Learning, where people come together as peers to solve problems and, at the same time, to use the experience as a laboratory for learning.[25] Reg Revans, often called the "father" of Action Learning, based his thinking on his own early professional development as a physicist. He noticed that his colleagues learned best when they collaboratively investigated difficult problems that stubbornly resisted solution. Because there were no easy answers, they asked questions to generate fresh insights into their formulation of the situation. When Revans took charge of management development in the coal mines during World War II, he translated these principles into a design for learning from experience.

Action Learning resembles Action Research, but its practitioners focus less on research than on achieving personal and organizational development. In both Action Learning and Action Research, individuals spend a good deal of time helping one another think in new ways about the problem at hand, identifying hunches, taking action to test them, continually seeking feedback and examining consequences, both intended and unintended. In Action Learning, however, members more consciously reflect on what and how they are learning about the problem, their work in the group, the system in which the problem is embedded, and about themselves as learners. Groups find that they learn best when they are composed not of experts but of individuals with diverse backgrounds whose naïveté allows them to think differently about the situation at hand.

There is no uniform way in which to engage in Action Learning, but over time several patterns have developed.[26] Two models are typically used in organizations in the United States. The first, closer to that proposed initially by Revans, involves a group of peers who come together over a period of time to

think through and address their respective individual challenges. The second involves a group that works together as a team on a single common challenge that is often systemic in nature. To enhance development, an Action Learning challenge should not have a known solution or be easily solvable. Challenges are typically difficult issues over which reasonable people are likely to disagree.

The first model focuses more on individual learning; the second model is often used for team building and/or organizational change. The models differ in design, primarily because the project focuses either on individual or group challenges. In both models, people learn by paying conscious attention to what happens. Depth and degree of learning often vary with the skill of members and their ability to bring difficult issues to the surface. Learning is driven by the group's agenda and timing. Individuals are helped to avoid giving advice and instead ask questions that uncover personal beliefs that influence action. They raise alternative viewpoints and identify implications that others might have difficulty in seeing.

Action Learning, like Action Research, can drive change in the system's culture and practices, which is needed if school reform is to have any chance of success. Often members of Action Learning groups find that problems reside in the system itself, which they need to learn how to change. This awareness can help lift the "blame and shame" that often accompany difficulties. As a group works on a problem, it becomes clear when policies, practices, structure, rewards, or metrics are blocking resolution. The group needs to learn how to bring these factors to light with the right people in the system. Members may well need to master the politics of change. Issues are typically deeply embedded in long-held, seldom-questioned beliefs and practices. Heated discussions often take place about norms or assumptions about people, practices, and institutions. Action Learning allows the conflicts within the system to surface, and it works best when it is supported from the top and recognized as a vehicle for change.

While teachers need to be competent in their subject, knowledge is something more than raw data or facts. The choices that teachers make about which facts to emphasize are fundamen-

tally intertwined with the ways teachers think about these facts and with the ways in which they help their students to assemble and interpret them. Students commonly work within a knowledge domain that has first been circumscribed and interpreted for them by teachers. As teachers learn from their own experience in teaching, they gain insight into what students may need to know so that they can make best use of this information. This is where Action Learning can be especially relevant.

To model and enable the transformative learning necessary for the world that today's students will encounter, teachers have to undergo such learning themselves. Teachers must step outside of the usual ways in which they think and act, which can be disquieting because it often requires letting go of familiar viewpoints acquired long ago. Professional development that supports transformative learning has to challenge teachers to examine deeply held beliefs and assumptions, while it simultaneously provides support so that they can manage feelings of incompetence and vulnerability.

ACKNOWLEDGMENTS

The author is grateful to Tom Bailey, Constance Barsky, John Broughton, Gary Griffin, Joann Jacullo Noto, Jack Mezirow, Peter Neaman, Karen Watkins, and Ken Wilson for their reading and constructive comments on various versions of this essay.

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[17]Robert Kegan, *In Over Our Heads: The Mental Demands of Modern Life* (Cambridge, Mass.: Harvard University Press, 1994), 152–153; italics in the original.

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[19]Problem-based learning has been pioneered by the medical schools at Case Western Reserve University in the 1950s and McMaster University in Canada in the 1960s. See David Boud and Graham Feletti, eds., *The Challenge of Problem-Based Learning* (London: Kogan Page Limited, 1985).

[20]Goal-based scenarios build people's experience in real-life situations into simulated computer-learning tools. See Roger C. Schank, *Tell Me a Story: A New Look at Real and Artificial Memory* (New York: Charles Scribner's Sons, 1990); and Roger Schank, *Virtual Learning: A Revolutionary Approach to Building a Highly Skilled Workforce* (New York: McGraw-Hill, 1997).

[21]For a review of research, see David Stern, "The Continuing Promise of Work-Based Learning," *CenterFocus* (18) (November 1997). See also Thomas Bailey and Donna Merritt, "School-to-Work for the College Bound," *IEE Brief* (15) (May 1997).

[22]See, for example, Larry Hirschhorn, *The Workplace Within: Psychodynamics of Organizational Life* (Cambridge, Mass.: MIT Press, 1990); and Michael Welton, *Toward Development Work: The Workplace as a Learning Environment* (Geelong, Victoria: Deakin University Press, 1991).

[23]Some restructuring projects incorporate support for the deep learning that teachers undertake when they learn from real-life challenges. See Ann Lieberman, ed., *The Work of Restructuring Schools: Building from the Ground Up* (New York: Teachers College Press, 1995). Professional development schools, for example, have created seminars that prepare teachers to facilitate change, and they provide technical support.

[24]These approaches, which include Action Research, Action Science, Action Learning, Collaborative Inquiry, and Action Inquiry, are discussed in Ann Brooks and Karen E. Watkins, eds., *The Emerging Power of Action Inquiry Technologies: New Directions for Adult and Continuing Education*, no. 63 (San Francisco: Jossey-Bass, 1994) and in a special forthcoming issue of *Management Learning* being guest edited by Joseph Raelin. On Action Research, see Herbert Alrichter, Peter Posch, and Bridget Somekh, *Teachers Investigate Their Work: An Introduction to the Methods of Action Research* (London and New York: Routledge, 1993); Peter Holly, "Action Research: The Missing Link in the Creation of Schools as Centers of Inquiry," in *Staff Development for Education in the 90s: New Demands, New Realities, New Perspectives*, 2d ed., ed. Ann Lieberman and Lynne Miller (New York: Teachers College, 1991), 133–157; and Donald Schön, ed., *The Reflective Turn: Case Studies in and on Educational Practice* (New York: Teachers College Press, 1991).

[25]For more on Action Learning, see, for example, Alan Mumford, ed., *Action Learning at Work* (Aldershot, U.K.: Gower, 1997); Mike Pedler, ed., *Action Learning in Practice*, 3d ed. (Aldershot, U.K.: Gower, 1997); Reg Revans, *The Origins and Growth of Action Learning* (Bickly, Kent: Chartwell-Bratt, 1982); and Krystyna Weinstein, *Action Learning: A Journey in Discovery and Development* (London: HarperCollins Publishers, 1995).

[26]Judy O'Neil and I review these different models in "The Many Faces of Action Learning," *Management Learning* (forthcoming). A highly popular model in the United States was launched by General Electric; see David L. Dotlich and James L. Noel, *Action Learning: How the World's Top Companies Are Re-Creating their Leaders and Themselves* (San Francisco: Jossey-Bass, 1998).

[27]Linda Darling-Hammond, "Policy for Restructuring," in *The Work of Restructuring Schools*, ed. Lieberman, 171.

Daniel M. Fox and John M. Ludden

Living but Not Dying by the Market: Recent Changes in Health Care

THE HEALTH-CARE INDUSTRY, long dominated by its suppliers, has changed in the past decade as a result of demand exerted by business and government purchasers. Because of this demand, health-care markets have become more competitive, enabling purchasers, insurers, and investors to benefit from gains in efficiency and productivity. Many physicians' groups now share risks and rewards with the health plans and managed-care organizations that evolved from or are replacing insurance companies and other "third party" payers. Health-care costs as a percentage of the gross national product (GNP) were stable from 1992 to 1997, partly as a result of competition in health-insurance markets.

Increased competition also inflicts pain, as it has in other industries. Health plans and physicians' groups regularly lobby for government regulation that will insulate them from market risk and against proposed legislation that would make them more accountable to consumers. Purchasers want advantageous prices without sacrificing stable contracting arrangements and the goodwill of the employees, senior citizens, or Medicaid beneficiaries for whose health care they contract. Health plans press providers for discounts and greater productivity but continue to demand that they perform at high levels of quality. Health professionals negotiate for higher compensation and increased autonomy while insisting that they remain committed to an ethics of service. Consumers seek coverage at

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favorable rates and say they understand its limitations, but when they are patients they frequently refuse to accept less than the most extensive treatment available.

This essay explores the causes and some of the consequences of these events. Competitive markets in health care have emerged for compelling reasons. These markets have modified but not diminished the effects of two persisting metaphors. The first is the quest for "magic bullets"—advances in science that become the basis for new interventions. The second is a vision of empathic relations between physicians (and other health professionals) and patients, a metaphor that borrows idealized imagery of empathy from friendship and family relationships. A new metaphor, of a web or network connecting each part of the health industry, is evolving alongside the others. Hence our title: the market in health care is a partial solution to extraordinarily complicated problems.

This discussion of health care is meant to provide a comparative context for considering contemporary issues in K–12 education. A reading of the other essays in this issue and subsequent exchanges with other authors sustained our opinion that the history and current politics of K–12 education and health care in the United States are quite different. One goal of this essay, therefore, will be to note those areas where similarities seem relevant and where differences seem particularly illuminating.

AMBIVALENCE AND NOSTALGIA IN CONTEMPORARY HEALTH CARE

Not until the past decade did most Americans associate health care with markets; indeed, the financing and delivery systems for health care were separate and distinct. The delivery system developed goals and procedures in easily rationalized isolation from the marketplace. Physicians, other health professionals, and managers based these goals and procedures on concepts of sickness, health, suffering, and science. Physicians usually defined their assets as scientific and medical knowledge, intellectual understanding, and effective empathy. They understood that these assets were limited in amount and uncertain in effect. But only recently has their awareness of limited resources come to include limited financial resources.

The rise of health maintenance organizations (HMOs) and managed care has been an important cause of this new awareness. These delivery organizations were devised to provide prepaid health care to enrolled populations and to remove business pressure from practicing physicians. They recruited physicians by appealing to their desire to avoid the distractions of managing an office. The HMOs of the 1970s were group practices that sought to limit care to what was rationally necessary, adopting principles of "clinical parsimony" as a valued ideal. HMOs had lower costs as an incidental result of that clinical parsimony. Because HMOs linked financing and care delivery, however, their existence and growth set the stage for conflict as financial resources became limited.

Unlike Germany, the United Kingdom, and most other industrial countries, the United States does not accord high priority to the value of social solidarity in distributing health services. In the United States the "uninsured" do not have a social sponsor for their health care. They receive care only in unusual, unsponsored situations—typically personal and public health emergencies. Self-sponsorship is unaffordable for most of the uninsured.

For sponsored (that is, insured) persons in the United States, the clinical context of health services is determined by what their insurance covers. Health plans and physicians act as if insurance concepts (such as coverage and exclusion) are congruent with medical concepts (such as indicated, appropriate, and necessary). An insurance question about whether a patient is covered for a particular procedure or drug is often also a clinical question about whether or not that maneuver will be performed. For example, "Is the use of Simvastatin (trade name Zocor) covered for treating high cholesterol?" The answer might be that it is not covered because it has not been proven to be more efficacious than an alternative agent for the condition from which this patient suffers. Or the answer might be that it is covered because it offers the best opportunity for an effective intervention. Whatever the answer, the patient will be treated as if the insurance coverage determined the content of the treatment. Because insurance "benefits" drive the content of care, the financing and delivery functions have been so thoroughly elided that they are now almost synonymous.

Many people look back to an alleged golden age of American health care. Nostalgia for a time when health care was privileged among American public, corporate, and personal expenditures often merges, in current conversations, with a yearning for a retouched past in which physicians, receiving fees for their services, maximized the interests of each patient—and hospital staff, the beneficiaries of generous cost-plus financing, eagerly carried out physicians' orders. People did complain about their health care, or lack of access to it, in the decades between World War II and the 1990s. But these complaints seemed no more than a transitional problem for an industry that was growing from around 5 percent to 15 percent of the nation's economy. Before government and business purchasers became intolerant of rising costs, health care based on science developed in virtual isolation from financial limitations, concerned only with the limits imposed by biology, psychology, and the speed of the advancement of knowledge. Thus the providers (physicians, hospitals, and the like) set the terms, conditions, objectives, and resources for health care at the beginning of the current change period. While this control has eroded, it was a critical starting position. It is not clear that there has been any similarly comprehensive control of conditions, objectives, and resources in K–12 education by the equivalent of providers.

Without any reason to sense a financial limit, the cost-plus, fee-for-service delivery and financing systems expanded the number of legitimate interventions for diagnosing and treating disease. Well-defined analytical processes established the legitimacy of each intervention. For example, the federal Food and Drug Administration determined the safety and efficacy of a new drug, or a peer-reviewed research study established the relative desirability of a new test, drug, or surgical procedure. This system of piecemeal development did not take into account the differences in value among interventions that gain legitimacy; nor was the worth of each intervention evaluated relative to that of others. Legitimacy implies coverage. In the American context of shared belief in the efficacy of science and its applications as a means for achieving continued progress, use was restrained by neither intellectual nor cost limitations. Medical science produced a continuous flow of interventions, each scientifically legitimate and therefore reimbursable.

The sustained power of science's metaphorical domain made, and still makes, this history important to physicians and patients. For the public seeking care, the world is often condensed to the search for a "magic bullet"; for every disease or condition there should be an effective cure. Moreover, the best of these interventions will take effect at or near the beginning of the causal chain that produces pathology. For example, research on HIV/AIDS and media reports of its results exemplifies the continuing public expectation that a magic bullet, or collection of them, will make the world the way it once was for patients. The prevailing research model favors the development of a small set of discrete, definable interventions. Research protocols use sample populations that are as uncomplicated as possible so that the answers will be clear.

Moreover, the magic in the bullets can lead investigators to profit on the bottom line, fueling the procession of research from academic hospitals to pharmaceutical companies. The development of a single drug like fluoxetine (trade name Prozac) can produce enough profit to secure the earnings of a company like Eli Lilly for the length of its patent and beyond. The development of each bullet presents a new opportunity and is additive. A new bullet persuades the public that medical truth changes rapidly, although most of them do not replace anything. Recent examples include interventions to reduce cholesterol, herbal antidepressants, and bone-marrow transplantation to treat breast cancer.

Another metaphorical domain has been important in health care during this century, existing alongside the metaphors of science. This domain involves caring, nurturing, and healing. Caring entails careful listening, objective questioning, precise attention to detail, and the exercise of empathy. Delivering care means an emphasis on continuity, the understanding of cultural context and of the dimensions and power of the relationship so that caring could be emphasized for both the cure and the comfort of patients.

Such care is most obvious and important when the patient is sick. Most practicing physicians trained in hospitals where the physician's personal experience of caring could be very intense. But the dramatic personal intensity of the caring process has diminished as the scope of health services changes to include

more emphasis on both the prevention and early detection of disease and on the long-term management of chronic conditions. At the same time, most training still occurs in hospitals, where the patients are often desperately ill and where the average length of stay has been declining for more than a decade. As a result, the intensity of caregiving has been separated from the relationship between a physician and a particular patient. Unlike Marcus Welby, M.D., the medical hero of 1970s television, the physicians and nurses of *ER* (Welby's 1990s counterparts) did not know their patients yesterday and will not know them tomorrow. The metaphor of the caring physician has survived only as the rapid application of skill and science.

When consumers complain about limitations and disappointments from managed care they are complaining about more than competitive markets. They are worrying about their access to new and effective interventions, and they are concerned about the withdrawal of caring relationships. Nevertheless, most consumers still tell survey researchers that they are satisfied with their care. But consumers' current satisfaction could be temporary, given the rapid changes in the organization of the health-care industry. These changes are largely the result of competitive pressures. Few major market areas have the same array of competing health plans that existed even three years ago. No managed-care organization has the same policies for referral to specialists, prior approval of treatment or hospitalization, and redress of grievances that it had at the beginning of the decade. There is no consistent national direction to these changes.

Medical science for many years attracted media attention by waging war on various diseases, devoting its efforts to expanding knowledge, and introducing new and often overlapping technologies without regard to steadily aggregating costs. The limited success of the wars on cancer and diabetes undercut the metaphor of war. The new metaphor of the "management" of chronic illness, with its connotations of distance, process, and the bottom line, has yet to stimulate excitement in the media and among consumers, partly because it has not been translated into meaningful personal stories. The media sometimes told a contrary story, even before the 1990s. From the late 1950s until the passage of Medicare and Medicaid in 1965,

news media called attention to retirees and poor people forced to seek charity care. Over the next quarter century, many journalists described the suffering of those without health insurance and, with increasing frequency, fraud and abuse by nursing-home and hospital owners, and even by some physicians, who took advantage of generous reimbursement under policies that privileged professional and institutional autonomy.

In the 1990s, widespread concern about diminished caring and the withholding of effective treatment provides the context for stories that appear more often in the business section than in the news pages of the daily and weekly press. Media clichés about health care have been inverted in the 1990s. Stories on the failure of health-plan bureaucracies and the ensuing misery of patients seem more numerous than accounts of successful medical intervention and the relief of suffering. The media are accurate witnesses to the ambivalence that attends the new reliance on the competitive market in the health sector.

FROM A PRIVILEGED TO A COMPETITIVE MARKET

During the past century many people discovered that health care is profitable without necessarily becoming enthusiasts for competitive markets. Pharmaceutical manufacturers have enjoyed profits and growth since the late nineteenth century, when scientific advances made physicians prescribers rather than compounders of drugs. Physicians' incomes rose more sharply than those of other professions (including law, education, and accounting) throughout the century because they had secured a legal monopoly of the service they offered. Their incomes rose even faster when private and public health insurance expanded after World War II. Insurance companies in the 1950s, hospital chains in the 1970s, and health plans in the 1990s learned to benefit from an industry in which payers rewarded those who did more for patients and charged more for doing it.

For most of the century a protected market in health care resembled markets for public utilities (for instance, civil aviation, electric power, telephones) and defense procurement. In these industries as in health care, the public, acting through elected officials, accepted a great deal of redundancy and inef-

ficiency as necessary to provide adequately for the general welfare, especially in times of great distress. Moreover, a nation that admired vertical integration and the rapid deployment of new technology elsewhere in its economy approved of the emergence of these characteristics in its health industry. From the turn of the century until the 1940s, leaders of medicine, philanthropy, business, and government assumed that Americans were becoming healthier mainly because of advances in science and technology, which were applied by practitioners who were certified by their responsible professional guilds and who worked in institutions arrayed in hierarchies of complexity.

The public and private sectors collaborated to subsidize the supply side of the regulated market in health services. Agencies of the federal government and national foundations sponsored research. State government, along with religious and secular philanthropy, built teaching hospitals that were strategically located to facilitate referrals from community hospitals—which were also constructed with state, federal, religious, and philanthropic funds. Physicians set qualifications for entry into the profession that were enforced by state governments; their own associations certified specialists.

The public and private sectors have collaborated since the 1940s to organize the demand side of the market for health care, creating four dominant payment streams. The largest payment stream, private or "voluntary" health insurance, covered employees and their dependents. This insurance was subsidized by a federal tax exemption for employers and employees ("tax expenditure" is the technical phrase) that reached $100 billion (about a tenth of spending on health care) by the mid-1990s. The next largest stream was federal social insurance, called Medicare, financed by a payroll tax and by direct expenditures from tax revenue. Third, the federal government and the states appropriated increasing amounts to pay for health services for the poor and those with low and moderate incomes, of all ages, who require nursing home and home health care. Finally, consumers spend a great deal for health care out of their own pockets for deductibles and copayments to their insurance, purchases of prescription and over-the-counter drugs, optometric services, and such alternative therapies as chiropractic care, acupuncture, massage, and various herbal treatments.

These four streams together became the American version of the national health-insurance schemes of other industrial countries. The American scheme accomplished in effect what other countries developed deliberately through public policy, making providers of care dependent on collective payers—in this case, business and government. As in other countries, government was the predominant payer, though in the United States this was through a mixture of direct appropriations, social insurance, and tax collections forgone. Unlike health insurance in most industrial countries, however, the American counterpart left uncovered a substantial number of people. Until the 1990s, cross-subsidies between the four financing streams provided health care for this cohort, about 17 percent of the population in 1997. As these cross-subsidies diminished, so did the incentive for providers to treat persons without coverage and to advocate social policy to pay for their care.

The public and private sectors subsidized both supply and demand in the health industry on the assumption that the health of the public would improve continuously as a result of advancing medical science. Since the 1970s, the health industry has had redundant facilities and too many specialized physicians, as a result of generous payment by both sectors. By the late 1980s, about 40 percent of hospital capacity nationwide was redundant—in some metropolitan areas, it was more than half. The medical specialties that utilized the most costly technologies and billed for procedures rather than time attracted the most candidates for entry and earned the highest incomes. For individual patients, these developments encouraged the belief that the more discrete services they received, the more likely they were to be free of illness. Most individuals were shielded from any knowledge of the unit costs of services and bore few significant costs for major illnesses.

It became evident in this period that the "health-care industry" commanded an increasing and very large portion of national resources. The size of this resource base provided opportunities for direction and deployment that are not available to K–12 education. During the 1980s, purchasers in business and government introduced competitive market mechanisms in order to reduce the overcapacity of the health industry and thus,

they believed, reduce the annual rate of increase in the four financing streams. They had three compelling reasons for destabilizing a large and comfortable industry: discomfort with the rate of increase in health-insurance premiums; the inadequate response of health-care providers to the growing dominance of chronic disease; and the failure of regulation of industry capacity and rates to reduce costs.

The most pressing reason to introduce strategies to make the health-care market more competitive was the dissatisfaction of business and government leaders with the rate of increase in the cost of health insurance. From the 1940s through the early 1970s, health care was funded by profits and tax receipts from unprecedented economic growth. Beginning in the 1970s, however, profits and tax collections stagnated while the rate of inflation in health-care prices exceeded inflation growth in the general economy. This occurred chiefly because health-care costs were driven by supply-side subsidies (cost-based hospital and tradition-based physician reimbursement), while most consumers were insulated from direct spending by generous insurance coverage. Because overall economic growth diminished in these years, health care grew more rapidly as a percentage of national product, which increased all the more the alarm of purchasers and the shareholders or legislators to whom they were accountable. By the 1980s, business and government—which together accounted for more than 90 percent of health expenditures—were desperate to spend less, or at least to spend better.

The second reason that purchasers encouraged market competition to restrain spending was growing skepticism that spending more for increasingly sophisticated services would lead to steady improvement in the health of individuals and populations. People were living longer in Western Europe, where health services were less expensive, both per capita and as a percentage of national product, than in the United States. Moreover, evidence was accumulating that behavior—diet, exercise, addictions—contributed to the incidence of disease, especially to such chronic conditions as cancer, heart disease, and stroke.

A profound change in the epidemiological situation reinforced skepticism about the effectiveness of high-technology health care among purchasers, whose views were encouraged by a

growing number of distinguished dissidents within medicine. Chronic disease had been an increasingly important cause of sickness and death in industrial countries since the second decade of the century. In 1920, the United States Bureau of the Census attributed most recorded deaths that year to chronic degenerative disease rather than to infections and injuries (even though most cases of heart disease were then classified as infectious).

Physicians and health-care managers usually treated chronic disease with methods derived from their success in using surgery and drugs to limit the consequences of infections and injury. They accorded priority to ensuring rapid response to acute symptoms and to referring patients to the appropriate level of hierarchically organized facilities and professionals. Health-care financing reinforced this priority, paying more for surgery and hospitalization than for consultation, despite accumulating evidence of the cost-effectiveness of preventing or postponing the symptoms of various chronic diseases and of enhancing patients' ability to function despite their disabilities.

By the 1980s, evidence of the cost-effectiveness of managing chronic diseases—assisting patients in monitoring their own signs and symptoms and accommodating their disabilities—began to seem convincing to many health-care purchasers in business and government. The cost of one hospital stay for acute diabetic ketoacidosis, for example, far exceeded the cost of teaching many patients with diabetes to monitor their blood sugar and reminding them to do so. Just as important, improved management of several chronic diseases (depression and arthritis, for instance) contributed to greater productivity in the workforce and lower public cost for income support and long-term care. Purchasers chose to make health-care markets more competitive in the 1980s, but only after they concluded that three decades of increasingly stringent regulation had failed. Regulation had not eliminated expensive oversupply, nor reduced the rate at which costs increased, nor transferred demand to providers (especially to HMOs) that managed chronic disease more efficiently.

Regulation of oversupply began in the 1960s. State governments allied with Blue Cross plans and other insurance organizations to restrain hospitals' expansion plans and their purchase of

major equipment by requiring them to secure a franchise (called a certificate of need) as a condition of access to tax-exempt bonds and reimbursement for services. But most large providers either had sufficient political influence to obtain any franchise they wanted from the states or transferred regulated services—surgery and diagnostic radiology, for example—to outpatient settings that were exempt from regulation. Some states regulated the rates that hospitals could charge to corporate and government purchasers. The politics of rate regulation, like those of certificates of need, favored providers more often than purchasers, though in some states, notably Maryland, regulation contributed to slowing increases in hospital costs.

HMOs—integrated ambulatory and inpatient service systems that charged an annual rate per patient (capitation)—held the promise of managing disease more efficiently and effectively while containing costs. The number of HMOs and their share of the insured population grew in the 1970s under federal legislation that offered them subsidized capital and required large employers to make them available to employees as an alternative to fee-for-service health insurance. The regulated market limited the financial incentives for consumers or collective purchasers to favor HMOs. Consumers who enrolled in an HMO exchanged absolute, and highly theoretical, free choice of their physicians for services that were less expensive in the aggregate, comprehensive, and likely to result in fewer hospital days during episodes of serious illness. These services were governed by ideals of clinical parsimony, the value of continuity in the relationship between physician and patient in primary care, and the importance of prevention. But since most consumers experienced health insurance as either a benefit paid by their employers or an entitlement, rather than as a personal expenditure, most had limited financial incentive to enroll in HMOs. Similarly, HMOs had an incentive to maintain prices that were close to what competing fee-for-service health plans charged to employers and the government.

COMPETITIVE MARKETS AND THE METAPHORS OF HEALTH CARE

By the mid-1980s, many large employers saw no alternative to rising health-care costs except to purchase care in markets that

were more competitive. Led by self-insured firms and state-employee benefit pools (which together employed considerably more than half the workforce by the late 1980s), employers demanded discounts from hospitals, groups of physicians, and wholesalers of pharmaceuticals. The phenomenon labeled managed care grew rapidly, though at different speeds and with different organizational variety in different metropolitan areas. A new brokerage industry arranged discounts and coordinated arrangements between consumers and providers of health care. Some of the brokers were established organizations, usually HMOs of several types or Blue Cross and insurance plans; others were new companies. Larger employers often acted as brokers for themselves. The cost advantages of clinical parsimony in HMOs were linked to discounted contracts and became "managed care."

The transformation of health-care markets had positive economic effects, at least for a while. The rate of growth in health-care costs slowed in the 1990s, making individual insurance policies relatively less expensive than they had been. The number of staffed hospital beds relative to the population began to diminish. Physicians became more geographically mobile, and, more important, they were increasingly choosing the primary-care specialties favored by managed-care organizations.

It is more difficult to assess the qualitative impact of market-driven organizations on the health care that people seek and receive. Moreover, it is almost impossible to determine whether health status is better or worse, because there is little data to compare the new system-based delivery with the fee-for-service of the past. The individualized ethic of the earlier "cottage industry" conception of health care obscured the reality that, in the aggregate, health professionals were motivated by profits and personal income just as other professionals were. Now the statistical certainty of population-based interventions is supplanting the uncertainty of individual practice. Purchasers of health insurance for larger groups are, for the first time, able to distinguish the characteristics of individual products. There is some evidence, for example, that managed care is delivering important preventive services to more people than the old fee-for-service system did, probably as a result of having integrated information systems and explicit targets and comparisons. Thus

the easily understood "magic bullet" turns into the less compelling metaphor of system-based delivery of "population health."

The objectives and technologies of "population health" have their own history, originating in the field of "public health." In public health, a variety of epidemiologic and statistical approaches are used to assess community health status. Systematic intervention can then be deployed to change that status. Such intervention is now used by managed-care organizations to effect change both through influencing providers and through direct interactions with patients. For example, improvements in the percentage of children appropriately immunized have been accomplished by these means. Such programmatic attention to "population health" requires the development of an ongoing system of measurement in order to define quantitative objectives and monitor the local improvement of these results.

Assessing the performance of health-care organizations can be accomplished in population-health terms, and this has resulted in the development of health-plan "report cards." While similar performance reporting may seem to have potential for K–12 education, some of health care's experience may be helpful. First, the temptation to expand reporting to include an ever-increasing number of different dimensions rapidly undercuts the ability of health-care delivery operations to focus on and achieve specific goals. Second, the apparatus of measurement systems and the aggregation of data consumes significant resources itself. Third, and most important, the relationship between achievements in population health and achievements in appropriate and satisfying individual health-care delivery is not at all clear. Population-health status is not simply a matter of rolling individual health-care encounters up to the collective level. For example, a person who undertakes to improve population health will identify subpopulations in which maximal improvement can take place for a given level of resources and then try to improve the mean result for those subpopulations, instead of trying to improve the health of the entire population by moving one individual at a time. Such a strategy is likely to cause disaffection among individuals and groups who do not have a priority need or for whom no short-term intervention is likely to be cost-effective quickly.

The new metaphorical domain of a "world wide web" has begun to emerge as managed care develops. In this domain, everything about health care and its delivery can be connected to everything else, for whatever purpose is a priority. Thus clinical managed care has developed "integrated care." In integrated care, the delivery system is organized so that separate services (for instance, diagnosis, testing, intervention, follow-up), delivered by separate clinicians (nurses, primary-care physicians, specialists, pharmacists), at separate times and in separate places are linked by information systems, contracts, referral patterns, clinical guidelines, and protocols. The priorities served by integrated care are cost reduction and/or quality improvement. Prices are set at an organizational level so that compensation for physicians and other clinicians is less variable and ultimately, perhaps, will decline in absolute terms.

The web metaphor creates networks of patients, members of health plans, sponsors, government agencies, interest groups, and other community organizations. The overlapping interests of these participants are all linked to the system, and all interests have legitimate claims. As this organizing metaphor spreads it could create very different demands and markets for medical-care services because it has the potential to reconnect the economic links among clinicians, patients, and systems and to establish new criteria for value. Nevertheless, the magic bullet remains the most powerful metaphor in health-care delivery, though the caring metaphor remains important, and the power of the web metaphor is increasing. The history of these metaphors has become entwined with the development of third-party financing of health care and increased sophistication in marketing. But the interventions based on this scientific understanding have been fueled by the marketplace.

The reorganization of health-care markets is influencing research. Medical research has been primarily concerned with the elaboration of a disease model, emphasizing the causal chain of pathology and the search for the most basic biological alterations. In this model, the understanding of an individual's pathologic condition and the direction of research is determined to a significant extent by the direction and content of previous research. In the research environment fostered by some HMOs,

however, the idea of setting research priorities based on the needs of a population is getting some attention. For example, significant research on the treatment of otitis media (middle-ear infection) did not begin until the late 1980s. Although otitis media accounted for half the visits by children to physicians each year, a managed-care clinical guideline could not be constructed because there were no research findings about what worked.

Reorganization has begun to influence medical education itself, impelling greater emphasis on "primary care" and on statistical and epidemiologic training. These changes have followed the rapid rise of managed care by almost a decade, but the cycle for new physicians means another seven years will pass before the first physicians trained for a managed-care world will begin to practice. To the extent that changes in K–12 education will require changes in teacher education, the same long lag times may be found.

SPECULATION ABOUT THE NEAR FUTURE

Many people are benefiting from competitive markets in health care, including investors for whom stock prices have escalated, health-plan managers whose salaries have grown, and purchasers in business and government who have contained costs and, just as important to them, now have more information on the care provided to beneficiaries and its results than ever before. Many consumers are enjoying continuity of care, the absence of copayment and coinsurance when they participate in HMOs, and, if they are prepared to pay more, unlimited freedom of choice in rapidly growing point-of-service plans. Many physicians enjoy a stable source of patient referrals, the availability of more information about their patients' histories than ever before, and freedom from the burdens of office management.

But many people dislike the discipline of markets when it affects them negatively. Patients may resent being informed that they are not covered for treatment by a particular physician or facility or that a particular course of treatment is not likely to make any difference in their condition. Employees may resent having their health insurance limited to one plan. Many physicians are unaccustomed to criticism of their skill and

judgment, even by their peers, and certainly not by distant employees of a health plan. Managers are embarrassed by evidence of their inefficiency, which previously could have been obscured in increasing rates of reimbursement. Hospital employees who believed their jobs were secure against redundancy now have personal reasons to defend the benefits their institution provides to its community. Shareholders are dismayed when earnings and share prices fall.

Complaints from health professionals about the negative effects of competitive markets are often responses to changes in their working conditions and incomes. Many physicians claim that health plans are forcing them to offer worse care by exerting pressure for more throughput, or denying the referrals or treatment they recommend. But there are few documented examples (and many stories that turn out to be ambiguous) of managed-care organizations requiring physicians to violate professional ethics. Many registered nurses insist that hospitals are harming patients by shifting care to lower-paid staff. But even nurses' professional organizations have found it difficult to offer examples of systematic and sustained harm.

Health-care markets are becoming more competitive. As health plans merge, fewer groups compete more vigorously for the loyalty of providers and hence for being selected by consumers and employers. In Sacramento, California, a regional market of 1.6 million people, two health plans now have 60 percent of enrollees, and four nonprofit systems account for 95 percent of all hospital-bed days. Two purchasing coalitions—one serving public, the other private employers—dominate the market.

The responsibilities of health plans are changing in the states and metropolitan areas with the largest enrollment in competitive HMOs, notably California and Minnesota. Some large purchasers are acting as brokers themselves, negotiating with hospital and physicians' groups for discounts and overseeing the care they provide. Increasingly, however, employers and government are asking health plans to manage networks of providers more actively, in the way that group- and staff-model HMOs have traditionally done. More plans are managing decisions about practice as well as coverage, especially for patients with chronic diseases. In the increasing number of mar-

kets where competition has reduced the price differential among physicians and hospitals—Minnesota, for example—the insurance function of plans is becoming subordinate to collecting and assessing information about the quality and convenience of care from providers and communicating it to consumers and purchasers. The plans are becoming the surrogates, the experts, who mediate between both consumers and collective purchasers and a complicated supply of services.

Three themes are likely to recur as turmoil persists and terms are renegotiated: the restructuring of the industry will accelerate; the struggle for consensus will continue about what can and cannot be valued by markets; and consumers will become increasingly skillful in assessing and acting on the competing claims of experts.

Restructuring

Change has just begun in the health industry. Hospital supply is likely to contract significantly. Physicians will be redistributed among specialties. As the functions of health plans and insurers change, they will insist on greater accountability of professionals to consumers, purchasers, and consumers. Government and large employers, which are expanding their oversight activities in response to complaints from consumers and providers, will increasingly collaborate in regulating the industry. Such regulation is likely to be directed towards both the insurance and the health care–delivery functions of the industry. There will be increasing specification and regulation of clinical conduct. As this widened concern plays out, it will become even more intensely political and, as in the recent debate about the frequency of mammography screening, less determined by scientific analysis or information.

Consumers will see the effects of continued restructuring in their insurance contracts and in their entitlements to Medicare, Medicaid, and the new children's health insurance. Business and government purchasers are likely to make explicit the costs of particular choices. Persons who value having the broadest range of choices (regardless of the scientific basis for them) and can afford them will pay more, both for insurance and out of pocket. Conversely, those with low incomes, including many

who are currently uninsured, are likely to have increased access to insurance coverage for preventive and catastrophic services; such coverage is less expensive than using insurance mechanisms to purchase routine health services.

From the rise of third-party insurance offerings in the 1940s through the present, there has been a persistent disconnection between the end users (patients) of the health care–delivery system and the payers and priority-setters for that system. Collective purchasers of health care, both public and private, are presently ascendant and have replaced providers as the major driving force. Consumers have less influence on health policy and priorities than voters in many communities have on school budgets (and, therefore, on educational policy). Nonetheless, every local health-care manager knows that local practice and local innovation are critically important. Those concerned about either health care or K–12 education should be wary of brilliant proposals for reform that have no history and no constituency among people who run for office, meet payrolls, and provide services to customers.

Values

There is evidence that a new consensus may be emerging on public responsibility for many persons who lack insurance. The Health Insurance Portability and Accountability Act of 1996 (HIPAA) guarantees that workers who change jobs can maintain insurance coverage; it also prohibits denial of insurance because of preexisting conditions, including pregnancy. The cost of guaranteed coverage may be significant in many states. Nevertheless, for the first time national law and regulation for health insurance applies to both commercially and self-insured employers. The health insurance legislation of 1997 creates an entitlement for children of the working poor whose family income exceeds the eligibility level for Medicaid.

Both measures passed because large self-insured employers either supported or did not oppose them. HIPAA imposes higher standards of market conduct on employers and the firms that underwrite or administer their insurance. Federal/state children's insurance recognizes that in the current economy many children will not be covered as a result of a parent's employment,

but that cost-effective policies can be written and subsidized with public funds. It is now conceivable that there will be incremental advances toward substantially universal coverage as providers and insurance markets become more efficient.

There is also evidence that some consumer concerns about the conflict between market forces and their welfare are being resolved. The rapid growth of point-of-service options for covered employees has eased considerable tension about maintaining established relationships with physicians and choosing physicians and hospitals in the future. Moreover, a number of health plans are defining expensive, life-saving treatments (transplants, for instance) as rare events that should be covered, for ethical reasons as well as to prevent adverse publicity, even if they are not explicitly described in insurance contracts.

The federal government and the states have exhibited considerable willingness to regulate standards of care when there is public voice for more generous coverage than some employers and health plans offer. More than twenty states, for example, regulated hospitalization after childbirth in 1995 and 1996; the federal government then did so for employees of firms that self-insure. A consolidating health-care industry eager to forestall regulation and regulators who respond to consumers and professionals may, together, eliminate most of the grievances against managed care.

Consumer Sophistication

Although consumers continue to admire advances in biomedical science, they are more aware than they were in the fee-for-service era that health-care providers have an economic incentive to serve them. Government agencies and employers, prudent buyers responsive to wary consumers, are requiring health plans and providers to make public comparable information about quality and results. Alternative sources of expertise are likely to become increasingly available.

Consumers vary considerably in what they value when choosing among plans, physicians, and treatments. The armies of reformers who have pursued the goal of universal entitlement in health care at various times assumed that one method for organizing services and one for paying for them would suffice. A few

reformers, examining evidence about universal health care in other industrial countries, concluded that two health plans would be necessary: an adequate minimum entitlement managed by government or a public/private consortium for most of the people, and a private system for people with means who wanted better service or more choices. After a decade or so of a more competitive market in health care in the United States, it is evident that consumers are not so easily satisfied. In health care, as in telecommunications and transportation, consumers demand more than tightly regulated markets presume to offer.

Americans apparently continue to expect the health-care industry to advance in the conquest and management of disease, even if there is no effective coalition for making health care a public good that is universally available—as President Clinton was the most recent political leader to discover. Markets for health care are predicated on competition among suppliers for the scarce dollars of collective purchasers and demand from consumers for more intervention. The market, as a powerful metaphor, persists for the immediate future in an uneasy relationship with older metaphors—of magic bullets that create proliferating and reimburseable services and empathic caring that binds patients to physicians—and with the newer metaphor of a web of services that segments insured populations and defines targets of intervention.

PERSPECTIVES FOR K–12 EDUCATION

Although we find no systematic lesson for K–12 education from the development of the market in health care, we offer several points for consideration. First, health-care markets were highly "privileged" and then became competitive; K–12 "markets" seem to us "underprivileged" and therefore unlikely to make a similar transition. Second, the enormous size and relatively centralized character of resources committed to health care make the deployment of these resources a powerful tool for change. The smaller size and decentralized character of K–12 resources means such tools are not available in this area. Moreover, private employers, who purchase directly about half the health services produced in the United States, participate in K–

12 education only as corporate and individual taxpayers and as voters. Third, proponents of population health care have effectively defined goals and devised measures of their attainment. But this achievement does not necessarily result in greater satisfaction for either end users or frontline providers. Population achievements in K–12 education may well suffer the same fate. Finally, the future of competitive markets in health care depends on the collaboration of frontline providers. Change in the knowledge, skills, and attitudes of frontline providers has a very long time frame and will resist manipulation. Both health care and K–12 education appear to disconnect end users from policy, resource deployment, and objective setting. In the end, this means that resistance to change is rooted in local communities. To overcome this, the place to begin is in each household.

ACKNOWLEDGMENTS

During several discussions with the authors, John Deighton helped to clarify some of the ideas in this essay.

REFERENCES

This essay is grounded in a variety of primary and secondary sources. Each of the authors has firsthand knowledge of many of the events in medicine, health care, and health policy mentioned; each of us has also followed these events in media intended for both general and professional audiences. Moreover, both of us routinely take account of the extensive research literature on health policy and on the organization and financing of care. In addition, Ludden has accorded close attention to research on clinical medicine, and in particular the care of persons with mental illness and related conditions, and on the provision of health care to defined populations; Fox has given particular attention to research on health politics, tax and benefits policies that affect health care, and to the history of medicine and policy in the twentieth century. A compressed introduction to the literature on the organization, financing and regulation of health care from the early twentieth century through the early 1990s can be found in Daniel M. Fox, *Power and Illness: The Failure and Future of American Health Policy* (Berkeley: University of California Press, 1993 and 1995). Research literature that bears on this essay is readily available in the various databases of the National Library of Medicine, available in print and at <http://igm.nlm.nih.gov>.

Wallace E. Huffman

Modernizing Agriculture: A Continuing Process

AGRICULTURE IN THE UNITED STATES has undergone dramatic technological and social-economic structural change during the past century. Theodore W. Schultz was the first to emphasize the role of science-based technological change as a key force for causing agriculture to undergo a transition from traditional to modernizing conditions.[1] It is now well established that institutionalized research, not research undertaken by farmers themselves, is the key factor for producing innovations or knowledge leading to new technologies and advances in agricultural productivity under modernization. In the United States, it has taken many decades to develop the legal, political, scientific, and economic structure for the agricultural R&D system.

As technological advances occur, a type of economic disequilibria is created. For the modernization of agriculture to progress, it is not sufficient simply to have the creation of knowledge. Advances in science must lead to new technologies adapted to farmers' needs and then commercialized; information must be supplied about the potential of new technologies; and farmers must adopt them. Furthermore, technical advances in agriculture create a demand for further advances in science to refine the scientific principles underlying them and to resolve new problems that emerge. In agriculture, the performance of most technologies is sensitive to local climate, soils, and economic factors, so the potential for local adaptation is great and the impact of new technologies varies widely across locations on a

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given farm and across farms. This makes information dissemination and adoption decisions difficult because a simple decision rule is seldom appropriate. More generally, it is costly for farmers to acquire information, evaluate the available technologies, and adopt only the new ones that are expected to increase their profit. Farmers need to be tied into a receptive and productive agricultural research system.

The objective of this essay is to outline some of the key dimensions of the modernization of U.S. agriculture and to suggest that schooling in the country could learn important lessons from the organization and development of agriculture in the United States.

BEGINNING THE MODERNIZING PROCESS

How did the modernizing process for U.S. agriculture get started? Relatively parallel developments of institutions for higher education, research, and extension to serve agriculture broadly were needed. It is now easy to forget that in the mid-1800s the necessary institutions, a useful body of scientific knowledge, and human resources in trained scientists and educated farmers were missing; a large investment was necessary before institutionalized agricultural research would have technological successes with farmers.

Much of the invention and technological improvement in U.S. agriculture before 1840, and to a lesser extent up to 1900, came about from the activities of private individuals. Although equipped with little formal research training, they faced practical agricultural production problems or sought improved methods of production. These individuals were innovative farmers, blacksmiths, and estate owners; accordingly, a large share of the technical advances from this informal system was realized in the form of mechanical innovations rather than biological advances.[2]

Agricultural societies provided early support to teaching and research institutions. Keen interest arose within these societies about the latest techniques, fertilizers, and implements. The climate they generated—a mixture of innovation, competition, and dissemination of results—formed an integral part of the

"clientele" relationship that exists between farmers, the extension service, and agricultural research institutions. The early societies demonstrated the usefulness of research and education in improving agriculture, while also providing political interest-group support for the use of public funds for research and education in agriculture.[3]

Federal legislation was necessary to establish central pieces of the U.S. public agricultural research, education, and extension system. A legislative act established the United States Department of Agriculture (USDA) in 1862; the Morrill Act of 1862 established land-grant colleges; the Hatch Act of 1887 provided for state agricultural experiment station support; and the Smith-Lever Act of 1914 provided for agricultural extension support.[4] These legislative acts and the institutions developed and supported by them were major innovations in the development of agriculture. Yet they were not simply imagined into existence; by the time each of these major pieces of legislation was passed, considerable institutional development and experience with earlier institutions had been realized.[5] The U.S. Patent Office was a precursor to the establishment of the USDA, and early state colleges of agriculture were a precursor to land-grant colleges. Agricultural experiment stations first developed in Europe, especially in Germany in the mid-1800s, and served as an interesting model because they sought methods of applying laboratory science, especially chemistry, to agriculture. Both in Europe and as developed in the United States, these institutions were not part of or affiliated with a university, however, and the distribution of their results to farmers was not a major focus of their activity. Farmers' institutes, traveling agricultural-college short courses, and USDA field demonstration activities were turn-of-the-century precursors to the federal-state cooperative extension.

Between 1862 and 1887, several forces were pulling for the development of organized agricultural research in the United States. First, the newly established land-grant colleges created a demand for research to enhance the information content of their teaching programs in agriculture and home economics. Second, research methods were weak, hindering knowledge accumulation and scientific credibility. For example, in 1862

virtually no information existed on the chemical composition of agricultural products, soils, fertilizers, and agricultural waste; standard laboratory procedures did not exist for most chemical analyses. This made for slow advances in the chemical-content knowledge base and led to early credibility problems for the chemistry profession.[6] Third, between 1802 and 1898 the U.S. government made six major land acquisitions that completed the shape and area of the continental United States, and through successive policy choices worked to move federally owned lands into private land holdings. During the nineteenth century the frontier advanced westward across the country, bringing much new land into agriculture production. But developing new lands raised many new technical problems, which in turn heightened demand for agricultural science and technology. Fourth, before 1815 the transportation of agricultural commodities on dirt or mud roads and rivers meant high freight rates and relatively little interregional competition. But as canals and railroads were added to the U.S. transportation system during the remainder of the nineteenth century, a dramatic drop occurred in interregional transport costs. Farmers on the relatively poor soils of the east coast states confronted immense competition from the new farmers on the good soils of the Midwestern states.

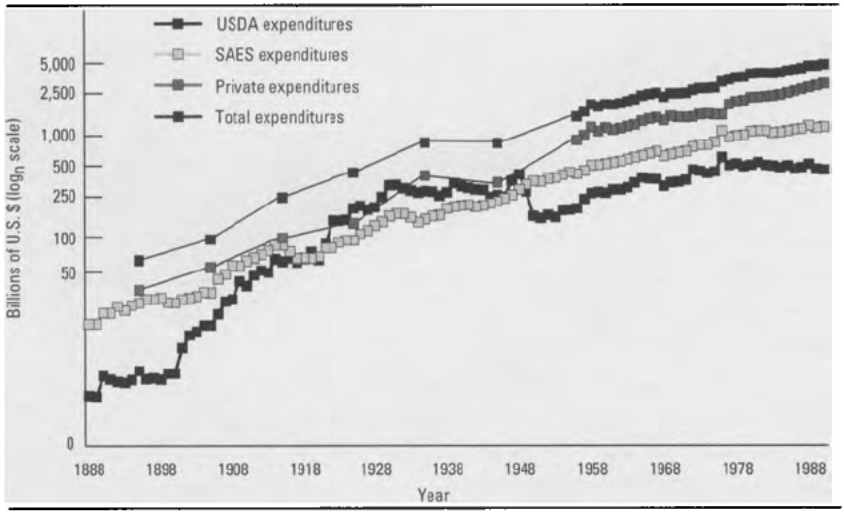
And whether facing new challenges of turning the prairie into cropland or encountering new competitive pressures on established farms, farmers frequently turned to their local state government for assistance—including state support for public land-grant colleges, agricultural experiment stations, and agricultural extension.[7] Between 1875 and 1887, fourteen states established agricultural experiment stations. The Connecticut State Agricultural Experiment Station, established initially at Wesleyan University in 1875, was the first successful one.

The passage of the Hatch Act in 1887 was the most important legislative step in institutionalizing public agricultural research in the United States. The legislation was much debated between political interest groups of the north and south and between "states rights advocates" and "federal control proponents." To gain passage of the legislation, control of state agricultural experiment stations was given to the states, leav-

ing the USDA with the relatively minor role of aiding and assisting them. Each qualified state was to receive an equal federal appropriation of $15,000 per year to support a station; and, in contrast to the German model, the stations were to be established under the direction of a state land-grant college or university.[8] The stations were mandated by the legislation to acquire and spread practical information connected to agriculture and to conduct original research. After passage of the Hatch Act, state agricultural experiment stations were quickly established in all states.

This brief history shows that both the performance and the funding of agricultural research in the United States has been shared between private and public interests. From 1890 to 1990, real public agricultural research expenditures of the USDA and the state agriculture experiment station (SAES) system grew at an average annual rate of 4.2 percent; private sector real agricultural research expenditures grew at a rate of 4.8 percent during the same period (see figure 1).[9] The relative size

Figure 1. Expenditures on SAES, USDA, and U.S. Private Agricultural Research, fiscal years 1888–1990 (constant 1984 dollars)



Note: For 1888–1955, private research expenditures are available only at ten-year intervals, so the solid line connects the points for those years. This also affects the graph of total expenditures.

Source: Adapted from Wallace E. Huffman and Robert E. Evenson, *Science for Agriculture: A Long-Term Perspective* (Ames, Iowa: Iowa State University Press, 1993), 94.

of the USDA and SAES research system has switched twice over this period, in 1918 and 1948; but since 1948 the SAES system has been a considerably larger research enterprise than the USDA. Private agricultural research expenditures in the United States are generally accepted to be larger than public expenditures since about 1950.[10]

With the land-grant colleges and state agricultural experiment stations in place, the various states and the USDA searched for a mechanism to educate farmers and rural people and to disseminate farm and home information to them. Part of the struggle arose from the very different information needs and social structures in the northwest and south. In the south, the USDA had early successes by seeking cooperation with state and local organizations, working with and through local farmers, and using local demonstration fields to illustrate selective and better management practices; but working through the land-grant colleges proved less than successful. By contrast, in the north and west, extension work was generally associated with applied research of the land-grant colleges, especially farm management research. Information was supplied through college and traveling short courses and distribution of publications to farm households.[11]

The third significant legislative innovation came in 1914, when passage of the Smith-Lever Act smoothed over differences between the north and south in organizational philosophy for extension work. The Smith-Lever Act provided for cooperative extension between the land-grant colleges and the USDA in each state. The Cooperative Extension Service aided in diffusing useful and practical information on subjects related to agriculture and home economics and to encourage its application. The agricultural colleges were to establish extension departments to give instruction and practical demonstrations. Each state was eligible for a federal appropriation of $10,000 per year plus additional federal funds to be allocated among states on a formula based on a state's share of the rural population. Of course, the mechanism for allocating federal funds to Cooperative Extension has changed over time,[12] and the revenue for Cooperative Extension has come to consist of federal, state, and local sources.

DEVELOPING A SYSTEM OF AGRICULTURAL SCIENCES AND TRAINING SCIENTISTS

Both a system of applied agricultural sciences and methods for training agricultural scientists were needed before new technologies could be developed that would support farmers' research needs and the modernization of agriculture. The early training of agricultural scientists could advance only after a new science system for agriculture was created and in place. To establish this system, research methods were borrowed from the general sciences (e.g., chemistry, botany, physics); others were developed to meet the special circumstances associated with agriculture and home economics in land-grant colleges. The creation of the new system occurred largely between 1862 and 1920. The years from 1900 to 1920 are now seen as a period when the public agricultural research system was under great stress because few important advances in science were being made. Yet it was during this era that a system of agricultural sciences came of age. The change came about in part by agricultural research developing ties to the core sciences, but more importantly by investing in "pretechnology science," intermediate between core science and applied agricultural science.[13] Furthermore, much applied research became multidisciplinary.

The R&D system for agriculture did not develop as a linear organization of science and technology. In a linear organization, advances in science lead directly, albeit with some lag, to advances in technology, without any feedback in the opposite direction.[14] In contrast, in agriculture, science and technology developed bi-directionally: advances in science led to advances in technology, and advances in technology led to advances in science. It might be thought that this sort of exchange would run counter to the differing cultures of scientists and technologists. Yet because of the agricultural roots of most agricultural scientists, the scientists and farmers saw the importance of feedback between them.

With the periodic strengthening of intellectual property rights (e.g., in the 1930s, 1970s, and 1980s), the boundary between publicly- and privately-funded research has shifted.[15] During the late nineteenth century a large share of research for U.S.

agriculture was in the public sector. Over time this has shifted, so that now more than two-thirds of all U.S. agricultural research is conducted in the private sector. Interestingly, the private sector continues to find large investments in general or core scientific research unprofitable, as well as applied research in areas where commercially saleable products and information are not easily obtained (e.g., natural resource and environmental research, open pollinated crops, food safety and human nutrition, agricultural and rural policy). This means that public-sector research has become more concentrated over time in core and pretechnology sciences.

Low cost and efficient exchange of knowledge among scientists (and innovators) is important for refereeing priority claims to innovations but also for the accumulation of verified hypotheses that constitutes scientific knowledge in a field.[16] Scientific communication systems were first developed to facilitate horizontal exchange among researchers in the core or basic sciences. To facilitate this exchange, scientists developed specialized language and measurement procedures to achieve exactness and credibility. In most sciences, this is the language of statistics, experimental design, and exact measurement. The journal papers, reference citations, specialized language, and elements of style are chiefly designed to allow scientists working on similar problems to disclose findings quickly and accurately to one another.

The science exchange system that originated in the core sciences has been modified and used in pretechnology science and to some extent in technological inventions. Scientific papers, with their specialized language usually associated with a discipline and with standards set by scientists themselves, have been a very important vehicle for horizontal exchanges. Downstream and upstream exchanges of knowledge are more difficult because some of the language and style that facilitates horizontal exchange hinders other types of exchange.

During the nineteenth century, public agricultural research was limited by a weak scientific knowledge base and the small number of individuals that were trained or being trained to do scientific research. Most of the early agricultural research was "art" rather than "science." The early U.S. agricultural scien-

tists were largely sent to Germany for training, especially in agricultural chemistry. During the eighteenth century, completing a Ph.D. degree in the German model was an indication that an individual had successfully mastered a body of knowledge and the skills needed to advance the state of knowledge in the sciences. Gradually the training of U.S. agricultural scientists evolved into a program requiring advanced course work in the sciences, training in research methods, and supervised experience in conducting and reporting research.[17]

PERFORMANCE AND CHANGE IN U.S. AGRICULTURE

During the past century, U.S. agriculture has faced two persistent long-term challenges requiring structural change: technological change and rising real wage rates in the nonfarm sector. (There are, of course, other forces of a short-term and less dramatic nature that have also affected agriculture.[18]) The U.S. agricultural sector has undergone major economic and social change as it has adjusted to these forces and become more thoroughly integrated into the U.S. and world economies.

Forces for Change

Although regional markets for agricultural products were relatively well integrated by the turn of the century, the extent of integration of farm and nonfarm input markets has been debated.[19] It seems that before 1933, farm and nonfarm input markets were poorly integrated, but by the 1970s they had become well integrated.

The expected compensation from nonfarm employment represents an opportunity cost to farm labor when the two labor markets are integrated. Table 1 provides information on the real wage rate for production workers in manufacturing. These jobs have generally been accessible to workers in agriculture, and wage data for production workers in manufacturing are available at regular intervals going back one hundred years. The data in table 1 show that real manufacturing wage rates rose by a factor of 5 (or an average of 1.6 percent per year) from 1890 to 1990; real compensation rose faster, by a factor of 7.6 (or an average of 2.1 percent per year). These are large

Table 1: Historical Data on U.S. average wage rates of production workers in manufacturing and agriculture, and legal minimum wage, 1890–1989.

	Manufacturing Wage				Farm Wage				
Year	Avg. weekly hours paid[a]	Avg. hourly wage ($/hr.)	Real hourly wage (1914=100)[c]	Real hourly comp. (1914=100)[c]	Rate w/o board[e] ($/day)	($/hr.)	Real wage[c] (1914=100)	Federal min. wage ($/hr.)	Price Index[f] (1914=100)
1890	54.0[b]	0.16	79	77	0.95	–	72	–	90
1900	53.2[b]	0.18	96	94	1.15[c]	–	94	–	83
1910	51.0	0.21	100	98	1.35	–	100	–	93
1920	47.4	0.55	126	129	3.30	–	114	–	199
1925	44.5	0.54	141	144	2.35	–	93		
1930	42.1	0.55	151	149	2.15	–	89	–	166
1935	36.6	0.54	179	174	1.35	–	68	–	137
1940	38.1	0.66	214	224	1.60	–	79	0.25	140
1945	43.5	1.02	259	276	4.35	–	167	0.40	179
1950	40.5	1.44	273	301	4.50	0.69	129	0.75	240
1955	40.7	1.86	318	347	–	0.82	138	0.75	266
1960	39.7	2.26	348	399	–	0.97	148	1.00	295
1965	41.2	2.61	378	441	–	1.14	163	1.25	314
1970	39.8	3.36	396	470	–	1.65	191	1.60	386
1975	39.4	4.81	411	513	–	2.45	207	2.10	531
1980	39.7	7.27	425	562	–	3.67	211	3.10	777
1985	40.5	9.54	433	644	–	4.31	193	3.35	1,001
1989	41.0	10.47	408	613	–	5.17[c]	199	3.35	1,165

Sources: U.S. Bureau of the Census 1975; Economic Report of the President, 1991.

[a] Before 1940, hours paid for and hours worked were almost the same. After 1940, employers started paid leave programs. In 1989, paid-for leave time is roughly 10 percent of paid-for work time (Department of Labor, 1989.)

[b] Estimates from related series.

[c] Deflated by the price index in the last column.

[d] Compensation includes wage and employer cost of employee benefits (paid leave, retirement plans, health programs, unemployment benefits). For 1900–1970, Albert Rees, *Long-Term Economic Growth, 1860-1970* (Washington, D.C.: U.S. Bureau of Economic Analysis, 1973). For later years, Bureau of Labor Statistics. *Handbook of Labor Statistics, 1980* (U.S. Government Printing Office, 1983); and Bureau of Labor Statistics, "Employment Cost Indexes and Levels, 1975-89" (Bulletin 2339), Oct. 1989.

[e] Dollars per day 1890–1950; dollars per hour, 1950–1989.

[f] Consumer price index (Bureau of Labor Statistics) up to 1960; after 1960, implicit price deflator for personal consumption expenditures (Bureau of Economic Analysis). The BEA's series rise less rapidly during the late 1970s mainly because it uses comparable rental rates on owner-occupied housing rather than interest rates.

increases, and represent a powerful force for pulling labor out of agriculture over time—and possibly for causing labor-saving technical change in agriculture.[20]

Technical change is difficult to summarize adequately. Innovations in science and technology make possible improvements in products, production processes, intermediate inputs, biological and other materials, and management and information systems. In agriculture, for an innovation to be successfully adopted by farmers they must expect that it will increase their profit. Yet only a small share of all potential agriculture technologies will actually be adopted by farmers. The primary impact of new technology on the economy thus occurs at the technology diffusion stage, where new products and processes are spread across the potential market. Hence, measuring the impact of new technologies must focus on identifying and measuring how the economy changes as new technologies are introduced and used.

Three types of indicators of technical change exist: observed successful innovations, the number of inventions, and productivity change. Technological successes like hybrid corn provide concrete, but highly selective, examples of how a new technology is developed and adopted. Although the first scientifically successful "hybrids" were obtained in corn in 1907 by public-sector researchers, thirteen more years of research and experimentation were required before the first commercially successful hybrid corn variety was developed (for Connecticut). Another decade of research and development was required before commercially successful hybrid corn varieties were developed and available to farmers in the Corn Belt.[21] Starting in the 1930s, hybrid corn varieties rapidly replaced open-pollinated corn varieties in the Corn Belt, and then spread to other corn growing states. As research and development continues—that is, once successful varieties are replaced by a superior new one—new research makes past discoveries obsolete. Hence, in hybrid corn and most agricultural technologies, the technology used by farmers keeps changing as new discoveries and improvements occur.

U.S. farmers produce for national and international markets with a profit objective. Because a large share of the new technologies are inferior to the current technology used by a farmer

and because profitability depends on local geoclimatic and economic conditions, making good adoption decisions is difficult; skills obtained through schooling seem unambiguously to contribute to successful choices.[22] Successful adoption of new technologies (varieties, biotechnology, information systems) has been shown to increase the profits of early adopters.[23] In a competitive market, early adopters of superior technologies will have reduced real costs of agricultural production; lower-cost producers will increase their output and take a larger share of the market. In contrast, late adopters will lose because they will face lower output prices compared to the old technology state. Nonadopters will face lower profits and may be forced to exit the industry. In agriculture, new technologies have frequently changed interregional comparative advantage, sometimes giving an advantage to farms of a particular size.[24]

The number of inventions (e.g., patents or new varieties) can provide a useful summary of the pace of change at the technology frontier.[25] For example, consider cultivators and plows. Few patents in this class were granted before 1830; in the 1830s and 1840s, there were 115; 226 between 1850–1859; 1,683 between 1860–1869; 1,308 between 1870–1879; 1,152 between 1880–1889; and then, in the decades following, new patents tapered off. Yet if patent counts provide rough indexes of the pace of invention, they are not very useful for assessing the economic impact of technical change.

Productivity analysis is an economist's attempt to approximate the "ultimate" impact of technical change on useful output without trying to identify "intermediate" successful technologies or count innovations. To accomplish this, economists have developed measures of total factor productivity (TFP) that express aggregate output per unit of aggregate input (rather than per unit of one input, say labor or land). The growth of aggregate output that cannot be explained by aggregate input (under the control of producers) is defined as TFP. Careful aggregation of outputs and inputs to account for quality and compositional changes are important to obtain an informative measure of TFP and one that will be a good proxy for technical change.[26]

Over the past hundred years, U.S. agriculture has a remarkable record of total factor productivity growth: the average annual rate of TFP growth has been about 1.6 percent per annum.[27] For the past fifty years, the growth rate of total factor productivity for U.S. agriculture has been even higher, about 1.9 percent (see figure 2).[28]

Although TFP statistics for other sectors of the U.S. economy do not extend back a century, Jorgenson and Gollop have constructed measures for nine sectors including agriculture for the post–World War II period.[29] They show that the average annual TFP growth in the agricultural sector over the 1947–1985 period exceeded the corresponding rate for the U.S. private nonfarm economy by more than 3.5 times. It was more than double the rate of TFP growth for the manufacturing sector. Furthermore, among their nine sectors that cover the private economy, the average annual TFP growth rates for the agricultural sector over the period 1947–1985 were significantly larger than for all other sectors, except for the communications sector. Moreover, they conclude that productivity growth in U.S. agriculture is different from the rest of the economy. For agriculture, productivity growth accounted for 82 percent of the growth of output, while for the rest of economy, productivity accounted for only 13 percent of the growth.

The relatively rapid TFP growth of U.S. agriculture during the past century can be interpreted as relentless technological change or modernization. These TFP increases of 1.6 to 1.9 percent per year accumulate into a very large long-term impact. Given measures of TFP and R&D activities, economists have chosen to use econometric techniques to relate TFP to past investments in R&D, among other things, and to skip the intermediate stages of invention, adoption, and diffusion of technologies. Although there are potential problems with correctly identifying causal relationships,[30] the evidence has yielded a generally impressive story.[31]

One example uses TFP data for a crop, livestock, and aggregate agricultural sector in forty-two U.S. states from 1950 to 1982.[32] Such an approach shows that investments in public and private agricultural research, public agricultural extension, and farmers' school are a major part of the explanation for varia-

tion cross-sectionally and for overtime in TFP for agriculture. Their public and private research variables are derived as weighted expenditures over the past thirty-three years. The extensive lag length takes account of the fact that expenditures on research do not immediately produce innovations; there is selection and further testing before commercialization, and once a useful technology is marketed it is not immediately adopted by producers. Furthermore, some advances in knowledge are an input into later research and may be useful over many years.[33]

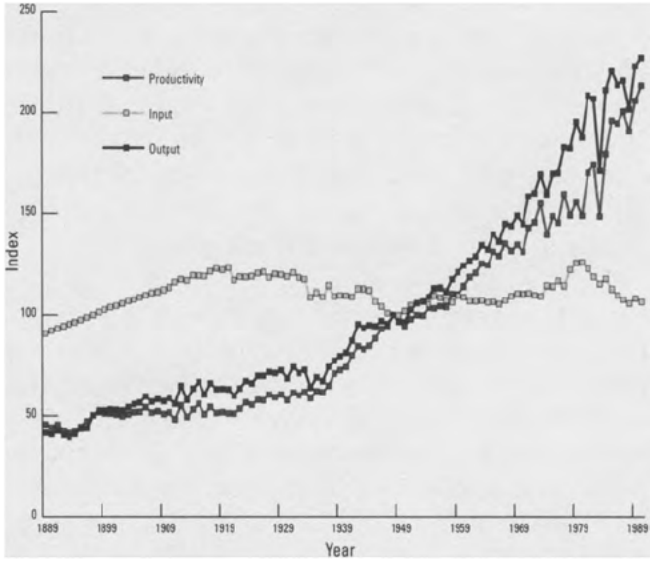
Structural Change

U.S. agriculture has undergone major structural change over the past century. In 1890, U.S. farms numbered 4.5 million; and the number grew steadily to 6.4 million in 1910. Little change then occurred until the Great Depression pushed the number to 6.8 million in 1935. Farm numbers decreased most rapidly from 1950 to 1969, going from 5.4 to 2.7 million. Since 1970 there has been a slow decline in farm numbers. In 1990, there were only 1.9 million U.S. farms, about 30 percent of the number at its peak in 1935.

Aggregate U.S. farm output was about 5.5 times larger in 1990 than in 1890 (an annual average growth rate of about 1.7 percent). The rate of growth of aggregate output was significantly faster after 1935 than during the 1890–1935 period (see figure 2). With the number of farms declining and aggregate output growing, average output per farm (one measure of size) grew rapidly. The average farm size was 1.6 times larger in 1940 than in 1890, but was 8.8 times larger in 1990 than in 1940. Since 1960 farms have also become more specialized in the products or outputs they produce.[34]

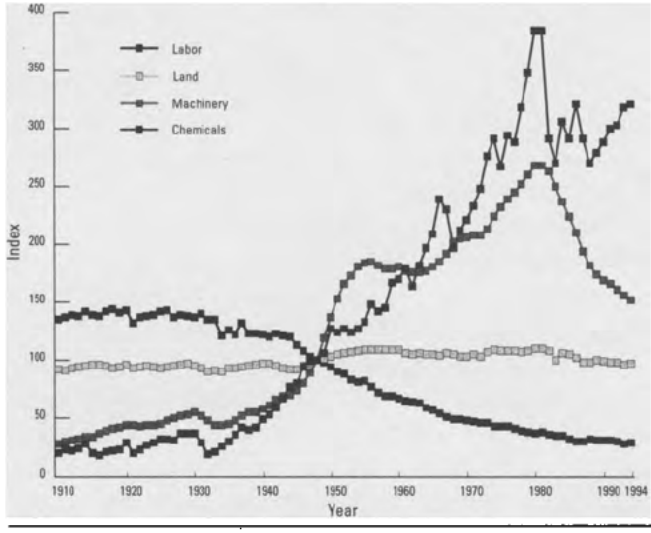
Notably, the index of aggregate real input under the control of U.S. farmers has not changed much over the past century (see figure 2), but the composition of the inputs has changed dramatically. Aggregate real input in 1990 is only slightly larger than in 1890, and larger growth in aggregate output is possible only with large productivity growth or technological change. Figure 3 displays trends in labor, land and building, farm machinery, and chemical use in agriculture from 1910 to

Figure 2. U.S. (Real) Farm Output, Farm Input, and Total Factor Productivity, 1889–1990



Source: Adapted from Huffman and Evenson, *Science for Agriculture*, 183.

Figure 3. U.S. Aggregate Farm Input Use, 1910–1994 (1948=100)



Source: For 1910–1948, from Ralph A. Loomis and Glen T. Barton, "Productivity of Agriculture," U.S. Department of Agriculture, *Tech. Bulletin* (1238) (April 1961); for 1948–1994, from *Economic Report of the President, 1997* (Washington, D.C.: U.S. Government Printing Office, 1997), Table B-98.

1994. These data show a strong decrease in labor use, especially after 1950, and the changes are generally parallel to the reduction in the number of farms. At the same time, machinery and chemical input use increased; the land and buildings input remained largely unchanged over time. With relative input price changes that have occurred over this period, Gardner concludes that the large reduction in labor use in U.S. agriculture can only be explained by labor-saving technological change; that is to say, the new technologies generally use less labor to produce a given quantity of output at any given relative input price.[35]

Although the trend in labor use in U.S. agriculture is strongly negative, labor's share of production costs does not show a similar trend because real wage rates have been rising. The picture is further clouded by some estimates of factor cost shares that either ignore or grossly undervalue the time farm operators and other unpaid farm family members spent in farm work.[36] However, if we value operator and unpaid family labor on an opportunity-cost basis and piece together information from a couple of studies that use roughly similar methodology, a fairly clear picture emerges. During 1910–1946, labor's share of production costs in agriculture was between 55 and 62 percent without a strong trend. By 1948, the share was about 43 percent and trended downward to about 29 percent by the mid-1950s; from the mid-1950s to 1980, labor's cost share in agriculture remained largely unchanged.[37] Thus, it seems safe to say that labor's cost share in U.S. agricultural production has been cut by 50 percent over the past century.

Agricultural production in the distant past was relatively labor intensive, but relentless technological change has changed all that. Much of the work has been mechanized or automated, extensive seed-bed preparation for field crops has been replaced by no-till planting, and modern pest control is accomplished by a combination of chemical, pharmaceutical, and biotechnical methods.[38] Furthermore, new information technologies using computers, satellites, sensors, and geographical information systems have greatly advanced measurement possibilities for collecting data with spatial and temporal dimensions for physical and environmental conditions, input use, and crop

yields in agriculture.[39] Compared to fifty or a hundred years ago, today's farmers spend relatively more time in planning, analyzing, and managing their farm business and less in field work and livestock care. Hence, information acquisition and analytical and decision-making skills that are made possible with higher levels of formal schooling are increasingly important to successful U.S. farmers.[40]

Changes in agriculture have also benefited the rest of the U.S. economy. The share of the U.S. labor force that was employed in agriculture was relatively large, 43 percent, in 1890. In 1910 it declined to 31 percent and to 21.5 percent in 1930. In 1950, 11 percent of the labor force was employed in agriculture, and the decline continued to 2 percent in 1990. Hence, a century ago only 57 percent of the U.S. labor force was nonagricultural; now it is more than 98 percent. Real prices received by U.S. farmers for their products have also *fallen* over this time period. For the period from 1948 to 1989, prices received by farmers for crop and livestock products relative to the general price index *declined* at an average rate of 1.9 percent per year.[41] If we consider the period from 1910 to 1989, excluding the World War I and II years, real prices received by farmers declined at an average rate of 1.5 percent per year—which translates into large consumer welfare gains. Thus, the long-term decline of the share of the U.S. labor force in agriculture and of real prices received by farmers is largely due to the relatively rapid increase in agricultural productivity that shifted the supply schedule for farm outputs to the right faster than the demand schedule for farm outputs was shifting from the effects of population and real income growth. Furthermore, the productivity gains in agriculture that made possible a dramatic reallocation of the U.S. labor force and a decline in real food prices greatly aided the growth of cities and made possible a rising standard of living for the U.S. population.[42]

U.S. SCHOOLS: LESSONS FROM THE SCIENCE OF AGRICULTURE

The past performance of U.S. public schools, especially since 1960, stands in stark contrast to that of U.S. agriculture. A school is an institution that produces local public services (i.e.,

the schooling of children in a relatively small geographic area), which has varied in size over time and cross-sectionally. Competition among schools is limited significantly by children being tied to a limited choice of schools within a short distance of their parents' home. Formal schooling is part skill creation, part local culturalization, and part screening, and the relative importance of these components differs across countries, through grade levels, and over time.

Starting in about 1983, several reports detailed the declining performance of American schools.[43] Although there has been much discussion of the state of American schools and some experimentation with curriculum, class size, teacher training, school size, school choice, and similar variables, the consensus is that little fundamental improvement of American schools has occurred,[44] and furthermore, that the scientific knowledge base upon which decisions are being made is weak and poorly constructed.[45]

The problems of U.S. schools and schooling seem to be related to the problems of schools and schooling in other English-speaking, high-income countries (particularly the United Kingdom and Canada). U.S. schools, however, face some special problems associated with ghetto (note the avoidance of using "high population density" or "urban") life-styles. One common dimension of the problem of these public schools lies in unresolved issues about teaching methods. This arises from a failure of the educational R&D system to adequately formulate and test hypotheses about learning and teaching in schools and to build a stock of verified hypotheses (that is, the scientific knowledge base for schooling) that could help guide good schooling policy, school administration, and those involved in setting schooling policy. Indeed, it would seem that precisely the lack of such a knowledge base would tend to encourage school policymakers, educators, and parents alike to demand good information—and to proceed cautiously in making changes in the absence of conclusive evidence on the superiority of "new" teaching methods.

To simplify and focus the discussion, I emphasize a dichotomy between "progressive" and "traditional" teaching methods. Although they came into use without strong scientific evidence of their superiority, traditional methods of teaching and school

organization evolved over approximately a century of experience in elementary and secondary schools. Thus, they were largely a set of methods based on the refined art of teaching (that is, what seemed to work relatively well in a wide range of school locations) rather than the science of teaching or learning.

Although my characterization of competing teaching methods will undoubtedly do injustice to the teaching profession, teacher-training colleges, and educational philosophers, it will help fix ideas for the comments to follow. Under "traditional" teaching methods, learning is directed by the teacher (rather than the student), typically in whole-class learning activities for classes of relatively "equal" ability students. Teaching is systematically focused on important subjects. Students are in particular directed to learn basic knowledge, including arithmetic operations, phonics, grammar, and punctuation. Teachers' expectations of students are relatively high, grading standards are stringent, and students from sixth grade on are expected to complete regular homework assignments and to perform well on formal and standardized tests.

Under "progressive" teaching, which has its origins in the 1960s and early 1970s, teaching is primarily "child-centered learning by discovery." Students choose when and where to proceed in discovery. Classes consist of "mixed" ability students, and teaching is largely helping students choose individualized or small-group projects to complete and helping them with issues that arise. No emphasis is placed on teaching or learning important basic knowledge like phonics, grammar, punctuation, and arithmetic, or on information organized around subjects. Teachers' expectations of students are relatively low, grading standards are informal or loose, homework is not regularly assigned, and students do not take formal or standardized tests.

The attempt to replace traditional teaching methods in public schools with progressive teaching methods over the past three decades reflects the unscientific nature of school administration, teacher education, and research in education and schooling. Before the 1960s, teacher colleges and teaching methods had a strong ideological bias in favor of egalitarianism and against streaming or forming relatively homogenous ability groupings of students (even when student populations were

large enough to permit forming them). This schooling philosophy seems never to have had a strong scientific basis, is socially cost-inefficient, and may have become a hindrance to recent progress in public schools. Furthermore, it contradicts the trend in successful modern industrial production practices where homogenous inputs are a key factor in the quality control of the output and in keeping costs of production low.

With roughly thirty years of time over which to accumulate strong evidence on various components of progressive teaching methods developed from Dewey, Piaget, Clegg, and others, the empirical evidence remains weak for widespread use of the following practices in public schools: mixed ability classes (versus grouping students by ability and streaming of students); child-centered learning by discovery (versus whole-class teaching and teacher-directed learning); wide-ranging, unstructured projects (versus material organized around individual subjects and essential knowledge); and children progressing at their own pace through distinct phases of learning, without teachers trying to speed up the pace (versus teachers having high expectations for students' achievements and intervening with active teaching methods).[46] In support of traditional methods, new research has shown that stringent grading standards and assigned homework are having a strong positive effect on the performance of U.S. schoolchildren.[47]

Why is there a weak scientific base to teaching methods? Education or schooling research now has a major advantage over agricultural research of a century ago because of the accumulation of a large body of core scientific knowledge and well-developed methods of experimental design and statistical methods, a dramatic fall in the price of data storage and computing, and a large number of individuals being trained at the Ph.D. level in related fields who could conduct schooling research, given the right incentives. Although science in general advances by providing researchers with the widest possible range of channels to discovery, critical evaluation of research output for the quality of discovery is absolutely essential, including its application of rigorous methods, logical reasoning, and strength of evidence for or against well-formulated hypotheses. Otherwise, the research does not accumulate over time

into a stock of useful knowledge. Hence, schooling research must greatly strengthen its scientific quality.

Schooling research and teacher education, however, seem to have been disadvantaged relative to agriculture by the establishment of public state teacher colleges often separate from the research-oriented public state universities. A key attribute of the evolution of higher education in the United States during the twentieth century was the linking of the *diffusion* of knowledge closely to the *creation* of knowledge.[48] In this process, a university, a collection of colleges and possibly professional schools, became a production center where the research of one part enhanced the teaching and research of other parts. Thus, colleges within a university came to have a significant comparative advantage over free-standing colleges, including teachers' colleges, because they could exploit technical complementarities among their various components. Thus, the early state politics of instructional location may over the long term have placed schooling research at a major disadvantage for obtaining easy access to important advances in related sciences and scientific methods.

Schooling research, like agricultural research, must also carefully distinguish in its research and recommendations between methods that might work well under highly controlled experimental conditions and those that seem likely to work well when widely applied in the field—that is, broadly across a variety of public schools—given heterogeneity in teachers, students, and local needs for skills. In agriculture, new technologies that are unprofitable or marginally profitable are never widely adopted and do not change agricultural productivity. Although schools do not face price competition like farmers, schooling research should focus on discovering and recommending new methods that are grossly better than traditional ones, methods that can improve the performance of schoolchildren and graduates of secondary schools. This is the primary way of insuring that new recommended methods will significantly improve schooling quality (or reduce cost). Furthermore, feedback is needed from school administrators and teachers about what seems to work well and what does not work. When discoveries of new superior teaching methods are made, a major information dissemination

effort is needed to help school administrators and teachers understand the new methods and possibly overcome suspicion of their merits and motivations. Thus, research to develop successful teaching methods for public schools needs some teacher and school administrator input into the design, and considerable resources must be devoted to disseminating information about how and when to use them. Teachers, like farmers, are not trained in scientific research methods and cannot be expected to conduct original schooling research, although they may usefully participate in it.

When schooling research discovers superior new teaching methods, it makes some past discoveries and methods obsolete. Thus, although progressive teaching methods may have always been inferior for widespread use in public schools, a return to traditional teaching methods will not be the long-term solution to superior teaching methods either. Hence, successful research creates obsolescence and the need for selective change in schooling as in agriculture.

The impact of agricultural research and its credibility was undermined in the early years when different research institutions produced conflicting findings. Research into education and schooling that is poorly designed, executed, and evaluated does little to improve the quality of teaching, and to the extent that inferior new teaching methods get adopted by schools, they most likely lower schooling quality and the achievement of schoolchildren. They may also eventually undermine public confidence in new teaching methods and possibly in public schools.

As new legislation has strengthened intellectual property rights to innovations, the private sector has found it profitable to undertake a broader range of agricultural research and development activities. This has provided competition for public agricultural research institutions.[49] The public sector continues, however, to be an important funder and performer for research in pretechnology and general or core sciences. With public confidence in U.S. public schools being undermined by the implementation of questionable teaching and school-administration practices, and with changes occurring in the distribution of tastes for schooling and extracurricular activities by parents,

political interest groups have successfully won new state and federal legislation that enables new "schooling" institutions (e.g., home schooling, charter schools, sectarian schools) to operate. These new institutions, along with the existing private (largely church-affiliated) schools, seem poised to train an increasing share of the school-aged students during the next decade. Although this competition may weaken public schools in the short term, it seems likely to create the incentives needed to make the public-school systems in the United States undergo additional soul-searching and perhaps lead them to increased demand for high-quality research and information on schools and schooling. Over the long term, the public schools can become stronger. However, it seems unfortunate that poor decisions about teaching and school administration practices have caused so many needless changes.

Schooling quality is an important attribute of a year of schooling, but it is difficult to judge. In the United Kingdom, the public's dissatisfaction with schooling quality reached the point in 1988 that new legislation was enacted establishing a national curriculum and accompanying national tests for pupils aged seven, eleven, and fourteen.[50] This legislation represented a major attempt to establish common performance standards by which all students and schools could be evaluated. In 1991 the British Ministry of Education conducted an evaluation of alternative teaching methods and concluded that learning-by-discovery was failing badly in primary schools. In response, the ministry urged a return to traditional teaching methods. To hasten this move, a new inspectorate of public schools, Ofsted, was created in 1992. Its job is to inspect the teaching methods and performance of primary schools, and the inspector has continued a broad campaign against sloppy, progressive-inspired teaching methods.

In the United States there is a long history of local and state control of schooling policy.[51] Although this system served the country well for its first two hundred years, the rapid growth in service-sector employment, the demand for educated labor, and the emergence of a national labor market for individuals with higher education and a high frequency of interstate mobility have greatly changed the political-economic environment

for schooling policy. The appropriate political jurisdiction for making schooling policy may have grown extensively beyond the boundaries of localities and states; state-government control of schooling policy is no longer socially efficient in the United States.

Finally, teacher colleges have for many years entertained a strong ideological bias against grouping and streaming students in public schools. One can speculate that this ideology is also rooted in the unscientific nature of schooling research—that is to say, the inability of schooling researchers to conceptualize and statistically test models of behavior where relationships are complex and outcomes are uncertain or risky. If the classification methods used by school administrators and teachers for grouping students frequently place them in the "wrong" group, there is a socially undesirable cost of grouping or streaming. Research on improved methods for grouping can and should increase the share of "correctly" placed students, but it may involve significant research in the complex area of child development, the production of competencies in young adults,[52] and the adoption of methods from economics and statistics for dealing with decision-making under conditions of uncertainty, including principal-agent models.[53]

Over the long term, technical change in public schooling has been slow, and it sometimes seems to have been technological regress rather than progress. The future international competitiveness of the United States hinges on U.S. schools finding a route to steady technological and institutional progress.

ACKNOWLEDGMENTS

This essay benefited from extensive discussions with Kenneth Wilson and Constance Barsky and from participants in the conference "Stability and Change in Vital American Institutions" at the Ohio State University, January 30–31, 1998. Financial assistance was obtained from the Iowa Agriculture and Home Economics Experiment Station. Journal paper no. J-18111 of the Iowa Agriculture and Home Economics Experiment Station, Ames, Iowa, project no. 3077, supported by Hatch Act and state of Iowa funds.

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The Politics of Innovation

THIS ESSAY PROVIDES A HISTORICAL PERSPECTIVE on the process of innovation in American communications. It is drawn from a larger, ongoing study of communications policy in the post-office department, Western Union, and the Bell System in the formative era that stretched from the adoption of the Constitution to World War I. This period holds special interest for students of innovation, since it witnessed the establishment of a modern postal system as well as the commercialization of the electric telegraph and telephone—three of the most notable improvements in communications technology during the past two hundred years.

It is my hope that this brief account can provide some insight into the innovative process in other complex social institutions, such as primary education. To facilitate comparison, innovation is defined broadly to include conceptual advances as well as technical breakthroughs, and the innovative process is understood to embrace the diffusion as well as the origination of novel methods and ideas.

Communications and education, of course, differ in many ways. Communications has long been one of the most dynamic sectors of American society, while education, with a few notable exceptions, is among the most stable. Nonetheless, several themes in the history of communications would seem to be relevant for educational reformers. These include the inescapability of politics; the indispensability of a broad, uni-

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versalistic mandate; and the instrumentality of competition as a catalyst for change. The history of communications also introduces a note of caution for educational reformers frustrated with the status quo. Even in communications—a realm far *less* hemmed in by societal constraints—the innovative process has never been smooth or straightforward. At the very least, the dynamism of American communications may provide something of a template against which educational reform can be gauged. If a particular innovative strategy failed in communications, it is not likely to succeed in education.

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The earliest—and, very possibly, the most fundamental—innovation in American communications took place in mail delivery. Beginning in the 1790s, the government undertook for the first time to provide a geographically far-flung population with regular, time-sensitive information about commerce and public affairs. Prior to the 1790s, news had been confined to the Atlantic seaboard; by 1828, it had become ubiquitous throughout much of the vast trans-Appalachian hinterland. Almost two decades *before* the commercialization of the electric telegraph, the United States experienced a communications revolution that would exert a far-reaching influence on the pattern of everyday life. In 1832, the respected political theorist Francis Lieber made this point in a compelling way. The modern postal system, Lieber declared in an encyclopedia entry, deserved to be ranked, alongside the printing press and the mariner's compass, as "one of the most effective elements of civilization."[1]

While the American postal system in the early republic almost never receives more than incidental notice from historians, it was in fact the keystone of an elaborate communications infrastructure that included the stagecoach industry and the newspaper press. Indeed, its social effects were so wide-ranging that it can be usefully characterized as a *technological system,* giving it priority—ahead of the railroad and the electric telegraph—as one of the earliest of the great technological systems of the modern age.[2]

Among the outstanding postal administrators in the early republic was John McLean, postmaster general between 1823 and 1829. McLean expanded service, regularized administrative procedures, and instituted a meritocratic personnel policy that, had it not been repudiated by the Jacksonians, might well have become a prototype for the modern civil service. In tribute to McLean's achievement, and to the growing role of mail delivery in American life, President Andrew Jackson officially designated the postal system a government department in 1829. By this time, it was by far the largest organization in the United States.

The single best measure of the growing role of the postal system in the early republic is the rapid expansion in the number of post offices during the first few decades of the new nation's existence. When the Constitution was ratified in 1788, the postal system embraced a mere sixty-nine offices, almost all of which were strung along the Atlantic seaboard in a single North-South chain known today as the Old Post Road. By 1800, the chain had become a network of nine hundred offices; by 1828, over seventy-six hundred. Not until the 1880s would Western Union operate on a comparable scale.[3]

The magnitude of the American achievement is particularly evident if one adopts an international comparative perspective. In the 1830s, there were twice as many post offices in the United States as in Great Britain and over five times as many as in France. In an age in which France had four post offices for every one hundred thousand inhabitants, and Great Britain seventeen, the United States boasted no fewer than seventy-four. European observers were understandably impressed. The American postal system, exclaimed Alexis de Tocqueville following his 1831 trip to the United States, was a "great link between minds" that penetrated into the "heart of the wilderness," bringing enlightenment to all.[4]

The innovativeness of American postal policy owed little to technical breakthroughs in engineering or science. Well into the 1830s, the horse remained the principal motive power. The key postal innovation, rather, was conceptual. Prior to the break with the British crown, American postal policy remained constrained by its fiscal rationale. No achievement garnered colo-

nial postal administrators greater official renown than the amount of revenue that they returned to the treasury. In Great Britain, this fiscal rationale would continue to shape postal policy well into the twentieth century. (Indeed, the British post office would not run its first annual deficit until the 1950s.)[5] In the United States, in contrast, this fiscal rationale was soon supplanted by a capacious commitment to civic education. In a country that claimed to derive its authority from the sovereignty of the people, it seemed self-evident that the citizenry had a right to be well informed.[6] Postal policy in the early republic became a means to this end. As the political theorist Benjamin Rush explained in 1787, the postal system was the "true non-electric wire of government" and the "only means" of "conveying light and heat to every individual in the federal commonwealth."[7]

The educational rationale for postal policy had major fiscal implications. Now that postal administrators were no longer obliged to maximize the revenue they returned to the state, they redirected the postal surplus to various developmental projects. For a time, postal administrators found it possible to fund these projects out of postal revenue. Beginning in the 1840s, however, they began to run up large annual deficits, obliging Congress to make annual appropriations to cover their costs.

It is sometimes assumed that the adoption of an educational rationale for postal policy was an evolutionary development rooted in social circumstances that could be traced back to the colonial era. While plausible, this assumption is mistaken. Like so many events in the history of American communications, this conceptual advance was, rather, unplanned and unforeseen. No one in 1788, let alone 1776, could have anticipated the full magnitude of the changes that were about to occur.

Consider the celebrated *Federalist* essays that James Madison prepared during the ratification debates to help persuade undecided voters to ratify the Constitution in the pivotal state of New York. Though Madison firmly supported a stronger central government, he did not envision an enlarged role for communications. Citizens would learn about the affairs of state not from the press but, rather, from personal meetings with their representative when he returned home to meet his constituents face-to-face.[8] For example, in *Federalist* number 10—

the most important single piece of political theory to emerge from the constitutional debates—Madison treated *poor* communications as a guarantee of political stability. Given the enormous territory that the new republic embraced, Madison explained, it was logistically impossible for tyrannical factions to conspire against the public good. From such a standpoint, communications improvements were not without their potential perils and, as Madison mused at the time in a private memorandum, might eventually drive the republic apart.[9]

Even Benjamin Franklin failed to anticipate the conceptual advance that would undergird American postal policy in the early republic. This was true even though Franklin was an unusually astute student of public affairs, as well as a former royal postal officer who, in the 1760s, had himself introduced various postal innovations. Indeed, Franklin's very familiarity with royal postal policy may well have predisposed him to assume that postal policy in the independent United States would remain broadly similar to postal policy under the Crown. It is perhaps not entirely surprising then that Franklin highlighted the administrative continuities with the colonial era during his brief stint in 1775 as the first postmaster general of the United States.

The new, sweeping rationale for communications policy was institutionalized in the Post Office Act of 1792. Though this law has occasioned little sustained discussion from specialists in the period, and is almost invariably omitted from textbook accounts, it deserves to be remembered as a landmark in American communications policy and one of the most significant pieces of legislation to have been enacted in the early republic. The text of this act includes no ringing phrases to invite historical scrutiny. Yet it established two principles that would soon restructure American communications in a fundamental way.

The most important of these principles invested Congress, rather than the executive, with the authority to establish new postal routes. Since Congress could be expected to be more responsive to local pressure than postal administrators, this principle virtually guaranteed that the postal network would rapidly expand from the Atlantic seaboard into the trans-Appalachian West. To this day, in the National Archives there are

thousands of petitions to Congress that testify to the determination of ordinary Americans to improve their access to news from afar. "We recommend that a post be established to our district and county towns," declared one group of South Carolinian petitioners in 1793, since such communications were the "soul of commerce!" Lacking such a "direct, regular, and immediate communication by posts," the petitioners explained, they were "kept in ignorance," and "know not anything which concerns us, either as men or planters."[10] Before long, ordinary Americans came to assume they had a *right* to be linked to the communications network, regardless of the cost. In some instances, as critics did not fail to point out, this led to the establishment of routes that could not bear one-hundredth of the expense.[11]

The second principle provided a series of targeted subsidies for the press. Not only did Congress admit newspapers into the mail—a major departure in its own right from colonial and revolutionary practice—but it also permitted them to be transmitted at highly favorable rates. In addition, Congress formalized a long-standing convention that enabled newspaper editors to gather news at a minimal cost. The results were predictable. During the early republic, newspapers typically made up as much as 95 percent of the weight of the mail, while generating a mere 15 percent of the revenue. Interestingly, this subsidy troubled few contemporaries, in part because, in this period, newspapers were the *only* item that the vast majority of postal patrons received.[12]

Taken together, these various principles enshrined *universal access* as a defining feature of American communications policy. Public figures in the early republic may not have termed this mandate "universal service," yet it anticipated in several regards the corporate philosophy that would later be championed in the Bell System by Theodore N. Vail.

To accommodate the expansion in mail volume that had been set in motion with the Post Office Act of 1792, postal administrators established a stagecoach-based, hub-and-spoke sorting scheme that involved the creation of a network of distribution centers overseen by a team of middle managers. This organizational innovation proved surprisingly enduring and lasted until

the Civil War, when it was supplanted by the train-based, continuous-sorting scheme that came to be known as railway mail. For a time, Congress even underwrote the establishment of a rudimentary national stagecoach network by awarding highly advantageous mail contracts to stagecoach proprietors. According to one estimate, the stagecoach industry soon came to rely on postal contracts for as much as 33 percent of its total revenue.[13] "Having obtained the mail contract from Milledgeville to Montgomery, Alabama," announced one typical broadside in 1826, the proprietors would soon establish a stagecoach line to transport passengers between these two towns.[14]

So long as the postal system remained self-sustaining, the cost of the various cross-subsidies was borne by letter writers—and, specifically, by merchants and the well-to-do. Prior to the passage of the Post Office Acts of 1845 and 1851, which significantly reduced the basic letter rate—ushering in what reformers hailed as the age of "cheap postage"—it could cost as much as 50 cents to mail a single letter, a substantial sum in an age when many Americans made $1 a day. Not surprisingly, as late as the 1830s, congressmen could matter-of-factly proclaim high letter postage to be *popular*—since, by subsidizing newspaper carriage and rural mail routes, it benefited the many at the expense of the few.[15]

One of the unanticipated consequences of these cross-subsidies was the incentive they offered entrepreneurs to underbid the government on selected routes. In the period between 1839 and 1851, a number of enterprising individuals—including William Harnden, Henry Wells, and James W. Hale—established independent mail-delivery firms that competed head-on with the post-office department, providing postal patrons with a comparable, and, in many instances, superior level of service for a significantly lower fee. The independents also introduced a number of innovations that were subsequently adopted by postal administrators, including mandatory prepayment, mail boxes, and postage stamps.

Why these firms emerged at this time, and not earlier, is an open question. Yet the competitive challenge that they posed was unmistakable. At the height of the independent mail-delivery boom in 1845, as many as two-thirds of all the letter mail in the

country was being conveyed by nongovernmental carriers—or, as the phrase went, "outside of the mail."[16] In the entire history of the U.S. Postal Service, postal administrators have never faced a more formidable threat. In response, Congress passed the Post Office Acts of 1845 and 1851, which mollified postal patrons by significantly lowering the basic letter rate and fortified the postal monopoly by plugging the legal loopholes that the independents had so successfully exploited.

It is something of a puzzle why so many subsequent postal innovations—including city delivery, railway mail, rural free delivery, and parcel post—lagged behind their counterparts in Europe. Equally perplexing is the repeated failure of reformers to expand the jurisdiction of the post-office department to embrace telegraphy and telephony, as was common in much of the rest of the world. After all, in the early republic the American postal system had been innovative in a number of realms. Why did this trend not persist throughout the rest of the century?

At least part of the answer can be traced to the extraordinary sensitivity of American political leaders to the specter of political corruption. Public figures of all political persuasions deplored the partisan manipulation of public office, stymieing reformers intent on expanding the government work force. Jacksonian party leaders galvanized this concern by lavishing an unprecedented number of postmasterships on political supporters, institutionalizing the notorious "spoils system" that would undergird federal hiring practices until well after the Civil War. Indeed, to an extent that is often overlooked even by specialists in the period, the creation in the 1830s of the mass party—and, with it, the modern two-party system—owed a major debt to the *prior* expansion of the postal system in the period before 1828.[17]

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The specter of corruption played an equally conspicuous role in the early history of electric telegraphy. In particular, it helps to explain why this major technical breakthrough—the first communications technology to be based on electricity—came to be

administered as a private enterprise. In the deregulatory climate of the late twentieth century, this outcome may seem unsurprising. A century ago, however, it set the United States apart. In this period, the United States was the *only* major industrialized country in which telegraphy was administered by a private corporation rather than a public agency. Yet if the inventor of the telegraph, Samuel F. B. Morse, had had his way, the United States would have diverged less markedly from the European norm.

Morse's approach to telegraphy was shaped by his familiarity with the optical telegraph that had been invented by Claude Chappe in the 1790s in revolutionary France. Chappe's telegraph consisted of a chain of towers—located, on average, ten miles apart—fitted with a pair of wooden shutters that could be arranged in a variety of positions. By manipulating the shutters, operators could transmit in just under three minutes a rudimentary message from Paris to Lille, a distance of 100 miles. Most early messages were government dispatches; during most of its history, the French government prohibited ordinary individuals from using Chappe's telegraph at all. Chappe coined the term "telegraphy"—which meant, literally, "writing at a distance"—to describe his invention, even though it was not, strictly speaking, a *recording* medium. The optical telegraph proved invaluable to Napoleon, who used it to coordinate military campaigns, and it remained a mainstay of French communications for almost fifty years. Along with the guillotine, it deserves to be remembered as one of the principal technological innovations to have been spawned by the French Revolution.[18]

Morse's telegraph resembled Chappe's in several ways. Like Chappe's, it relied on relays to transmit signals over long distances. Chappe's relays were human; Morse's, automatic. French telegraph administrators referred to their human relays as "mutes"—which they were, quite literally, since the government employed deaf people to staff the intermediate towers that were located in between the stations at which messages were sent and received.

Chappe's example also influenced Morse to prepare a dictionary code to translate words and phrases into a numeric form. Like Chappe, Morse assumed that it would take far too long to

transmit messages letter by letter. Only hesitantly—and at the prodding of his assistant, Alfred Vail—would Morse switch to the dot-and-dash alphabetic code that to this day bears his name and that has been used by telegraphers ever since.

While Morse was well aware of his indebtedness to Chappe, he took pains to highlight the distinctiveness of *his* invention. First, Morse contended, it facilitated continuous, twenty-four-hour transmission, in contrast to the optical telegraph, which was restricted to the daytime and good weather. Second, it made it possible to record messages in a permanent form—making the electric telegraph, as it were, the first *true* telegraph. Morse believed this feature of his invention to be a compelling advantage, and went so far as to suggest that operators could record incoming messages in bound books, if this were desired.[19]

Perhaps the most startling difference between Morse's telegraph and Chappe's stemmed from Morse's ideas regarding public policy. Like Chappe, Morse assumed that the government would play a prominent role in telegraph regulation, and lobbied hard to persuade Congress to purchase his patent outright. Wary of unregulated competition, Morse hoped in this way to ensure that his invention would be commercialized in a socially responsible manner. Should the electric telegraph be left in the hands of "speculators" who might "monopolize it for themselves," Morse warned, it could easily become the means of "enriching the corporation at the expense of the bankruptcy of thousands."[20] Unlike Chappe, however, Morse rejected the notion that his invention would be used primarily for government dispatches. The electric telegraph, Morse posited, was but "another mode" of accomplishing the "principal object" for which the postal system had been established, "to wit: the rapid and regular transmission of intelligence."[21] Accordingly, he intended it to be open to the public at large, a policy he regarded as "more in consonance" with the "political institutions under which we live."[22]

Morse's faith in government control was widely shared. In an age in which no individual business enterprise could match the administrative capacity of the central government, it made sense for reformers to look to the state to oversee such a

potentially vast undertaking. In the 1830s, for example, New York harbormaster Samuel Reid urged Congress to establish a 1,200-mile line of optical telegraphs between New York and New Orleans. Reid proposed that this enterprise be overseen by the post-office department, which, he believed, would help to guarantee the sanctity of the messages it transmitted. Though Congress never built Reid's line, his project had the support of many prominent public figures, including Postmaster General Amos Kendall, who hailed it as "just the thing" to supplant a horse express that he had established on the same route to carry the mail.[23]

Morse's commitment to government control led him in 1843 to secure a federal grant to build a forty-mile telegraph line between Washington and Baltimore. Morse completed his line in 1844; in the following year, he secured its transfer to the post-office department, where it would remain until Congress abandoned the idea of a government telegraph in 1847.

While Morse favored government ownership of his telegraph patent, he opposed the establishment of an exclusive government monopoly. Fearful of the "vast mischief" that such a powerful institution might come to exert, Morse recommended, as an alternative, that Congress lease the rights to various routes for a specified sum, promoting in this way a "general competition." Such an arrangement, Morse hoped, would combine the advantages of private initiative and public oversight. It also promised to raise a good deal of money. Should the government take the new technology "solely under its own control," Morse predicted, the income derived from the leases alone would be of "vast amount."[24]

Had circumstances been different, Congress might have established a practical leasing arrangement, or conceivably even a government-administered system. Whig presidential contender Henry Clay publicly supported government control of Morse's invention, as did Democratic postmaster general Cave Johnson, albeit with the reservation that he did not see how a government telegraph could ever cover its costs.[25]

Notwithstanding a solid base of bipartisan support, Morse failed to prevail upon Congress; much to his chagrin, he presided over the privatization of the new technology. The reasons

for Morse's failure are complex, and included bad luck, technical setbacks, personality conflicts, and a tacit refusal on the part of Congress to increase the patronage that would be at the disposal of the party in power.

Once it became evident that Congress had no intention of purchasing Morse's patent a swarm of entrepreneurs entered the field, and the American telegraph industry was born. Just as Morse had feared, he had inadvertently unloosed a competitive maelstrom, or what one telegraph historian has termed an era of "methodless enthusiasm."[26] Industry leaders like Hiram Sibley did their best to bring some order to the confusion: first by instituting a series of pooling arrangements in the 1850s; then by cooperating with the Union army during the Civil War; and, finally, by merging several regional firms into Western Union, which emerged in 1866 as the first nongovernmental institution to operate on a truly national scale.

The rise of Western Union did not go uncontested. Troubled by its high rates and limited geographical scope, industry critics lobbied to bring it under federal control. Though these efforts proved almost entirely unsuccessful, they did hasten the passage of the Telegraph Act of 1866, which granted Congress the authority to purchase, at a mutually agreeable price, the assets of every telegraph company in the United States that agreed to be bound by its terms. In return, the law gave consenting firms the right to erect telegraphic lines on any postal route in the country, a valuable privilege in an age in which the individual states continued to exercise a broad range of powers over their internal affairs. This agreement proved acceptable to most of the leading firms in the industry, including Western Union, whose officials came to hail it as a contractual guarantee that its shareholders' rights would be duly respected.

Interestingly, Western Union's critics generated little support among the merchants and manufacturers who were the principal users of the new technology. From their standpoint, speed and accuracy—and not cost and access—were the overriding concerns. So long as Western Union transmitted time-sensitive commercial information quickly and accurately between the leading commercial centers, which Western Union did reasonably well, its business customers had little cause for complaint.

For industry critics, this was precisely the problem. "As a telegraph for business, where dispatch is essential and price is of little account," declared Massachusetts lawyer Gardiner Greene Hubbard in 1883, "the Western Union system is unrivaled; but as a telegraph for the people it is signal failure."[27]

Industry critics often contrasted Western Union's narrow, business-oriented focus with the much broader mandate of the post-office department. In urging a government takeover of the industry, Wisconsin Congressman Cadwallader C. Washburn in 1869 posited that the cost of a telegram should be low enough that telegraphy, like letter writing, could be accessible to the poor. Why, he asked rhetorically, should it cost an immigrant servant girl in Illinois a week's hard labor to telegraph a ten-word greeting to her friends back in New York?[28] "The telegraph office holds the same relation to the educational interests of the people that the post office does," postulated Iowa Congressman Frank W. Palmer in 1872. "Yet the telegraph office is established only where it seems to be the pecuniary interest of its shareholders that it should be established. This policy, in a country of unexampled enterprise and progress in other respects, is a mockery of the whole genius of our people."[29]

Western Union officials rebutted these arguments in various ways. Almost invariably, they conceded Congress the right to buy them out under the terms of the Telegraph Act of 1866—provided, of course, that their shareholders were properly reimbursed. Yet they consistently opposed the establishment of a government-subsidized "postal telegraph" that would compete with them head-on. Competition, even more than government ownership, was their *bête noire*. This was true even though, as Western Union officials occasionally acknowledged, competition *had* not only forced major rate reductions but also significantly expanded the industry's geographical scope.

Should Congress nationalize the industry, Western Union officials warned, the consequences would be unfortunate. Every European government ran its electric telegraph at a loss, as Western Union president Norvin Green observed in 1883. Should Congress require the industry to lower its rates and expand its facilities, it would have no choice but to subsidize its opera-

tions. Yet since far more Americans paid taxes than sent telegrams, such a policy would be highly regressive. After all, less than half a million Americans ever sent a telegram, far fewer than mailed a letter or received a newspaper that had been sent through the mail.

Green also warned of the potential political dangers of government control. In monarchical regimes, he observed, the government monopolized the telegraph in order to protect it against the "plots and schemes" of "disaffected and opposing elements or parties."[30] Such a repressive policy, however, had no place in the republican United States. Should the government nationalize the industry, Green warned, it might well exert a corrupting influence over the electoral process, particularly if it augmented the insidious influence that postal patronage had already come to exert. The "genius of our government," Green postulated, is that the "people rule." And, at least for the present, public sentiment was "adverse" to the "administrative power" having any such advantage in "directing or controlling the popular will."[31] Elaborating on his position a few years later, Green remarked that, if it could indeed be demonstrated that telegraph rates *were* lower in Europe—a perennial debating point that Green refused to concede—this could be explained by the determination of European governments to "reconcile the public" to the "enormous engine of power and espionage" that the government telegraph had there become.[32]

Far more successful than industry critics in shaping Western Union's business strategy were its many business rivals. Western Union was particularly vulnerable to competition in the intra-urban market, where barriers to entry were low. Even in its long-distance telegraphy, it was repeatedly challenged by upstart rivals, of whom the most formidable was the financier Jay Gould.

Gould's strategy rested not in his superior technology—for he had none—but rather on an artful combination of financial daring and political clout. Twice in the late 1870s, Gould cobbled together a rival telegraph network that Western Union officials found prudent to buy out, at a heavy cost, in order to avoid a full-scale rate war. "No one knows better than Gould," explained an exasperated Norvin Green during the midst of the

first of these struggles, "that an opposition telegraph in this country cannot be made a success as a business enterprise."[33] Still, Gould's challenge *did* force Western Union to drop rates and expand and improve service for its clientele.

In certain circumstances, Western Union officials took the lead in encouraging innovation. In the 1870s, for example, Green's predecessor William Orton aggressively sponsored inventors who promised to increase the carrying capacity of its telegraph lines. At the time, no wire could transmit more than one message in a single direction at a specific moment. To overcome this obstacle, Orton purchased the rights to a novel telegraphic apparatus that had been patented by Joseph B. Stearns. Stearns's invention made it possible to transmit two messages simultaneously over a single wire, doubling its capacity. Orton hailed Stearns' duplex as the most important innovation in electric telegraphy since Morse's original invention; by 1872, an improved version was widely used on Western Union's lines throughout the United States.[34]

Orton regarded ownership of Stearns' patent as a valuable competitive weapon. To protect his investment, he patented as many similar inventions as he could. Toward this end, Orton hired Thomas A. Edison, then a still-youthful tinkerer best known as the inventor of a stock ticker. By putting Edison on his payroll, as Orton explained to Stearns, Western Union would be able to "anticipate other inventors" and also to patent "as many combinations as possible."[35] Edison was rather more candid. Orton had hired him to work on the duplex, as he later testified, "as an insurance against other parties using them—other lines."[36]

Orton's decision to hire Edison led, unexpectedly, to the invention of an acoustic or quadruplex telegraph, a device that could transmit *four* messages on one line simultaneously, two in each direction. Though Orton had subsidized Edison's quadruplex research, he somehow failed to acquire for Western Union the necessary patent, and, for a time, Edison dangled his invention before Western Union's competitors, including Jay Gould.

The quadruplex debacle was the final chapter in Western Union's brief experiment in the active sponsorship of new technology. Under the leadership of Green, who became president

shortly after Orton's death in 1878, the firm returned to its prior strategy of purchasing promising inventions on the open market. Lacking a firsthand knowledge of electrical technology and convinced that the telegraph industry had become technologically mature, Green assumed that Western Union's control of key duplex and quadruplex patents guaranteed it a dominant position in the field.[37]

Green's conservative business strategy shaped his decision in November 1879 to cede the nascent telephone industry to William H. Forbes, the president of a small and struggling start-up firm that was then known as National Bell. Had Western Union remained in telephony—then an infant industry but a mere three years old—it might well have emerged as a leading player. Western Union controlled several key telephone patents, had a major ownership stake in one of the country's leading manufacturers of electrical equipment, and owned the American Speaking Telephone Company, which ran successful telephone exchanges in several cities, including New York and Chicago. Yet Green preferred to compromise, and, after extensive negotiations with Forbes, turned Western Union's telephone patents over to National Bell in return for a seventeen-year royalty on every telephone that National Bell leased and a monopoly over interurban telegraph messages originating in National Bell's local telephone exchanges. Since at this time telephony was confined to a geographical range of approximately 30 miles, Green believed that he had struck an excellent bargain. Henceforth, Western Union would focus on the long-distance communications market, and Bell on the local loop.[38]

To this day, it is by no means certain why Green gave up on the telephone. Green's official correspondence makes it plain that he fully recognized its commercial potential and, especially in his earliest negotiations, had much confidence in Western Union's patent position. Though Green's negotiations with Forbes *did* occur during the same months that Green was immersed in a fierce competitive struggle with Gould, there are few hints in Green's correspondence that Gould's threat influenced Green's decision to sell out. Far more important was Green's revulsion at the prospect of a competitive struggle. "I have had much difficulty" in winning the consent of my associates, Green

confessed to Forbes, shortly before they closed the deal, since, among other things, Green's associates had been legally advised that "we shall have less difficulty in continuing the use of our telephones than you will in yours." Yet, Green added, in the end Western Union and its allies were willing to concede a portion of what they "firmly believe they are entitled to" for the "sake of peace and harmony" and to "avoid the trouble, loss, and expense of a wasteful competition."[39]

Equally shortsighted was Green's decision three years later to sell to Forbes Western Union's controlling interest in Western Electric, the principal manufacturer of Western Union telegraph equipment. Once again, Green defended the spin-off as simple common sense, since, as he explained to an associate, "everything in our line that we manufacture costs us more than we could buy it for."[40] Yet from the standpoint of hindsight, it was another major missed opportunity. Within a few decades, Western Electric would evolve into Bell Labs—one of the leading research facilities in the modern world—while Western Union would suffer the indignity of being taken over in 1910 by AT&T, the successor firm to Forbes's National Bell.

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The early history of telephony demonstrates how a different, more expansive business strategy could, under the right circumstances, hasten the rise of what would become, by World War I, one of the largest and most innovative institutions in the country. The origins of AT&T date back to February 1876, when Western Union scourge Gardiner Greene Hubbard secured a patent for a novel communications device that had been recently invented by Alexander Graham Bell.

Hubbard initially had little interest in Bell's experiments in telephony. As a keen student of telegraphy, however, he recognized that Bell's research in voice transmission had great relevance to the quest for an acoustic telegraph—which, like a quadruplex, could transmit multiple messages over a single wire. When, in 1874, Hubbard learned that no patent for an acoustic telegraph had yet been issued, he urged Bell to turn his energies in this direction.[41]

To Hubbard's chagrin, Bell had little interest in acoustic telegraphy and continued to experiment with voice transmission. A teacher of the deaf, he hoped to devise a means to improve their ability to communicate. Among his pupils was Hubbard's deaf daughter, Mabel, with whom he had fallen in love and who he hoped to marry. Hubbard begrudgingly conceded the merits of Bell's invention, and when Bell devised a workable telephone, Hubbard secured him two key patents. In July 1877, Hubbard organized the Bell Telephone Company to exploit the telephone commercially. Two days later, Bell married Mabel in Hubbard's front parlor. According to a well-known and very likely apocryphal story, the previous fall Hubbard had offered to sell Bell's first telephone patent to Western Union president William Orton for $100,000. Only when Orton refused—or so the story goes—did Hubbard turn his attention to transforming the Bell Telephone Company into a viable business enterprise.[42]

The telephone industry, like the telegraph industry before it, crystallized around the control of key patents. None were more important than the two patents Hubbard secured for Bell. In the period between 1876 and 1894, when the Bell Company enjoyed a patent monopoly, Bell lawyers won over six hundred infringement suits, giving the fledgling firm a major competitive boost.

Hubbard's business strategy combined a vigorous defense of patent rights with the energetic recruitment of agents to set up operating companies in various localities. To retain a modicum of control over these firms, Hubbard decided to lease, rather than sell, its patented telephone apparatus and to acquire an ownership stake in the operating companies. Typically, Bell licensees solicited subscribers in a relatively small geographical area, such as a city or town, who they then connected to a central switchboard or exchange. Few of the operating companies interconnected, since technical constraints kept telephony's range to about thirty miles.

Hubbard's strategy helped to insure that the Bell operating companies maintained consistent technical standards and a high level of service. Eventually, it would facilitate the creation of the interconnected telephone network that would come to be

known as the Bell System. Early on, however, interconnection remained little more than a visionary dream. Though Bell established AT&T as a long-distance subsidiary in 1885, the vast majority of telephone calls would continue to take place within local exchanges until well after World War I.

Hubbard's influence upon Bell's business strategy declined around 1880, when his leadership was successfully contested by shareholders determined to steer a more fiscally prudent course. Notable successors included E. J. Hall, a key figure in Bell's expansion in the South. Hall did much to institutionalize Bell's distinctive business mindset, which disparaged competition and venerated stability, consensus, operational efficiency, and technical expertise. Hall also cultivated support for Bell technical standards among sympathetic government officials, particularly in state legislatures and state regulatory commissions. Just as the judiciary had shielded Bell from competition between 1876 and 1894, so the state governments helped it to fend off potential challengers between 1894 and World War I. The political entrepreneurship of Bell executives like Hall significantly raised barriers to entry in the industry, since it obliged Bell's competitors to match its high performance standards. In addition, it eliminated the looming threat to Bell's administrative autonomy that was posed by municipal regulation.[43]

Bell executives adopted a selective approach to innovation. The most pressing technical challenge in late-nineteenth-century telephony was what one historian has called the "switchboard problem." As the number of subscribers in a given telephone exchange multiplied, it became progressively *more* expensive to provide customers with a basic level of service—reversing the typical pattern in mass-production industries like steel and automobiles. The larger the number of subscribers, the greater the problem. Several Bell rivals met this challenge by automating the switching process. Bell executives, in contrast, stuck by manual switching. Prior to World War I, virtually every telephone call that a Bell subscriber made required the personal intervention of a highly trained, female telephone operator.[44]

Why Bell proved so reluctant to adopt automatic switching is an intriguing question. Part of the answer is technical: prior to

World War I, no satisfactory method of automatic switching had yet been devised. Yet if Bell executives had made automatic switching a high priority, it seems likely that this technical hurdle could have been more speedily surmounted, as it eventually would be in the 1920s. More fundamental were the social and cultural assumptions that automatic switching undermined. In particular, automatic switching violated the principle of "user transparency"—that is, the notion that telephony should be kept as simple as possible, requiring of subscribers nothing so demanding as the need to dial a number. This assumption reflected the sensitivity of Bell executives to the fact that most telephone subscribers hailed from the middle or upper classes and had come to regard telephone operators as a logical extension of their household staff. The decision to use the telephone—or so these executives assumed—should be akin to ringing a servant to hand-deliver a personal note. "The telephone operator," declared AT&T president Theodore N. Vail in 1915, was the "servant of every subscriber, as though she was in his office or in his direct employ. . . . There never can be, in my opinion, any way devised to get rid of the 'intelligence' which at some point in making up the connection is apt to be required."[45] Not until the 1920s, with the widespread introduction of the dial telephone, would Bell democratize telephony by permitting subscribers to hold a telephone conversation without having to rely on the assistance of operators to make the connection.[46]

Bell executives proved far more committed to solving the problem of long-distance telephony. Here, too, social and cultural assumptions loomed large. Though the market for long-distance telephony remained decidedly limited, Bell executives were driven to secure it by what one historian has aptly termed their "almost irrational commitment" to interconnection.[47] The invention by Bell engineers in the 1880s of the loading coil and in the 1900s of audion, the first vacuum tube, were major steps toward the realization of this goal. So, too, was the advent, in 1915, of telephone service between New York and San Francisco, which demonstrated for the first time the feasibility of telephony on a truly continental scale.[48]

The promise of long-distance telephony may have captivated Bell executives; yet it proved to be extremely expensive and, in large part for this reason, had little appeal for the vast majority of telephone subscribers. What they demanded, rather, was cheap and reliable service within a limited geographical range. The obliviousness by Bell executives to this commercial reality encouraged the rise, following the expiration of Bell's patents in 1894, of a legion of independent telephone firms that offered rudimentary, inexpensive telephone service not only in urban centers, where Bell was already well established, but also in many rural regions that Bell had yet to tap. Independent strongholds included St. Louis, Rochester, New York, and countless smaller cities and towns in the South and Midwest.[49]

It would be a mistake to contend, as some historians have, that the independents alone hastened the creation of the ubiquitous national telephone network that we take for granted today. This goal would not be attained until after World War II and was much facilitated by generous federal subsidies for the establishment of telephone service in rural regions. Yet the independents did greatly expand the market for telephony, even as they confronted Bell executives with a competitive challenge that they had no choice but to meet. [50]

Bell's strategic response to the independents was coordinated by Theodore N. Vail, president of AT&T between 1907 and 1919. Vail's long career with Bell began in 1878, when Hubbard appointed him the first general manager of the Bell Telephone Company. Vail left the firm in 1887 and, after a twenty-year hiatus, returned in 1907 at the behest of a banking consortium led by J. P. Morgan. The Morgan interests had large holdings in Bell securities and looked to Vail to end the threat that the independents posed to their investments. They were not to be disappointed.

The cornerstone of Vail's business strategy was his commitment to universal service. Universal service for Vail meant nothing more, and nothing less, than the connection of all existing telephones; it did not necessarily entail either rate reductions or the extension of telephony into poorly served areas. To popularize interconnection, Vail launched one of the earliest public-relations campaigns in the history of American

business. Its theme was "one system, one policy, universal service," which succinctly expressed Vail's vision of an integrated national telephone network under the supervision of AT&T—which, since 1900, had been the parent company of the various Bell interests.

Like many Bell executives, Vail admired technical efficiency, disliked competition, and placed great faith in systems engineering. Driven by what historians have come to call the "network mystique," he made the continuous pursuit of technological innovation a key corporate goal.[51] To translate these values into practice, Vail promoted various improvements in technical standards, sponsored basic research in telephone technology (including long-distance telephony), and systematized the relationship between AT&T and the various operating companies. To build political support, Vail articulated a novel theory of corporate governance in a remarkable series of public addresses. No longer, Vail declared, would AT&T be administered as a private enterprise for the benefit of its shareholders; henceforth, it was to be a public utility dedicated to the public good.

Vail's strategy proved highly effective. By World War I, it had minimized the challenge posed by the independents and stabilized the value of AT&T's stock. Universal service was the key. Emboldened by Vail's vision of a unified telephone network, AT&T encouraged the interconnection of Bell and non-Bell telephone exchanges, ending the challenge that the independents posed. Moreover, Vail carved out for AT&T an enviable political niche. Under his leadership, the attorney general joined with Bell executives in 1913 to establish ground rules for the industry. This agreement legitimated Bell's dominant market position, forestalled (at least for a time) the threat of antitrust proceedings, and promulgated a set of principles that would structure relations between Bell, the operating companies, and the independents for over seventy years—until the court-mandated breakup of the Bell System in 1984.

How Vail came to his faith in universal service is an intriguing question. One likely source was his firsthand familiarity with the universalistic mandate of the post-office department, where he had worked for a time in the 1870s as superintendent

of the railway mail service. Another possible influence was Vail's uncle, Alfred Vail, one of the key figures in the early history of electric telegraphy and a staunch advocate of government telegraphy. Vail's views were also doubtless shaped by his long friendship with Gardiner Greene Hubbard, who had hired Vail away from the post-office department in 1878. Whatever its origins, Vail's ambitious vision was by no means unprecedented. Indeed, it reinvigorated a long-standing civic tradition in American communications policy that included Hubbard's critique of Western Union, Samuel F. B. Morse's call for government control of electric telegraphy, and Benjamin Rush's vision of a national postal network. By rejecting the narrowly commercial business strategy that had so constrained Western Union, Vail reinterpreted for the twentieth century the expansive rationale for long-distance communications that had first found expression in the Post Office Act of 1792.

* * *

In the period between the adoption of the federal Constitution and World War I, the innovative process in American communications followed no consistent pattern. The most fundamental technical breakthroughs—electric signaling in the 1840s, voice transmission in the 1870s—emerged in highly unusual contexts that provide few obvious lessons for students of innovation today. Equally idiosyncratic was the conceptual advance that hastened the creation of the modern postal system in the years immediately following the adoption of the federal Constitution.

Yet certain themes do stand out that may provide some guidelines for the future. Most major innovations originated *outside of* existing institutions. In telegraphy and telephony, technical breakthroughs spawned entirely new industries. In mail delivery, a conceptual advance invested an existing institution with a sweeping new rationale. The principal exception was long-distance telephony, which, though important later on, had yet in this period to be widely diffused.

Equally instructive is the relevance to the innovative process of what might best be termed the organizational culture. Institutions like the Bell System that defined their mission in broad,

universalistic terms proved to be not only more enduring but also more innovative than institutions like Western Union, which did not. Even the post-office department enjoyed, for a time, a reputation for innovation, even though in the end this proved impossible to sustain. It is hardly surprising that key decision makers at the post-office department and Western Union distrusted innovation. Institutions, after all, tend to resist change. Yet it may prove of some value to recall that, at least in communications, competition could prove a major stimulus for the diffusion of new methods and ideas. This was true even in the Bell System, where executives like Vail had championed innovation as a business strategy. At no point, however, was competition synonymous with an absence of government regulation. Indeed, the history of American communications provides compelling evidence that stability and change need not be necessarily opposed and that highly regulated institutions *can* foster innovation, particularly if their leadership articulates a compelling vision and commands not only the necessary technical and financial resources but also the levers of power.

ACKNOWLEDGMENTS

For suggestions and advice, I am grateful to Kenneth G. Wilson, Constance K. Barsky, David Hochfelder, and Kenneth Lipartito.

ENDNOTES

[1]Francis Lieber, *Encyclopedia Americana,* vol. 10 (Philadelphia: Carey and Lea, 1832), 289.

[2]Richard R. John, *Spreading the News: The American Postal System from Franklin to Morse* (Cambridge, Mass.: Harvard University Press, 1995), chaps. 2, 3. To avoid potential misunderstanding, I refrained in this book from calling the postal system a "technology," since this term is sometimes restricted to mechanical contrivances such as a steam engine or telegraph key. If, however, one follows the example of Thomas P. Hughes and expands the definition of technology to embrace large-scale networks—such as an electrical power grid—then it is entirely appropriate to characterize the postal system in this way. For the more conventional view, see Ruth Schwartz Cowan, *A Social History of American Technology* (New York: Oxford University Press, 1997), 151–152.

[3]David Paul Hochfelder, "Taming the Lightning: American Telegraphy as a Revolutionary Technology," Ph.D. dissertation, Case Western Reserve University, forthcoming.

[4]Alexis de Tocqueville, *Democracy in America,* ed. J. P. Mayer, trans. George Lawrence (1835; 1840; reprint, Garden City, N.Y.: Doubleday & Co., 1969), 384–385, 11.

[5]M. J. Daunton, *Royal Mail: The Post Office since 1840* (London: Athlone Press, 1985), 339.

[6]Richard D. Brown, *The Strength of a People: The Idea of an Informed Citizenry in America, 1650–1870* (Chapel Hill: University of North Carolina Press, 1996), chap. 4. See also J. R. Pole, *The Gift of Government: Political Responsibility from the English Restoration to American Independence* (Athens, Ga.: University of Georgia Press, 1983).

[7]Benjamin Rush, "Address to the People of the United States," *American Museum* 1 (1787): 10.

[8]The constitutional provision granting Congress the authority to establish post roads, Madison observed at one point—to the surprise of later commentators, such as jurist Joseph Story—was a "harmless" power unlikely to figure prominently in public life. That Madison could have dismissed the postal system in this way, Story wrote in 1833, was "one of the most striking proofs of how much the growth and prosperity of the country have outstripped the most sanguine anticipations of our most enlightened patriots." Alexander Hamilton, James Madison, and John Jay, *The Federalist,* ed. Jacob E. Cooke (1787–1788; reprint, Middletown, Conn.: Wesleyan University Press, 1961), 287; Joseph Story, *Commentaries on the Constitution of the United States,* vol. 3 (Boston: Hilliard, Gray, and Company, 1833), 22.

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[10]Petition of the inhabitants of Washington District, South Carolina, *State Gazette of South-Carolina* (Charleston), 1 July 1793, in *South Carolina Postal History,* ed. Harvey S. Teal and Robert J. Stets (Lake Oswego, Ore.: Raven Press, 1989), 23–24.

[11]*Annals of Congress,* 4th Cong., 2d sess., 1 February 1797, 2057–2058.

[12]For a different view, see James W. Carey, *Communication as Culture: Essays on Media and Society* (Boston: Unwin Hyman, 1989), 1.

[13]John F. Stover, "Canals and Turnpikes: America's Early Nineteenth-Century Transportation Network," in *An Emerging Independent American Economy, 1815–1875,* ed. Joseph R. Frese and Jacob Judd (Tarrytown, N.Y.: Sleepy Hollow Restorations, 1980), 75.

[14]Cited in Henry DeLeon Southerland, Jr., and Jerry Elijah Brown, *The Federal Road through Georgia, the Creek Nation, and Alabama, 1806–1836* (Tuscaloosa, Ala.: University of Alabama Press, 1989), 61.

[15]*Register of Debates,* 22d Cong., 2d sess., 2 January 1833, 939.

[16]William D. Merrick, *Speech of Mr. Merrick, of Maryland, on the Bill to Reduce the Rates of Postage. . . .* (Washington, D.C.: Gales and Seaton, 1845), 13.

[17]Richard R. John, "Governmental Institutions as Agents of Change: Rethinking American Political Development in the Early Republic, 1787–1835," *Studies in American Political Development* 11 (Fall 1997): 371–374.

[18]Martin Van Creveld, *Technology and War, from 2000 B.C. to the Present* (New York: Free Press, 1989), 155.

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[20]Samuel F. B. Morse to Francis O. J. Smith, 15 February 1838, in *House Report* 753, 25th Cong., 2d sess., 335: 8.

[21]Samuel F. B. Morse to Levi Woodbury, 27 September 1837, in *House Report* 753, 9.

[22]Samuel F. B. Morse to C. G. Ferris, 6 December 1842, in *House Report* 17, 27th Cong., 3d. sess., 426: 9.

[23]Printed memorial from John R. Parker to the Senate and House, January 1837, copy addressed to Amos Kendall, Incoming Correspondence, RG 28, Post Office Departments Records, National Archives, Washington, D.C.

[24]Morse to Smith, in *House Report* 753, 8–9.

[25]Henry Clay to Alfred Vail, 10 September 1844, Vail Telegraph Collection, Smithsonian Institution Archives, Smithsonian Institution, Washington, D.C.; Cave Johnson, "Report of the Postmaster General," 1845, in *Sen. Doc.* 2, 29th Cong., 1st sess., 470: 861.

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[27]Gardiner G. Hubbard, "Government Control of the Telegraph," *North American Review* 137 (December 1883): 522.

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[30]Norvin Green, "The Government and the Telegraph," *North American Review* 137 (November 1883): 433.

[31]Ibid., 433, 434.

[32]Norvin Green, "Are Telegraph Rates Too High?" *North American Review* 149 (November 1889): 574.

[33]Norvin Green to Hugh Allan, 27 June 1879, president's letterbooks, Western Union Records, Archives Center, National Museum of American History, Smithsonian Institution, Washington, D.C.

[34]Paul Israel, *From Machine Shop to Industrial Laboratory: Telegraphy and the Changing Context of American Invention, 1830–1920* (Baltimore: Johns Hopkins University Press, 1992), 135–138.

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[42]George David Smith, *The Anatomy of a Business Strategy: Bell, Western Electric, and the Origins of the American Telephone Industry* (Baltimore: Johns Hopkins University Press, 1985), 27.

[43]Kenneth Lipartito, *The Bell System and Regional Business: The Telephone in the South, 1877–1920* (Baltimore: Johns Hopkins University Press, 1989), chap. 8; Milton L. Mueller, Jr., *Universal Service: Competition, Interconnection, and Monopoly in the Making of the American Telephone System* (Cambridge, Mass.: MIT Press, 1997), chap. 9.

[44]Milton Mueller, "The Switchboard Problem: Scale, Signaling, and Organization in Manual Telephone Switching, 1877–1897," *Technology and Culture* 30 (July 1989): 534–560.

[45]Theodore N. Vail to Arthur Brisbane, 25 June 1915, president's letterbooks, AT&T Archives, Warren, N.J.

[46]Venus Green, "Goodbye Central: Automation and the Decline of 'Personal Service' in the Bell System, 1878–1921," *Technology and Culture* 36 (October 1995): 912-949. See also Kenneth Lipartito, "When Women Were Switches: Technology, Work, and Gender in the Telephone Industry, 1890–1920," *American Historical Review* 99 (October 1994): 1075–1111.

[47]Lipartito, *The Bell System*, 225. "By its very nature," Lipartito explains, innovation is a process that takes place in the absence of perfect foreknowledge and, thus, has an "irrational or nonrational side." It is a mistake, he adds, to assume that every innovation is successful because the innovator "saw further or looked deeper" than did others into the "true nature of a technology." On the contrary, it might be just as true that the successful innovator "proved

skillful at closing off other roads and making his innovation seem like the right choice."

[48]Neil H. Wasserman, *From Invention to Innovation: Long-Distance Telephone Transmission at the Turn of the Century* (Baltimore: Johns Hopkins University Press, 1985).

[49]Mueller, *Universal Service,* chaps. 6, 7; Claude S. Fischer, *America Calling: A Social History of the Telephone to 1940* (Berkeley: University of California Press, 1992), chaps. 4, 5.

[50]Fischer, *America Calling,* 105–107.

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Thomas P. Hughes

Designing, Developing, and Reforming Systems

THE AMERICAN PUBLIC AND PROFESSIONALS in education voice considerable concern about the state of the precollege school system in the country today. Society is far less critical of the country's telephone, computer, and electrical power systems, which many experts argue are the world's best. Even though technological systems differ from educational systems in numerous ways, they have shared many problems, as this essay will show. Because technological systems, such as electrical light and power, have introduced many technical and organizational changes over the last century that have impressively raised the level of performance, analogies may suggest educational-system reforms that would support the achievement of education goals. Therefore, in this essay I shall draw analogies, or lessons, from the history of electrical power systems.

INVENTING AN ANALOGOUS FUTURE

"The greatest thing by far is to be a master of metaphor," Aristotle wrote in *De Poetica*; "it is the one thing that cannot be learnt from others; and it is also a sign of genius, since a good metaphor implies an intuitive perception of the similarity in the dissimilar." The use of analogy can lead to innovative ideas. Inventors and engineers working in the realm of technological systems have often resorted to analogy to move from known technical artifacts to imagined unknown ones, much as reformers could move from the educational system as it is today

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to what it might be. Edison, for example, conceived of the quadruplex telegraph, perhaps the most elegant and complex of his inventions, on the basis of an analogy with a water system involving pumps, pipes, valves, and water wheels. Later, he imagined the interaction between existing illuminating gas distribution systems and an incandescent-light system. The analogy stimulated him to invent a whole system rather than only an incandescent lamp.

The history of early wireless applications is rich with other instances of invention aided by metaphor. Michael Pupin, the inventor of the telephone-line loading coil, had the fruitful idea that wireless waves could be more easily comprehended if they were seen as analogous to the better-understood electrical waves of alternating-current electricity, widely used by 1900 for lighting and power. Recognizing underlying similarities between a telephone receiver and a wireless detector helped Reginald Fessenden invent the heterodyne principle that today remains fundamental to radio technology.[1]

EVOLVING TECHNOLOGICAL SYSTEMS

Electrical light and power systems in the United States can be traced back to 1882, when Edison and his associates began operating a central station on Pearl Street in the Wall Street district of Manhattan. The station supplied light and, later, energy for motors to a small district about one mile in radius. During the 1880s Edison's direct-current urban stations, similar to the one at Pearl Street, began operating in other large cities in the United States and Europe. In the late 1880s, the Westinghouse Company built alternating-current stations in less populated areas of the country. By about 1900 the General Electric Company (which had taken over the Edison system) and the Westinghouse Company supplied polyphase alternating current, which was well suited for supplying light and power both to urban and to less densely settled areas. This is the form of electricity distributed in the United States today.

We should note that the electrical light and power systems began on a small scale compared to the gaslight systems that then prevailed. By 1900 electrical lighting was displacing gas

lighting, and electrical motors were becoming increasingly common in streetcars and factories. Many of the central generating stations, however, were not interconnected, and they functioned with different technical characteristics (e.g., voltage and frequency). The situation resembles that of schools today, for there is little interaction through the exchange of teachers, pupils, or teaching materials.

Around the turn of the century, the interconnection of generating stations improved. The technical characteristics of the connected stations, it should be emphasized, were not standardized, but technical gateway devices, such as transformers and motor-generator sets, made it possible to link stations operating with different voltages, frequencies, and technical characteristics. Furthermore, the interconnected stations, as well as the utilities that owned and managed them, retained a substantial degree of autonomy in the technical and managerial realms. This development should interest those who seek to integrate schools into larger systems without creating a rigid hierarchical and standardized structure.

As interconnected electrical light and power systems (hereafter, "electrical power systems" or simply "power systems") expanded after 1900, the utility companies that owned them negotiated agreements with state governments that gave the utilities a monopoly in their supply area or region in return for their acceptance of state regulation of service and prices. Advocates of these "natural" monopolies stressed that they avoided costly duplication of the physical plant by competing companies. At about the same time, the Bell telephone utilities worked out their own natural monopoly agreements.

Until the Great Depression of the 1930s, power systems, or utilities, rapidly expanded and often merged.[2] They achieved increased reliability of service and economies of production by using plant capacity more fully. To manage the increasingly large power utilities with their many generating stations, the owners and managers, who often had engineering backgrounds, devised such novel organizational forms as consulting firms, joint-venture interconnections, and holding companies. During the depression, the federal government presided over the establishment of the Tennessee Valley Authority, an island of gov-

ernment ownership in a sea of private utilities. This new approach to organization may be suggestive to those who want to reform the structure of educational systems.

After World War II, the introduction of nuclear-powered central stations dominated innovational activities among the utilities. Time and usage revealed nuclear-generated power to be more costly and less reliable than its enthusiastic promoters predicted. During the last decade, deregulation has brought greater changes in electricity supply than those resulting from the introduction of nuclear power. Even as late as 1970, if someone had predicted deregulation and the waning of natural monopolies, few would have taken the idea seriously. Utilities had grown so large and their technical and organizational momentum was so great that such drastic change appeared unimaginable. Yet today states are allowing competition among suppliers and distributors of electricity.

Shortly before the 1990s brought in the winds of change to the electrical-power monopolies, deregulation ended the Bell telephone natural monopoly, and the health-care system witnessed a movement from a physician-centered system to one dominated by health-management organizations. These changes took place despite the momentum of the systems, which was created because of the increased presence of vested organizational interests and long-embedded technical practices. These momentum-defying changes suggest that similarly drastic changes could take place in the educational field.

HETEROGENEOUS SYSTEMS

Electrical generating stations often supplied heterogeneous components coupled in a network. These included home appliances, industrial motors, incandescent lamps, arc lights, and streetcars. Gateway or coupling devices—such as transformers, which linked loads with different voltages, and rotary converters, which linked alternating with direct current devices—made it possible to interconnect these heterogeneous components into a single system. The diversity of the components allowed the heterogeneous systems to fulfill the various needs of the district that they served.

By 1910 power systems in the United States usually interconnected not only heterogeneous loads but also central generating stations with different characteristics. High-voltage transmission lines often interconnected water-powered and coal-fired power stations as well as widely separated stations supplying areas with different economic and social characteristics. Generating stations were linked symbiotically. A central station that was overloaded at a certain time of day or year took power from an interconnected station that was heavily loaded at other times. Coal-fired stations interacted with water-powered ones: water-powered stations carried a heavy load when rivers were swollen, and coal-fired ones took the base load when reservoirs were low.

By contrast, school systems today rarely cultivate interaction and interdependence by sharing resources.[3] Schools could benefit economically and pedagogically from additional interconnection. If they were heterogeneous and interconnected like generating stations, the schools could share their physical and human resources. If the interactions were analogous to exchanges within heterogeneous power systems, a school stressing sports could provide sports opportunities for students in other schools; a school concerned about a lack of work skills could offer training to students in other schools; a school focusing on the built and natural environment could raise the consciousness about these matters for all the students in the district. Diversity and symbiosis would prevail.

An even more obvious benefit of additional interconnection would be the fuller utilization of physical resources in order to reduce the capital cost per student. Interlibrary loan is a well-established example of resource sharing, as is the sharing of computer and communication resources. In fact, resource sharing among university computer centers led to the establishment of the ARPANET, the predecessor to today's Internet. Computer centers with mainframe computers and complex software could move computing tasks from a machine on the network carrying a heavy load at a particular time to a less-burdened one. Software could be exchanged as well.

A major reason why organizations such as schools do not interact and share resources is because those in charge fear a

loss of local autonomy. With power systems, system builders overcame this resistance. They often purchased relatively small autonomous power systems and merged them into larger ones. On other occasions, the system builders created consulting engineering organizations, joint ventures, and holding companies that established federated structures made up of autonomous or semiautonomous utilities.

Financiers, engineers, and managers physically interconnected power systems through electrical transmission lines. Those pushing for integration and interconnection sought to improve technical characteristics, such as system reliability, and to lower costs, especially through improvement in the system load factor.[4] The Stone & Webster Company, the Pennsylvania–New Jersey–Maryland Interconnection (PNJ), and the Rheinisch-Westfälisches Elektrizitätswerk (RWE), leading examples of the interconnection process in the electrical-power realm, will be discussed below.

RESOURCE-SPECIFIC SYSTEMS

Power systems are often resource or place specific. Systems in a region where hydroelectric power is plentiful will use this as raw energy. If they are located in a heavily industrialized region, they will generate energy that is usable by industry. If situated in a region rich in coal, this will be the fuel for the power plants. If the region is a metropolitan one, energy will be supplied in multifarious forms needed by the various urban infrastructures and appliances. In this way, electrical-power utilities generally have regional styles.

School systems can also respond more specifically to the resources and needs of the district in which they are located. Urban schools can draw upon a host of cultural facilities. A school system located in a small Midwestern community might compensate for the lack of an art museum, symphony orchestra, or university by maintaining a highly developed computer information network that provides access to these sorts of institutions. If agricultural activities and interesting ecological regions exist in the vicinity, the school system could stress environmental studies. The possibilities for reorganizing school systems to make them more resource specific are numerous.

Basic science, social science, humanities, and arts competence could be common to all school systems; beyond these, the regional and district characteristics could shape the curriculum. The resulting variation in school characteristics would further the symbiotic interaction described above.

SOCIOTECHNICAL AND SOCIOEDUCATIONAL SYSTEMS

Electrical power systems have long been components in large sociotechnical systems. These sociotechnical systems include not only generating stations and the utilities that own them but also electrical manufacturers, research laboratories, investment banks and brokerage houses, regulatory bodies, and other organizations. The various components often maintain their managerial and ownership autonomy and have functions other than those associated with the sociotechnical power system. They interact, however, to fulfill the common goal of supplying electricity.

Schools could be similarly interconnected with other cultural and social organizations to form a socioeducational system. A socioeducational system could encompass cultural organizations as well as research centers and university departments of education. Schools today take advantage of local cultural organizations, but rarely is the interaction formalized. A socioeducational system could be loosely coupled, leaving virtual autonomy to the various components in the system and at the same time allowing for coordination and cooperation in achieving common goals.

SYSTEM BUILDERS

Throughout this century, system builders interconnected heterogeneous, resource-specific power systems in the United States to form large regional power systems. Three phases, each with a different kind of system builder predominating, characterize this growth. During the period from about 1880, when Edison established the first commercially successful electrical lighting system, until about 1890, inventor-entrepreneurs designed and presided over the development of urban systems. From 1890 to about 1910 manager-entrepreneurs such as Samuel Insull, who

headed the Chicago Commonwealth Edison Company, dominated the utility industry and created systems that supplied not only urban districts but surrounding areas as well. During the next two decades, consulting engineering firms and holding companies became the principal system builders of large regional power systems.[5]

Builders of regional systems focused on making interconnections and interfaces among local power systems in order to coordinate or combine them. As noted previously, lowering the cost per kilowatt-hour motivated the system builders. The systems builders also provided a central pool of highly trained engineers, managers, and cost accountants who concentrated on serving the shared or common needs of local systems. They left the responsibility for responding to unique and routine local needs to resident engineers and managers.

System builders, whether individuals or organizations, usually preside over related technical and organizational change. Before 1900 the widespread introduction of transformers and alternating-current electricity permitted a single utility organization to supply a large city, thus replacing a host of smaller district utilities. The introduction of steam turbines around 1900 to replace reciprocating steam engines resulted in increased generating-station capacity and the need to organize larger utility companies, supplying both urban customers and those in the surrounding areas, in order to utilize this capacity. When technical advances brought high-voltage transmission facilities, which allowed economic transmission of energy over large regions, the holding-company organizational form flourished. Reasoning by analogy suggests that reformers of educational systems should also link pedagogical innovations with organizational innovations.

The history of the Stone & Webster Company, a consulting engineering firm, provides an outstanding example of a system-building organization presiding over related organizational and technical changes. Founded in 1893 by Charles A. Stone and Edwin S. Webster, both early graduates of MIT in electrical engineering, the company designed and managed electrical-power facilities. In their first year, the young partners had a fruitful learning experience from which an analogy suggesting

reform in educational systems can be drawn. J. P. Morgan, the renowned financier, had purchased the stock of a number of electrical-power utilities in financial difficulty. He asked Stone & Webster to appraise the properties; in doing so, they gained insight into common financial, managerial, and technical problems and found likely solutions for the electrical utility industry.

By 1910 the company offered integrated engineering, management, and financial services to independent utilities and, in the process, often acquired a financial interest in the companies to which it offered these integrated services. In many cases, Stone & Webster would assign one of its employees to act as a resident manager for the utility. In addition, Stone & Webster's statistical department acquired and analyzed financial and engineering information about the utilities and thus provided benchmark data and advice that led to rationalized and efficient practices among the utilities. By this time about half of Stone & Webster's six hundred employees were college graduates. The company employed the sort of highly trained professional that few individual utilities could attract and afford. The Stone & Webster group by 1932 consisted of forty-three utilities that generated 2 percent of the electricity supplied by U.S. utilities. The firm had adopted the holding-company form of organization in the 1920s, but the utilities within its orbit continued to exist as corporate entities in a loosely coupled system.[6]

Stone & Webster's development suggests analogous and additional ways in which consulting firms might respond to school-system needs. A consulting firm for schools might serve a large number of schools spread over a broad region, looking for common problems and solutions. Furthermore, the firm could maintain a pool of experts, teachers and managers, and assign them to schools as needed—a practice that suggests interesting possibilities.

The organizational structure of the Pennsylvania–New Jersey–Maryland Interconnection (PNJ) provides another model for system building and coordination through organizational ingenuity coupled with technical inventiveness. As with Stone & Webster, the PNJ interconnected utilities into large power systems without depriving the utilities of their autonomy. Three utility companies—the Philadelphia Electric Company, the Pub-

lic Service Electric & Gas Company of New Jersey, and the Pennsylvania Power and Light Company—established the PNJ in 1925.[7] The three utilities continued their independent existence while at the same time participating in the joint venture.

Physically, the interconnection involved a two-hundred-mile, 220,000-volt circular trunk line. The three utilities connected to the trunk line through substations. Each utility fed energy into the trunk line or removed energy from it according to the load carried at a particular time. The utilities established the interconnection primarily to take advantage of the substantial economies accruing from their load diversity, which could be exploited through the interconnection to improve their load factors. The interconnection also took economic advantage of the utilities' favorable economic mix: two of the utilities depended on coal-fired generating stations while the third operated a large hydroelectric plant.[8]

Inventing the organizational structure of the PNJ proved more complicated than designing the physical layout. The three companies maintained their corporate identities. They organized management by committee for the PNJ. Each utility sent several representatives to periodic committee meetings, where members negotiated the price each would charge the PNJ when supplying energy to the system and the price each would pay when taking energy from the system. The success of the PNJ as a confederation of autonomous organizations brought engineers and managers from around the world to observe its character and function.[9]

The history of the Rheinisch-Westfälisches Elektrizitätswerk (RWE), a large German power utility of mixed ownership, provides another prime example of organizational innovation. In 1902 Hugo Stinnes, a German system builder with financial and managerial interests in the steel and coal industries in the heavily industrialized German Ruhr, obtained control of the RWE, which was then a small local utility. Stinnes used an expanded RWE network of distribution and transmission lines to interconnect the electrical generating stations and factories in his coal and steel empire.

To extend the RWE network, Stinnes acquired local power utilities and merged them with the RWE. Local governments

that owned many of these utilities resisted acquisition, but Stinnes and his associates often overcame this opposition by persuading local governments to invest in the RWE and local officials to take positions on the RWE board of directors. To formalize this arrangement, RWE became a mixed enterprise, with about half of its stock owned by local governments and the remainder by private enterprise, including German banks.[10]

SYSTEM BUILDERS FOR SCHOOLS

As their power-system predecessors did, system builders for local school systems should focus on designing technical and organizational interconnections. They should provide a pool of highly trained specialists as well as managerial talent. As in the electrical-power field, they should pay special attention to common problems and opportunities as well as to the capital-intensive aspects of school systems. They should concentrate on lowering the unit cost of computing facilities, both hardware and software. The new system builders should institutionalize their functions, utilizing an organizational structure similar to that of Stone & Webster, the PNJ, and the RWE. For example, a software resource group could serve a number of schools subscribing to its services. If the number were large enough, the resource organization could fund the kind of teaching simulations now supplied to industry by management consultants.[11]

A PNJ-like interconnection for schools could also bring economies. Teachers whose pedagogical competence transcended conventional disciplinary boundaries or who specialize in esoteric subjects could be assigned to the interconnection. For instance, if individual schools could not afford instruction in musical composition or computer programming, teachers with these qualifications could be situated in the interconnection organization. As in the case of the PNJ, the school-district interconnection could be managed by a committee made up of representatives from the various schools.

The mixed ownership of the RWE suggests possibilities for the resolution of the tension that now exists among advocates of public schools, charter schools, and for-profit schools in the United States. As with the RWE, public money could be in-

vested in for-profit schools, and public-school officials could sit on the boards of the for-profits. Representatives from the for-profit sector could become members of public-school boards. Then public schools, charter schools, and for-profit schools might be loosely coupled in heterogeneous systems. It should be stressed again that the organizations institutionalizing system-building functions for the schools need not be hierarchical.

PARADIGM SHIFTS AND INCREMENTAL CHANGE

Whether presiding over technical or organizational change, system builders must master innovation, a process involving invention (concept), development, and introduction into use. This is true for system builders in the electrical-power field and for those responsible for reform in school systems. Opinions differ about the nature of innovation. Some who have studied the process see innovation resulting from slow continuous change; others associate innovation with discontinuous revolutionary changes or paradigmatic shifts. System builders for schools, like those for power systems, should provide for and preside over both continuous and discontinuous change.

Thomas Kuhn, in his seminal work *The Structure of Scientific Revolutions*, eloquently argues the case for paradigm shifts.[12] Discussing the shift from the Ptolemaic paradigm to the Copernican, Kuhn writes:

> The transition from a paradigm in crisis to a new one from which a new tradition of normal science can emerge is far from a cumulative process, one achieved by an articulation or extension of the old paradigm. Rather it is a reconstruction of the field from new fundamentals, a reconstruction that changes some of the field's most elementary theoretical generalizations as well as many of its paradigm methods and applications.[13]

He then compares a full-scale paradigm shift to the switch of a *Gestalt*. This is the language of discontinuous change, despite Kuhn's reference to a transition.

With technology, both cumulative changes and paradigm shifts occur. Cumulative change, however, is far more prevalent. Countless technical and organizational innovations take place

incrementally and almost seamlessly in sociotechnical systems. Invention, research, development, and deployment occur and interact continuously. Some innovations bring more radical change than others—the introduction of alternating current during the last decade of the nineteenth century is a case in point. The change can be seen as a paradigm shift. If lighting is considered a system, then Edison presided over a paradigm shift when he introduced electrical lighting to replace gas lighting.

What constitutes a paradigm shift as opposed to cumulative change in the realm of technology is a matter of human perception evaluated against accepted definition. The move from direct-current electrical supply to polyphase alternating current required the design and deployment of generators, motors, and other hardware with different characteristics. In addition, the alternating-current system needed the elaboration of a new theory before rational analysis and design were possible. But most importantly, engineers and technicians had to learn new skills. The inability of direct current to transmit energy over more than several miles economically presented a reverse salient (see below) in the evolving direct-current system, which stimulated the radical changes. Taken together, these changes resemble a Kuhnian paradigm shift.

On the other hand, the transition from one form of current to another took place within an evolving organizational context. The Edison General Electric company, which had championed and manufactured direct-current equipment, merged with the Thomson-Houston Company, which presided over the making of alternating-current equipment. The resulting General Electric Company concentrated upon polyphase alternating current but continued to manufacture direct-current equipment for years. Radical innovation does not necessarily mean that older technology is obsolete. The new and the old can exist side by side for years. Kenneth Wilson and Constance Barsky have pointed out that even putative paradigm shifts in science do not bring the abandonment of older paradigms, as Kuhn argues.[14]

Over the past century or so, school systems have experienced continuous changes. The continual increase in the number of years of compulsory school attendance is a case in point. The call today, however, seems to be for radical change, or a

paradigm shift. For this to occur, a reverse salient should be identified comparable to the transmission limitations of direct current—or, more likely, a bundle of interconnected, reform-generating reverse salients. These might include the need for increased teacher training, for more pedagogical software, and for more focused and expanded research centers.

REVERSE SALIENTS AND SYSTEM INNOVATION

To explain the manner in which system change, or innovation, occurs, the concept of reverse salients proves useful. System builders discern the weakest point, or reverse salient, in a system and attempt to strengthen it. Besides the bundle of reverse salients noted above, many perceive the lack of reading skill to be a reverse salient in school systems today. Others may focus on the absence of computer facilities as a reverse salient, and still others may perceive the lack of positive parent participation as the salient problem. The perception of reverse salients depends on the interests and perspectives of the observers, and these change over time.

The concept of the reverse salient is borrowed from military history. Military commanders define a reverse salient as a reverse bulge in an extended front consisting of soldiers and equipment. The front changes over time, as reverse salients and salients (protruding bulges) appear along the line. The continuously changing battlefront is analogous to the unevenly advancing front of a complex technical or sociotechnical system with its many varying components.

Elmer Sperry, a prolific American inventor of early twentieth-century feedback systems, including automatic airplane and ship pilots, defined a reverse salient ("the weakest point") in a technical system:

> Think as I may, I cannot discover any time in which I have felt in the course of my work that I was performing any of the acts usually attributed to the inventor. So far as I can see, I have come up against situations that seemed to me to call for assistance. I was not usually at all sure that I could aid in improving the state of affairs in any way, but was fascinated by the challenge. So I would study the matter over; I would have my assistants bring before me

> everything that had been published about it, including the patent literature dealing with attempts to better the situation. When I had the facts before me I simply did the obvious thing. I tried to discern the weakest point and strengthen it. . . .[15]

System builders—whether inventors, managers, or organizations—identify reverse salients by firsthand observation and from technical literature and patents. To identify a reverse salient in an expanding system, a system builder must know the direction in which the system is moving or in which she or he wants it to move; this defines what is reverse, or backward. The goals of the system determine its direction. In the case of electrical-power systems, raising the load factor was a goal. Components in the system that retarded the raising of the load factor, whether technical or organizational, were reverse salients.[16]

Reverse salients can be identified in educational systems if the subsystems, components, and goals for the system are defined. As in the case of sociotechnical power systems, a reverse salient in a socioeducational system can occur in any one of its numerous heterogeneous subsystems and components. In the case of reading skills, reverse salients might be found among poorly trained teachers, deleterious home environments, inadequate teaching materials, poor preschool preparation, or a number of other aspects of the socioeducational system.

Not only should reforming system builders in education search systematically and broadly for reverse salients, but their responses should be systematic and multifaceted as well. For this reason, a consulting organization might be the best agency to identify reverse salients in socioeducational systems. If the organization serves a number of schools located in different areas, it can draw from numerous cases and generalize about the salients and the responses, as Stone & Webster did. Schools involved in consortia with a broad and complex field of action, like the PNJ, might also be able to respond more effectively.

THE ROLE OF RESEARCH

Organized research, drawing on physical science, solved many reverse-salient problems and nurtured the evolution of electrical

power systems from their earliest days. However, the relationship between science and electrical technology has not always been the linear one often imagined, equating technology with applied basic research. Frequently, electrical inventors and engineers developing new technology have forged ahead of scientific knowledge. Scientists subsequently rationalize the technological experience, which can then be used to improve upon the technology.

By 1880, Edison's laboratory in Menlo Park, New Jersey was one of the best equipped in the United States. He and his associates designed and developed generators, incandescent lamps, and other physical equipment there for use in the Pearl Street generating station. Within a decade or so, the engineering departments of the electrical manufacturers, especially General Electric and Westinghouse, provided improved and new equipment for the increasing number of central stations.

After the turn of the century, the electrical manufacturers created research and development laboratories. The General Electric Research Laboratory established in 1901 became the most renowned of the GE laboratories. During its first decade, it concentrated on the development of an improved incandescent lamp filament, a mission that typifies this and the other electrical manufacturers' concentration on solving problems that arose in practice and on improving the components of evolving electrical power systems. Engineering-school professors and their advanced students also did mission-oriented research and development in their university or college laboratories for the electrical utilities. Professors often served as consultants to the utilities and to the electrical manufacturers.

Edison's, General Electric's, and Westinghouse's research scientists and engineers, as well as the engineering-school professors, interacted closely with the engineers in the utilities. The researchers knew of the reverse salients in the field, especially those associated with electrical machinery. Numerous feedback loops existed among manufacturers, utilities, and consultants. This interaction should provide a model for the schools. There is an opportunity today for colleges of education, organizations creating educational materials, and consulting organizations in the educational field to interact more closely with one another and with the schools as part of the socioeducational system.

CONCLUSION

The history of power systems is a story of growth. But these large systems were not necessarily hierarchical, centralized, and standardized. They were usually heterogeneous and flat, and their diverse subsystems and components interacted symbiotically.

Because power systems were heterogeneous, their system builders had to cope with complexity and contradiction. System builders presiding over growth looked for, and corrected, reverse salients in various parts of the embracing system, both technical and organizational. Those responsible for reforms in the educational system should not assume that increased symbiotic interaction among school systems and organizations analogous to Stone & Webster, the PNJ, and the RWE would necessarily lead to standardization, hierarchy, and centralization.

Finally, a disclaimer should be filed. Analogies such as those drawn in this essay do not allow us to predict the future, nor should they be taken as sure guides to policy-making. They are primarily useful ways of provoking imaginative ideas about alternatives to a current stream of development.

ENDNOTES

[1]Hugh G. J. Aitken, *The Continuous Wave: Technology and American Radio, 1900–1932* (Princeton, N.J.: Princeton University Press, 1985), 33–34, 58.

[2]"Utility" refers to the company owning a power system.

[3]This is no less true of universities despite countless efforts to cultivate cooperation. Harvard University and the Massachusetts Institute of Technology, for example, are both located in Cambridge, Massachusetts, and cultivate different fields of knowledge but have only a limited exchange of faculty, students, and resources.

[4]On load factor see endnote 8.

[5]In the 1930s legislation limited holding-company acquisitions to systems that were geographically contiguous. For more on these phases, see Thomas Parke Hughes, *Networks of Power* (Baltimore, Md.: Johns Hopkins University Press, 1993).

[6]For more on Stone & Webster, see ibid., 386–391.

[7]Bayla Singer, "Power to the People: The Pennsylvania–New Jersey–Maryland Interconnection, 1925–1970," Ph.D. dissertation, University of Pennsylvania, 1983.

[8]Load diversity resulted from the Pennsylvania Power and Light Company having primarily a coal mining and industrial load that peaked in the morning and the other two utilities having larger urban loads that peaked in the evening. This diversity meant that the utilities could exchange power at peak load times. Their advantageous economic mix came from Philadelphia Electric drawing upon its large hydroelectric plant at Conowingo, Pennsylvania, and the Pennsylvania Power and Light depending on coal-fired plants located near coal mines. In times of low water, the thermal plants could carry the base load; when water flow at Conowingo was high it carried the base load. The various power plants fed into the common trunk line. Load factor is the ratio of the average load to the maximum load on a system during a specified period. Load factor, therefore, is a measure of the utilization of invested, or fixed, capital and greatly affects the cost of electricity and the profitability of the company. A major objective of utility managers is to avoid high peak loads on the systems, for the peak load determines the necessary investment in generating capacity for the system.

[9]Hughes, *Networks of Power*, 331–334.

[10]On the RWE, see ibid., 408–428.

[11]Among those companies supplying learning simulations for industry is Andersen Consulting.

[12]Thomas P. Hughes, "The Dynamics of Technological Change: Salients, Critical Problems, and Industrial Revolutions," in *Technology and Enterprise in Historical Perspective*, ed. Giovanni Dosi, Renato Giannetti, and Pier Angelo Toninelli (Oxford: Clarendon Press, 1992), 97–118.

[13]Thomas Kuhn, *The Structure of Scientific Revolutions* (Chicago: University of Chicago Press, 1970), 84–85.

[14]Kenneth G. Wilson and Constance K. Barsky, "Thomas Kuhn, Physics, and Revolutions in the Social Sciences," presented at a symposium on "The Legacy of Thomas Kuhn" held at the Dibner Institute for the History of Science and Technology, 20 November 1997.

[15]Elmer Sperry, "Spirit of Invention in an Industrial Civilization," in *Toward Civilization,* ed. Charles A. Beard (New York: Longmans Green, 1930), 63.

[16]System builders, for example, found a major reverse salient in urban power systems around 1900. Defining the Commonwealth Edison system broadly, Insull noted that the high cost of urban real estate in Chicago burdened his company when property for the expansion of existing power stations had to be acquired. Real estate, then, became a reverse salient. Learning that several power systems abroad were replacing reciprocating steam engines with the newly developed steam turbine, Insull and his associates saw that the steam turbine generated appreciably more power for each square foot of floor space it occupied than a reciprocating steam engine. Commonwealth Edison thus turned to the turbine as a means of increasing power generation with a minimum of property acquisition. This anecdote suggests that a reverse salient in one category might be solved by a response in a quite different one.

Kenneth G. Wilson and Constance K. Barsky

Applied Research and Development: Support for Continuing Improvement in Education

I shall take it as self-evident that each generation must define afresh the nature, direction, and aims of education to assure such freedom and rationality as can be attained for a future generation. For there are changes both in circumstances and in knowledge that impose constraints on and give opportunities to the teacher in each succeeding generation. It is in this sense that education is in constant process of invention.

—Jerome S. Bruner
Toward a Theory of Instruction[1]

INTRODUCTION

THIS ISSUE OF *DÆDALUS* WAS DESIGNED to seek historical lessons to help make sense of the nation's continuing struggle with education reform. Present policy is not working, as Louis notes; the nation seems not to know yet how to build a policy that is effective.[2] We will draw on other essays from this issue as we propose a new approach to generating policy. This new approach emphasizes learning how to answer many questions that have yet to be addressed.[3]

Although there is abundant knowledge about how to improve teaching and learning, that knowledge is scattered among many subdisciplines of education and among many of the nation's

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teachers and principals. Fortunately, there are a few reforms that have begun the process of uniting the achievements of many teachers with the findings of education research.[4]

In some examples, the unification process has been led by small groups engaged in applied research and development (R&D), similar to the group Resnick has assembled to work with school superintendents. We believe that these R&D groups have drawn on a great variety of school-related innovations, relying on teachers and researchers much as R&D historically has drawn on large numbers of modest but patentable innovations to design machines, electrical devices, or computer software. Still, little is known about how R&D in education actually works and how large a role these innovations from a multitude of individual teachers have played in reforms based on R&D.

One frontier blocking widespread use of R&D in education is the need to screen and incorporate far more innovations from individual teachers. Present R&D groups (none larger than five people) lack the capacity to review the achievements of the over two million teachers in the United States. How many novel ideas and teaching practices have yet to be recognized and taken advantage of in the current generation of reforms?

One lesson from history is that initiating and building institutionalized support for R&D takes time. The historical essays in this issue discuss technological advances that took periods of fifty years or more to achieve. It is evident that long lead times are required to establish new research fields, both basic and applied, and to expand access to new technology as the technology itself undergoes repeated incremental advances.

In the case of educational R&D we conclude that basic research has been showing continued advances, as is evidenced by the essays from education researchers in this issue, although far greater advances will be needed in the future. What is missing is an applied academic research discipline to provide institutionalized support for the emerging forms of R&D. Support currently missing ranges from advanced training for new recruits in R&D to advice to policymakers at the state and federal levels about issues involving R&D.

Because building a new academic discipline takes time, we offer a timeline, with measurable milestones, for its formation and subsequent impacts on reform. The first milestone would be three years from now, to satisfy those who want assurance of immediate action on reform. However, our timeline extends fifty years or more into the future, which should reassure veterans of past reforms who are wary of every new call for a quick fix.

We believe that the potential new frontier for educational R&D could lead to a process for sustained growth and the spread of reform. The frontier could hold as much promise for the future as do any of the natural sciences. Our recommendation is that federal government policies on education be changed to recognize this new applied academic discipline and its education R&D connections.

We see the need for the launch of a research and development initiative in education, paralleling existing national research initiatives related to AIDS or global climate change. This research initiative could make possible an era of reform with bold new goals for educational achievement in schools, higher education, and adult education.

WHY R&D IN EDUCATION? WHY NOW?

Why are we concerned about linking innovations from many classrooms when, for as long as anyone can remember, teachers (and college faculty, too) have been using their individual creativity to teach behind closed classroom doors? What is different about today?

Today there is a clash between leaders of education at the national and state levels, and teachers, parents, and school staff at the local level. Many state and national leaders want schools (and higher education) to be accountable for preparing all students for adult life and work, despite the unprecedented educational demands on adults in today's world.[5] These leaders want schools to implement accountability with little outside help, financial or technical. Otherwise they need to continue the remediation of adults, perhaps by increasing the capacity of today's community and technical colleges, as well as prisons.

In contrast, most parents and school staff are solidly committed to schools as they are, believing that only minor changes are needed. The reform priority at the local level is to improve the teaching of old-fashioned basic skills.[6] It is difficult to find anyone at the local level with either the interest or the time to look seriously at remediation efforts in community and technical colleges, to examine the other educational demands of adult life, and to ask what kinds of changes are needed in schools to prepare students more effectively for adulthood.

The tendency by all parties to rely on statewide or nationwide test score averages to determine whether reform is happening exacerbates the clash. The focus on average test scores shortchanges any school that makes serious progress on reform. Advances in one school's scores are drowned out by all the other schools that contribute to a statewide average. In fact, sizable improvements in even a few hundred of the nation's one hundred thousand schools would have negligible impact on the overall statistics. Moreover, when the average statistics indicate problems, it is impossible to diagnose causes of failure at the level of individual classrooms, where some of the most severe problems are to be found.

Few educational reforms are widespread enough to be visible in statewide averages. In this situation, there is little incentive for national leaders to take any one reform seriously, no matter how much it has actually accomplished with students, unless it has reached every school in the state or nation. As a consequence, national leaders and the media constantly denigrate schools and existing reforms indiscriminately every time scores are published. Hence, there is little incentive for any specific school to take national calls for reform seriously. This is on top of all the other problems of incentives in education, as Bromley details.[7]

Furthermore, low test scores provide an excuse for new presidents, new secretaries of education, or other new administrators to abandon specific reforms initiated by their predecessors. They launch new reforms, typically uninformed by anything that has occurred in the past.[8] These new reforms are seen as fads, each of which vanishes within a few years, making both

teachers and parents skeptical of any proposals for reform coming from outside their school.

Because of this turnover in reforms, the requirements that accountability places on schools—beginning with a major investment in the collection and storage of student performance data—have yet to be taken seriously. Before agreeing to become accountable, schools ought to demand major assistance in implementing accountability-based reforms, insisting on clear proof in advance that the changes will pay off for students and school staff. There should be proof that such reforms will survive any upheaval with principals, superintendents, school-board presidents, budget crises, and the like. But no present policy alternative takes these practical needs of schools into account.[9]

Still, there are a few R&D-based reforms now in existence that have demonstrated success in addressing the practical questions raised above.[10] They offer the possibility of change to large numbers of schools with much of the data collection and analysis centralized to reduce costs. Drawing on selected innovations from a large pool of teachers, they are able to maximize improvements in teaching and learning while controlling costs to each client school. Parents and school staff can visit other schools where a given reform is already in place to understand what it accomplishes and what its costs will be. These achievements are worth examining, especially when they help with longstanding inequities in educational opportunity between rich and poor, between whites and disadvantaged minorities.

Because of the lack of serious discussion of accountability, hardly anyone is aware of the true promise of R&D-based reforms. It may be useful to give two examples of what R&D-based reforms could accomplish. Although both are small and modest today, in the long term they could lead to truly major advances in student learning, even in such difficult settings as inner-city schools.[11]

EDUCATIONAL R&D: EXAMPLES

Success for All has an R&D group of five people, backed by a much larger staff.[12] The program served 750 elementary schools

in 1997–1998, about half of which were in inner cities and half in other pockets of poverty. It has been in existence for only a decade, and has expanded to over 1,100 schools for the 1998–1999 school year. Success for All's design includes a wide range of changes in school operations, from having students read to each other in pairs in first grade to the formation of a parent support team in every Success for All school in order to improve relationships with parents. A key component in the scheme is the implementation of a new role in the school, called a "facilitator."

Facilitators, who are extensively trained by Success for All's staff, meet frequently with facilitators from other Success for All schools; their role is to help the entire school staff follow through on changes they are expected to make. They hold sessions where teachers learn from each other how to improve their teaching. It is in these sessions where innovations developed by one teacher can be integrated into the practice of other teachers. The centralized design staff of Success for All is able to draw on these innovations as well. However, we do not know the extent to which teaching innovations travel from one school to another through revisions made centrally or through other interchanges between schools in the Success for All network.

Success for All's leadership spent well over a decade testing innovative reforms in individual inner-city classrooms before launching their program. Their experience with various measures of student performance, and conducting statistically valid testing with roughly matched control groups in classrooms not using their reform, enabled them to diagnose the most important problems that Success for All would have to address. Although it has not been formally documented, we can assume that much of the design of Success for All was influenced by this prior training and experience.

Success for All's designers initially focused on the prevention of school failure, with relentless efforts made to keep all, or nearly all students, reasonably near their grade level in performance. The priority is reading, with tutoring help for students who fall behind despite the best efforts of their classroom teachers. Recently, its designers have introduced a follow-up

program called Roots and Wings, a major effort devoted to improving the teaching and learning of mathematics, science, and social studies. Most schools implement Success for All for one or more years before they are ready to make the upgrade to Roots and Wings.

In spite of everything that Success for All is doing, it is important to emphasize what it is not doing. It is not devoting much effort to the design of computer software of any kind. The diagnosis of the inadequacies in inner-city elementary schools by Success for All's leadership identified problems that they believe are mostly unsuited to computers, or not most economically solved through computer technology.

Reading Recovery is a second R&D-based reform with extensive centralized data collection on student performance.[13] It is found in over nine thousand elementary schools, many in environments outside of poverty pockets. Reading Recovery is a specifically focused reform for first graders that strives to reduce the number of students who need remedial reading help when entering second grade.

EDUCATION R&D BENEFITS

One benefit of education R&D is that the testing of design alternatives, and in particular the rejection of inferior alternatives, can be done once on behalf of all the schools engaged in a reform; each school does not have to test alternatives for themselves. Poor reforms can be discredited before they proliferate. Many teachers and parents have had unpleasant experiences with completely ineffective reforms in their schools that are brought in for a year or two, with little substance to them and scarce training for teachers.

An organized R&D staff can conduct more thorough and expert testing of reform alternatives than single schools could do. In particular, they can conduct statistically valid longitudinal studies of student performance over several years to determine which alternatives have the maximum long-term impact on student learning. For example, Success for All is particularly noted for the care with which it collects data on its reform, with longitudinal studies demonstrating that students in a number of

its schools are outperforming students from matched "control schools" that have not implemented the Success for All program.

Another advantage of a trained R&D group is its ability to draw on basic education research. This knowledge is especially valuable for conducting longitudinal studies of student performance and for understanding school processes that are barriers to reform—from budgeting procedures to the realities of a teacher's daily life. It is also crucial in learning from the history of education about what has been tried and how it worked.

Still, it must be said that basic education research is fragmented and fraught with controversy. Extensive talent and experience are required to master the literature, especially since its explosive growth beginning in the 1980s. It is hard for outsiders to appreciate how much the education literature has grown and changed over the past eighteen years. The essays by Hampel, Sarason, Louis, Marsick, and Resnick and Hall all reflect this change. While there are some teachers who are able to understand this literature, it is unreasonable to expect all of the nation's 2.7 million teachers to be expert in the interpretation of research. But it is reasonable to demand such expertise from a far smaller, more highly selected, and more extensively trained R&D group.

LIMITATIONS OF TODAY'S EDUCATIONAL R&D-BASED REFORMS

There are serious drawbacks to even the best of today's R&D-based reforms. They are limited by the small size of their R&D staffs, who must have very broad knowledge of education research and of the education system and its many ways of resisting. This knowledge must be acquired on the job, since there is no advanced training for this form of R&D. It has taken well over ten years for the most critical staffs to build their knowledge, and there are few opportunities as yet for new recruits to obtain ten years of similar on-the-job experience.

Resnick faces a training problem of this nature with reform in New York City.[14] She has focused her own efforts on the accomplishments of an exceptional district superintendent, Anthony Alvarado. But there are no advanced training and

career-development paths for superintendents that would prepare them to rival such unique innovators as Alvarado. Resnick is obliged to help superintendents in her program develop the knowledge and skills that future leaders of R&D will need; we do not know how long this training will take, or even if it is possible, given all the operational demands faced by superintendents.

Another drawback to the R&D-based reforms is the problem of obtaining reliable measures of student performance. How do the immediate measures of performance (such as test scores) relate to ultimate outcomes? Do test scores tell whether students will be prepared for adult life or might require remediation? Do they indicate whether students will be ready for the job market, to become parents, or to become active in community life?

Can these difficult questions be answered for elementary-school reforms, such as Success for All, given the problems students face in maintaining educational progress through middle and high school? As Sarason observes, students become increasingly bored and unchallenged as they progress beyond elementary school, and no elementary-school reform can resolve the problems of succeeding grade levels.[15] Nor do we know what changes in middle and high schools will be needed to resolve such problems. Therefore, while low test scores in elementary school (as in reading) can signal alarming conditions, increased test scores provide no justification for complacency, either in elementary schools or at higher levels.

Because of such drawbacks in current education R&D-based reforms, most of which target elementary schools, they have received limited attention from educational leaders nationally. However, we believe it is possible to overcome these drawbacks and initiate a period of unprecedented achievement and growth. To understand how one might remedy the situation, it may be useful to turn to historical lessons.

HISTORICAL LESSONS ABOUT R&D

Several essays in this issue discuss the history of various technologies and their possible lessons for education. In particular,

Hughes's concept of "reverse salients" is useful in analyzing problems of education reform.[16] Reverse salients are those components that retard a complex system's progress towards desired goals, thereby requiring a number of innovations. For example, we believe we have identified at least two reverse salients in education—the lack of a training pipeline for recruits to R&D, and the clash between national leaders of education and teachers and parents at the local level. Both these reverse salients demand the attention of researchers. The history of technological R&D, in our view, has lessons for these specific challenges, but educators are skeptical that they have anything to learn from these technological histories. The problems of children falling behind, they say, have no connection with the history of devices such as tractors, telephones, or electric power grids. We disagree.

For example, we can examine the role of applied research in a "sociotechnical system" (Hughes's term) such as the electric power grid.[17] In this instance we are talking about the role of university faculty in a field such as electrical engineering. Clearly, these faculty do not design or build electric power plants, power grids, or new organizational structures linking utilities, at least not as their academic function.[18] Instead they organize and teach the knowledge and skills new recruits need to prepare them for such design work.

A direct comparison can be made here with the new applied research field that we propose. The difference is that the knowledge and skills needed by new recruits to R&D in education reform are related to innovations in teaching and learning and to organizational change, rather than with anything mechanical or electrical. While technological history as a whole is heavily influenced by the mechanical and electrical devices or agricultural products that have been at its core, the specific history of the start-up of a new applied research discipline, which historically is a standard way to provide advanced training, has little to do with gadgetry. It has everything to do with resistance to change and the challenges involved in creating a new setting for research. Any pioneer anxious to help found a new applied research field for education will face the same institutional barriers that numerous predecessors who founded

applied research in agriculture or electrical engineering also faced. Why not learn from this history?[19]

None of the policy alternatives discussed by Louis, for example, make any allowance for reverse salients of any type.[20] They all assume that reforms can spread automatically, with none of the complications that a reverse salient presents. Others of the education researchers writing for this issue also make no allowance for the possibility of reverse salients. Some assume that the problems will be overcome by greater political attention to education, additional voluntary efforts by parents and teachers, or new funding for schools. They do not expect the problems of reform to require new forms of expertise and unexpected innovations. Suppose, however, that a flow of new recruits to R&D materializes and that current reverse salients of today are overcome. What then? This brings us to our next lesson from history: a lesson about what R&D itself accomplishes over the long run that is not explicit in any of the historical articles in this issue.

R&D AND INCREMENTAL IMPROVEMENT

Turning now to an example where the impact of many years of R&D are visible in daily life—personal computers and the Internet—we notice that new models of personal computers are appearing every few months, and that they push a technological frontier: they are faster and cheaper; they hold more memory; and they work with an Internet that is simultaneously moving to ever-higher communication speeds. Successive models of personal computers have been emerging for almost twenty years, dating back to the Apple I or the first IBM PC, both of which (with their slow speeds, limited software, and few kilobytes of memory) are very primitive when compared with today's technology.

Twenty to fifty years from now, will people look back from the education reforms of their time and say the same thing about Success for All and Reading Recovery? Will both these reforms appear just as primitive as an Apple I now seems? This is not an absurd thought. The strategy of Success for All's leaders, in offering Roots and Wings as a successor, opens a

path into an educational frontier that could bring progressively greater innovation in the future.[21] Once teachers have mastered the innovations in Success for All, it becomes easier for them to learn the incrementally bolder innovations contained in its successor. Twenty to fifty years from now, there may be a long succession of reforms beyond Roots and Wings. For convenience, we could assign "model" numbers to the programs: Success for All is model 1, the present Roots and Wings, model 2, with successive future models being Roots and Wings 3 and 4, perhaps extending as far as Roots and Wings 7.

The design team for a future model 7 could well be much larger than model 1's design team of five people. Such a team could consolidate input from the thousands or even hundreds of thousands of teachers whose teaching is innovative and effective in quite different ways from teachers in Success for All or Reading Recovery. It is reasonable to expect an extraordinary range of capabilities and talents among such a large population of teachers. Thus, the changes incorporated into model 7 could make Success for All and Roots and Wings indeed seem primitive by comparison.

If one can imagine a much bolder reform occurring by model 7, then a key question is what support is needed to enable the development of a model 7? How much will teacher education have to change so that novice teachers could be hired by a model 7 school? How much change will be required in school materials and software?

The new applied research field will have to answer such questions. It must study with care the process of innovation that has generated long sequences of upgraded products in the past, each of which breaks new ground on one or more technological frontiers. How were engineering training programs constantly upgraded as technological products, from agricultural equipment to computer operating systems for telephone switches, became increasingly complex? What organizational changes were needed to provide day-to-day support and maintenance through each product upgrade? The historical studies of systems such as agriculture, communications, or electric power described in this issue are still at too early a stage of development to be able to answer such specific questions.

For educators and researchers on education who react negatively to lessons from the history of technology, it is useful to call attention to a process of repeated incremental advances of a very different type. We jump from technology to the arts, specifically to classical music—not as it is today, but rather at the time between Bach and Mendelssohn, when classical music made the transition from performers who primarily played music they composed themselves, as Bach did, to a more institutionalized structure in which orchestras drew on a much larger repertoire that was generally not composed by the orchestra's conductor or soloists.

As the repertoire expanded, soloists and orchestra members had to develop greater expertise in order to play it. Although a leading soloist would sometimes commission (or compose) works that only he could play, many of these compositions later became part of the repertoire that all competent soloists and orchestras were required to master. This suggests that a process of continuing improvement in performance skills has been in operation in classical music at least since the time between Bach and Mendelssohn.[22]

Reforms such as Success for All and Reading Recovery are starting to build a repertoire of reform designs and helping teachers learn one or another of them. Future teachers may be expected to master a number of these designs, as part of building their own repertoire of teaching skills. The present practice of expecting each teacher to develop all the aspects of his teaching in isolation, behind closed classroom doors, might disappear, particularly if incrementally improving reform models become more widespread than they are today.

Given the role that we see for education R&D, we next turn to consider the new applied research discipline that would support it. We have given the discipline the temporary name of "change science," believing that one of its major challenges will be to determine how to bring continuing change to education. It will also be extracting lessons from the history of continuing change in sociotechnological systems, education itself, or other arenas, some as distant as classical music.

CHANGE SCIENCE, A NEW APPLIED RESEARCH FIELD

Our expectation is that the pioneers who launch change science will set out with optimistic beliefs about what the discipline can accomplish, a set of open questions that they are eager to research, and some clues that they are already pursuing. While we cannot anticipate what these beliefs, questions, and clues will be for any particular recruit to change science, especially one who is highly talented and creative, we can give a general sense of what they might be for the new field as a whole. That the optimistic beliefs are likely to be greeted skeptically by existing disciplines and subdisciplines of research is one reason for our call for a new discipline, despite the complexities and delays that any new launch generates.

Some recruits to change science, in addition to spending time building an understanding of the current state of education research, may spend just as much time investigating the histories of systems other than education in the belief that they would yield a continuing set of lessons for the future of reform. Others may believe that both Success for All and Reading Recovery have set new and promising directions for reform but that they represent only a very early stage of reform, given the many stages of continuing improvement still to come.

The questions that Sarason poses offer significant opportunities for investigation by recruits to change science: What has been accomplished by major expenditures on reform over the past ten to fifty years? Could governmental agencies and private foundations be encouraged to make increasingly rigorous evaluations of their past expenditures? Would such evaluations create opportunities to redirect existing funding streams, in part, to expand research on education?[23]

How, exactly, have Success for All and Reading Recovery managed to defy past experience that reforms do not travel? How faithful are the implementations of these reforms in the bulk of schools that claim to use them? What is the *standard deviation* of student performance in these implementations (e.g., how poorly or how well are these reforms implemented in individual schools)?

Are students in middle and high school bored everywhere, or are there schools and communities that have eliminated boredom? Are they bored the world over, or only in the United States? Are students bored when they have responsible roles in the adult work of the school—helping with administrative matters or in teaching? Are they bored during extracurricular activities, or only in classrooms? How many students are indifferent to education because they cannot see what the future holds for them, and therefore have no basis for giving education a high priority in their current lives?[24]

Pioneers of change science will also want to establish an advanced training pipeline feeding new recruits into R&D, who would lead the effort to build bolder reforms in the future. These bolder R&D-based reforms would address a broad range of applications, ultimately (many decades from now) becoming universal: serving all organizations of society, not just education. Institutional (or organizational) change is what the pioneers in change science should expect reform to accomplish.

The pioneers entering change science will likely find that their research is itself held back by a reverse salient. This reverse salient is best understood by contrasting the academic field of history with a major scientific discipline such as astronomy, chemistry, or biology. In each of these natural sciences, researchers take for granted institutionalized catalogs and taxonomies on which their whole research field rests: catalogs of astronomical objects, chemicals, or life forms, respectively.

For each catalog there is a complex taxonomy that has been developed over centuries, and the taxonomies continue to change as new discoveries force revisions in them. These catalogs are institutionalized, in that many researchers contribute to their continued development, and formal standardization processes resolve controversies through political compromises whenever scientific evidence is insufficient. Nevertheless, most new phenomena uncovered through research fits into existing categories; a new entry in any of these catalogs is a specialized discovery, sometimes highly unexpected, rather than a normal part of a typical researcher's life.

If pioneers to change science find that they need a catalog, they will have to build it themselves. Fortunately, there is a

highly circumscribed aspect of history where the building of a catalog has already begun. It is in the area of scientific revolutions, as discussed by historians of science such as Thomas Kuhn, I. Bernard Cohen, and Frank Sulloway.[25]

Although pioneers to change science may or may not have a burning interest in scientific revolutions *per se*, the topic of the start-up of new research fields is surely related. Anyone who starts up a new field is rebelling against the establishment represented by the research fields already in existence. Pioneers entering change science may find it informative to expand the work on the catalog of scientific revolutions to include the start-up histories for a range of research fields. Thus it might be possible to take the limited existing catalog to a new state of usefulness with a few years of effort from a few sufficiently knowledgeable pioneers.

The building of such a catalog and its analysis could allow the pioneers to build a deeper understanding of the problems they will encounter while trying to establish change science. If, as we predict, the start-up period for the new discipline stretches as long as twenty years, there would be time for lessons from such a catalog to play a useful role in ameliorating the constant hassles that the start-up period might generate. Everyone concerned with R&D-based reform could benefit from these lessons.

For practical reasons, the discipline of change science should be located in academic institutions separate from basic education research and colleges of education. The educational-research community has been too divided internally to be able to agree on any overall integration of its research findings to the extent now needed for applied use. Also, it has been unable to agree on rigorous standards for entry into research or on rigorous and extended training for such entrants, at least not to the degree that will be required by the new research field from its inception. Moreover, it is not clear that it is possible to organize the education research literature without the use of lessons from the history of change in complex sociotechnological systems.

A second reason for separation is that one task for the new applied research field is to conduct research on colleges (or schools, or departments) of education as institutions. A number of the arguments for the centralized R&D-based reform of

schools apply equally to the reform of colleges of education. It may be possible to develop daring proposals for how such institutions could change in tandem with changes being supported in schools. This contrasts with the widespread expectation that the colleges will be able to reform themselves without external input—an expectation that has yet to be fulfilled.[26]

POLICY CHALLENGES

Short-term versus Long-term Policy Issues

A major challenge for policy is to know how to deal with the long time scale (several decades or more) that will be necessary for major educational change to occur. This time is needed because of the complexity of establishing change science, expanding the number of reforms based on R&D, and incrementally improving each reform after it is launched. In contrast, most policymakers, parents, teachers, and university faculty are focused on the immediate problems of schools in the next year or two. This dichotomy could be eased by resolving a confusion found in current policy debates.

Currently, no distinction is made between the "repair" of schools that used to work but are now failing as against achieving unprecedented revolutionary advances in student achievement. Obvious examples of repair would be a policy of restoring or replacing school buildings now in disrepair, a renewed focus on "basic skills," or the establishment of equitable funding between rich and poor school districts. There are good reasons to doubt our ability to repair schools. What aspects of current schooling do we know how to repair, without making matters worse in practice for schools, teachers, and parents? How often do repairs actually result in poorer conditions? Are there ways to increase the funding available for more effective and lasting reforms by reducing the number of ineffective reforms that are launched?

Although it is reasonable to ask what can be accomplished in the next one to three years, the answer cannot be very definitive. We have as yet very limited expertise, making it difficult to determine what could be accomplished soon in individual

schools, other than minimally effective reforms. Of necessity, it will take a longer time to bring about revolutionary advances. However, before ongoing revolutionary change can begin, we must overcome a significant problem that will dominate the early stages of change science. The problem is that there are as yet no formally recognized advocates of change science, and this condition will likely prevail until there is some evidence of actual achievement by those pioneering the new discipline.

Past sociological research on the diffusion of new concepts makes it clear that, at best, 1 percent or so of policymakers are ready now for the change-science revolution: perhaps a few in Congress, at the White House, in key federal agencies, in national organizations (such as the teachers' unions), in nonprofit foundations, and in education research.[27] As a result, it would be futile to appoint national commissions or National Research Council study committees to examine the proposed revolution: any such commission or study group would almost certainly oppose the concept. There are no change scientists yet to appoint to such commissions or committees, to give them the needed balance. Our recommendations for policy changes have to be achievable through the leadership of a minority of isolated champions. This policy responds to the unique needs of a new discipline in its earliest stages of formation.

A Timeline for Reform

As Louis notes, the policy framework for school reform has been changing and will surely continue to change incrementally in the future independent of any recommendations about change science.[28] What we propose to discuss is one possible adaptation of future change to encourage a launch of change science, and what current champions of radical innovation might do to assist this adaptation. But the reality of change will be far more chaotic than our discussion may imply. Anything we outline is only a starting point for dealing with a far greater complexity than what we are able to describe. We divide our timeline into three time periods.

The first period—definition and exploration. The first time period is intended to be short, three years at most. It would

encompass brief (two- or three-day) meetings on a variety of topics suggested by this essay, which might serve as independent affirmations of legitimacy for the change-science revolution.

If the historical essays in this issue missed the process of continuing improvement that we have suggested underlies technological change, does the literature on the history of technology contain discussion of this process? Do historians of technology find it credible that there is such a process, and, if so, will they give more attention to it in the future?

Similar questions apply to economists who study technological change and its linkages to economic growth. Have they recognized the process of continuing improvement as defined in this essay? How would they need to take it into account in their analyses? What would be the possible economic impacts if such a process matures in the field of education?

Have business and community leaders recognized that there is an R&D-based process of continuing improvement in technology? Will they adapt their recommendations and political pressures for school reform to take R&D in education into account?[29]

Can national leaders of reform come to some sort of agreement with representatives of teachers and parents that there is currently a futile clash about reform between the national and local levels? Can they agree that schools should be demanding substantial help with change, that it is a national responsibility to provide this help, especially help that depends on new investments in research?

The second period—a time of transition. The second time period might be used to resolve however many reverse salients are blocking the emergence of sustained cycles of R&D-based continuing improvement. The birth and early growth of change science has to occur before or during this second period, which could take five to twenty years. It would be a time of transition, from the many piecemeal efforts at reform one finds today to a more unified process of R&D-based educational improvement and institutional change. During this second period, champions of change science and R&D-based continuing improvement

could emerge from many quarters, including those who advocate, as Louis suggests, parental choice of schools, decentralization, or systemic reform.[30]

Some advocates of choice could decide that allowing schools to determine for themselves which R&D-based reforms to adopt, encouraging school staff, parents, and communities to collaborate in making this choice, makes more sense than pitting parents against schools. Some advocates of decentralization might conclude that change science–based reforms would support schools anxious to reduce the need for extensive bureaucratic controls. Some advocates of systemic change might find that change science and the new R&D-based reforms constitute the most promising mechanism to enable schools to meet high standards of accountability for all their students.

The greatest danger during this transition stage may be overconfidence. The United States cannot assume that anything it does to bring about the transition will actually overcome all the reverse salients blocking reform, which suggests it should not try to accomplish this transition without international help. Nor should leadership of the transition be delegated to just anyone. Only outstanding talent should be recruited to pioneer change science and conduct research on these reverse salients. Moreover, the transition is risky enough that as many independent efforts as possible are needed to attempt to launch sustained continuing improvement, drawing on innovative capacity the world over to maximize the number of competing efforts.

The initiation of change science is likely to require seed funding from private foundations and individual philanthropists, combined with voluntary career moves into change science by individual pioneers from many different backgrounds. One source might be adventurous tenured faculty who expect to retrain themselves for the demands of change science, perhaps having made similar career changes before. Universities that aspire to be leaders in the new field might see the need to prepare the ground for the establishment of interdisciplinary centers or other structures to provide an initial home for change science. Such centers might become departments of their own at some later date as their faculties expand.

The second period should include a number of extended policy activities. Informed third parties should thoroughly review the accomplishments of leading R&D-based reforms, including Success for All, Reading Recovery, and other such examples.[31] Early research studies should engage recruits to change science in focusing on the reverse salients preventing growth of R&D-based continuing improvement. As the recruits gain experience with their new research field, they should also recommend an initial set of priorities for research in change science and for the initial development of an institutional infrastructure for change science as a discipline. Other research studies should investigate whether or not change science is likely to become a global affair. Will other countries find that they need change science as much as the United States does?[32] Should they establish parallel research studies of the reverse salients blocking R&D-based continuing improvement in their countries? Should the United States foster interchange and cooperation with all such countries on common research challenges?

One challenge for such research studies is to help recruits to change science build their knowledge of the new field. The usual format of a research study—typically several two- to three-day meetings, spaced over two years, backed by a limited staff—is hopelessly inadequate. Based on our own experience, this is far too short a time for the new change scientists to come to grips with the innumerable controversies that now surround education reform and that possibly contribute to the reverse salients requiring study. Moreover, education studies with this usual format have far too little accountability because the committees are generally disbanded before there is any chance for public comment on the study's published recommendations.[33]

One response to these difficulties would be to establish the new research studies as full time for a minimum of five years, with the participants charged with modeling continuing improvement in their recommendations. They could publish a number of intermediate progress reports, each one responding in part to open comment and interchange with respect to previous progress reports.

Several of these studies could be established simultaneously to engage in open competition, the way individual researchers

and research teams are expected to do. They should be offered substantial resources so that they can establish observational studies of their own instead of relying on the testimony of others. There should be incentives to ensure that each study does its best to cope with the confusion and conflict that presently characterizes education.

A primary goal for the second period would be to address problems of equity for the poor and disadvantaged in the context of improving education for everyone. The demand to achieve absolute standards is a greater challenge in poor districts than well-off ones, but there may also be an unexpected advantage for poor districts in the context of revolutionary educational change: they may be readier for dramatic change than the more affluent districts. Moreover, the challenges of revolution in poor districts may be more interesting for the most talented change scientists. Federal programs might subsidize impoverished schools to offer a further incentive for the leading R&D-based reforms to address their problems, as both Success for All and District 2's reform are doing today.[34]

The third period—sustainability. The third period, lasting indefinitely, would see sustained growth of a market of reforms using R&D to help individual schools change. The market would emerge as enough change scientists accumulated knowledge to make possible a number of competing R&D-based reforms serving each category of school or other institutions. Ultimately, the market should span cradle-to-grave education.

The third period, as we define it, cannot begin until the new academic discipline of change science is launched and there is a steady flow of trained recruits for change-science R&D. At the beginning of the third period, the major challenge for policy would be how to support expansion of both the best of existing education research and of change science. We suggest the launch of a nationwide (or worldwide) research initiative for education reform, analogous to existing national initiatives on AIDS, global climate change, materials science, and computer communications. Such an initiative could offer expanding peer-reviewed support for research grant requests from both education researchers and change scientists. It should set priorities

for research funding based on the growth and obstacles to growth of cycles of continuing improvement for reform.

CONCLUSION

Societal pressures on education to improve are forcing a transition away from traditional educational practices to a framework that is as rooted in basic research and applied R&D as any of the major technologies of the past have been. The new research field of change science and the applied R&D sector of education would introduce and sustain stages of continuing improvement in education comparable to stages seen in technologies. Most people have long thought that education is something anyone can do with a minimum of experience. Today we have to think of education as demanding in multiple dimensions: as a science, as a design challenge, and as a performing art while still being an imperative for life in a democracy. Handed-down traditions are no longer enough.[35]

ACKNOWLEDGMENTS

We thank The Ohio State University, under the leadership of both Gordon Gee and most recently William Kirwan, for sustaining us with its intellectual and financial support as we have grappled with the issues of educational reform. We are grateful to the participants who joined us for two meetings at the university, which molded the shape of this issue, and for conversations beyond these meetings. Seymour Sarason, Charles Ericson, Bennett Daviss, Stan Glazek, Uri Ganiel, and Steven Katz provided input on earlier drafts of our manuscript. We are particularly grateful to Stephen Graubard for his support of this issue. This essay contains, in part, our recommendations for achieving reform sought but not fully implemented in an initiative cited in endnote 4, called Discovery. We thank the National Science Foundation and the state of Ohio for their generous support of Discovery, and all the participants in Discovery for helping us to learn the challenging realities of reform.

ENDNOTES

[1]Jerome Bruner, *Toward a Theory of Instruction* (Cambridge, Mass.: Harvard University Press, 1966), 22.

[2]See Karen Louis in this issue.

[3]See Seymour Sarason in this issue.

[4]See Lauren Resnick and Megan Hall in this issue and Northwest Regional Educational Laboratory, *Catalog of School Reform Models*, 1st ed. (Portland, Ore.: Northwest Regional Educational Laboratory, 1998). However, our emphasis on the diversity of accomplishments of individual teachers comes from our own experience with over two thousand teachers participating in a reform in Ohio (the Statewide Systemic Initiative, Project Discovery, jointly sponsored by the National Science Foundation and the state of Ohio). Many of them had struggled long and hard to change their teaching before entering this reform; their accomplishments were diverse, as were their talents, backgrounds, students, and the contexts of their schools. Moreover, none of our teachers had found sufficient time to develop all the changes they would need; most welcomed the further innovations they learned through our reform.

[5]See Victoria Marsick in this issue.

[6]See Jean Johnson and John Immerwahr, *First Things First: What Americans Expect from the Public Schools* (New York: Public Agenda, 1993).

[7]See Daniel Bromley in this issue.

[8]An exception to the constant administrative shifts is the private corporation established at the behest of former President Bush, now called New American Schools, which has provided continuing support for one of the R&D-based reforms we will discuss.

[9]See Louis, this issue, and Michael Fullan with Suzanne Stiegelbauer, *The New Meaning of Educational Change*, 2d ed. (New York: Teachers College Press, 1991).

[10]See, e.g., Susan J. Bodilly et al., *Lessons From New American Schools' Scale-up Phase: Prospects for Bringing Designs to Multiple Schools* (Santa Monica, Calif.: Rand, 1998); Catherine E. Snow, M. Susan Burns, and Peg Griffin, eds., *Preventing Reading Difficulties in Young Children* (Washington, D.C.: National Research Council, 1998); and Northwest Regional Educational Laboratory, *Catalog of School Reform Models: First Edition* (prepared by the Northwest Regional Educational Laboratory with assistance from the Education Commission of the States, March 1998).

[11]For an extensive list of reforms, see Northwest Regional Educational Laboratory, *Catalog of School Reform Models: First Edition.*

[12]Robert E. Slavin et al., *Every Child, Every School* (Thousand Oaks, Calif.: Corwin Press, 1996).

[13]Reading Recovery is based on research initiated in New Zealand. See, e.g., Carol A. Lyons, Gay Su Pinnell, and Diane E. DeFord, *Partners in Learning: Teachers and Children in Reading Recovery* (New York: Teachers College Press, 1993). See also Snow, Burns, and Griffin, *Preventing Reading Difficulties in Young Children*, and Northwest Regional Educational Laboratory, *Catalog of School Reform Models.*

[14]Resnick and Hall, this issue.

[15]Sarason, this issue.

[16]See Thomas P. Hughes in this issue.

[17]See Thomas P. Hughes, *Networks of Power: Electrification in Western Society, 1880–1930* (Baltimore, Md.: The Johns Hopkins University Press, 1983), 465.

[18]Hughes, this issue.

[19]See Wallace E. Huffman in this issue.

[20]Louis, this issue.

[21]Slavin et al., *Every Child, Every School.* More generally, see Kenneth G. Wilson and Bennett Daviss, *Redesigning Education* (New York: Teachers College Press, 1994).

[22]See, for example, K. Anders Ericsson, Ralf T. Krampe, and Clemens Tesch-Römer, "The Role of Deliberate Practice in the Acquisition of Expert Performance," *Psychological Review* 100 (1993): 363–406.

[23]Sarason, this issue.

[24]See, for example, National Institute on Student Achievement, Curriculum, and Assessment, *The Educational System in Japan: Case Study Findings* (Washington, D.C.: U.S. Department of Education, Office of Educational Research and Improvement, 1998), and references cited therein. This report cites exceptionally favorable teacher preparation in Japan as well as troubles with student disinterest in mathematics, perhaps due to pressures from competitive entrance examinations for high school and college. The proposed new research field does not exist in Japan, just as it is missing here, which could account for problems with education not being resolved in either country.

[25]See Frank J. Sulloway, *Born to Rebel: Birth Order, Family Dynamics, and Creative Lives* (New York: Vintage Books, 1996), esp. 39–41.

[26]For the latest educational establishment's view of teacher preparation, see National Commission on Teaching and America's Future, *What Matters Most: Teaching for America's Future* (New York: National Commission on Teaching and America's Future, 1996). Reading Recovery has already brought unexpected (if localized) changes to over twenty schools and colleges of education: see Lyons, Pinnell, and DeFord, *Partners in Learning.* However, Reading Recovery has yet to be studied for its lessons in how to implement change in a college of education.

[27]See, for example, Everett M. Rogers, *Diffusion of Innovations*, 4th ed. (New York: The Free Press, 1995), esp. chap. 7.

[28]Louis, this issue.

[29]Recommendations about school reform come from a variety of business organizations, such as the National Alliance for Business or the Business Roundtable. In addition, New American Schools gets its support from members of the business community: see Bodilly et al., *Lessons From New American Schools' Scale-up Phase*, which makes clear that New American Schools encountered difficulties not anticipated by business leaders.

[30]Louis, this issue.

[31]From the perspective of change science, one especially important need is to determine whether student performance is improved by the upgrade from Success for All to Roots and Wings. As of the writing of this paper, results were not yet available to provide even a preliminary answer to this question.

[32]There are international studies that indicate all advanced nations are having serious problems with their education systems. See, for example, Per Dalin and Val D. Rust, *Towards Schooling for the Twenty-First Century* (New York: Cassell, 1996). In the context of these shared problems, the rankings of nations in international test-score comparisons may have little relevance.

[33]We make these comments based on Kenneth Wilson's personal experience with a National Research Council study of the federal role in education research. This study was unable to get to the bottom of the problems (reverse salients) blocking education reform. It was terminated before its members could develop the necessary understanding of education research and start raising the kinds of questions that might have led to a consideration of reverse salients. For the committee's report, see Richard C. Atkinson and Gregg Jackson, eds., *Research and Education Reform: Roles of the Office of Educational Research and Improvement* (Washington, D.C.: National Academy Press, 1992).

[34]See, for example, Louis, this issue.

[35]For more of our recommendations and additional information, see the Learning by Redesign web site located at <http://www.physics.ohio-state.edu/~redesign/home.html>. Our inspiration both for drawing on historical analogies and for specific recommendations came in part from Peter Drucker, *Innovation and Entrepreneurship* (New York: Harper and Row, 1986), chaps. 9 and 110; and Stephen R. Graubard, "We Need to Know More," *Dædalus* 124 (4) (Fall 1995): 173–178.

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