INTRODUCTION

It is plain from the newspapers and trade journals that the new technology is the educational phenomenon of the moment. American schools always seem to have at least one such animal in residence, and microcomputers may retain this favored position for some time. But it also seems likely that this new technology will not work precisely as its sponsors hope: Perhaps it will not be adopted as widely as they wish—or more quickly, or widely, than anticipated. In addition, many teachers will not use it in the prescribed doses. Evaluations, of course, will show that the new technology is "working" for some schools and students, but "not working" for many others. Educators and policymakers will want to know why. Researchers will be invited to investigate and explain.

Readers with an acute attack of deja vu may stop here, feeling that they have been on this roller coaster before. But that is one point of this chapter: Barring any unexpected and amazing developments, this new educational technology will become embroiled in problems of adoption and use. We may be able to learn something about these problems from a consideration of similar problems in the past—the problems that Americans are now in the process of forgetting. New technology, after all, is an old educational enchantment. One part of the story begins late in the 19th century, when the rise of a new industrial technology excited imaginations everywhere. Educators thought that new methods of production already had increased what managers, citizens, and even ordinary workers needed to know, and they envisioned much greater
increases in the near future. If schools did not enroll more students and teach them more — how to work with the new technology, how to manage it, and how to understand it — grave political and economic trouble would ensue. This theme has lost none of its appeal. Education for the new industrial technology is still a favorite American incantation, one that critics and fans of education both recite, as they bash and boost the schools.

The uses of new technology in education is quite a different part of the story. This one dates back at least to the 1820s, when educators enthused about the production of more books, and their wider distribution. They were excited about the pedagogical possibilities of more diverse materials, more directly available to students and teachers. But educators' romance with new technologies of instruction warmed up as time passed. Since the end of World War II, educators, reformers, and school critics have seized on one technical innovation after another, seeing fabulous opportunities for better education in each. Changes in publishing that made cheap books widely available was an early case: The paperback revolution was announced as a way to free students and teachers from the texts, lectures, and recitations to which they had been chained since McGuffey. Educational television was another early hope, but prophecies of new freedom for teachers and students were quickly followed by stories about TV sets languishing in school closets. New curricula and texts in the sciences and mathematics may seem quite conventional in comparison to television, but they were nonetheless an important innovation in the technology of education. Computer-assisted instruction was much more exotic, though one remembers CAI more for its impact on large corporations (it encouraged several to create expensive but unsuccessful subsidiaries to develop and promote educational technology) than for its effect on school instruction. The successes of Sesame Street and its progeny soon distracted commentators from the dismal performance of both the new educational technology firms and CAI. But Americans had just gotten used to the new programming when microcomputers burst on the scene, the newest new technology. Promises of computerized educational revolution quickly put most of the older new technologies in the shade.

This second story is my subject here. Like any good love story, it has had many ups and downs. Some of the new technologies have been widely used, whereas others have been generally ignored by educators. But even the technologies that were used were not always employed as their sponsors had planned, or hoped. The sponsors often have been heartbroken by the abuses their offspring have sustained, in liaisons with schools. But these uses, misuses, and nonuses are all useful, because they can help in telling my story. I focus on two issues: What kinds of matches have been made—or frustrated—between technology and schools? What explains why some marriages have lasted, while others limped along, and still others never made it to the altar?
PATTERNS IN TECHNOLOGY USE

It seems only fair to begin with books. They are the oldest new technology in education. They are widely used, and they have persistently been advertised as having many of the same virtues now ascribed to computers. Books can be used very flexibly, after all. The great variety of books available means that students in a single class often can study the same subjects, or even the same topics within a subject, by reading very different books. Modern publishing also makes it possible to produce such variety quickly, where it does not already exist. The technology thus permits students to adapt their studies to differences in taste, talent, and time. Even when an entire class uses the same book, the technology is quite flexible. Each student can read at his own pace, with few queuing problems. Readers can flip back and forth for particular points, or review, with great ease. Books can be carried around and used at the student's discretion, read for hours at a time, studied in bits on subways and buses, or put aside for consultation with a teacher. They can be used individually or in groups. Books also can be published relatively inexpensively, and cost can be further reduced by reuse.

Given this remarkable technology, it seems reasonable to ask: do schools use books in ways that capitalize on their flexibility?

Yes and no. Teachers have capitalized on the flexibility of books, but they did so in ways that preserved rigid instruction for many students while reducing it for some others. First, the books most commonly used in public schools are texts. Despite the many different kinds of books that are available, texts dominate book use in public elementary and secondary schools. And despite the many more flexible ways in which the material printed in texts could be published—in smaller and deeper paperbacks, for instance—most of the material that students read is in texts.

A second point is that these texts are commonly prepared and employed as complete instructional packages. Although teachers select topics within texts, and sometimes use supplementary materials not connected with the text, it appears that in most cases the text, along with associated workbooks and worksheets, comprise the entire matériel of instruction. The great flexibility afforded by more mixed materials is typically foregone. One most commonly sees such mixed materials in high school advanced placement classes. There are amazing opportunities for students to diversify their readings within subjects or topics, and possibilities for further expanding these opportunities. But few of these opportunities are seized.

A third point is that texts and other reading materials are mostly used within a rigid lecture-recitation-seatwork organization of classroom work. This is the

---

2Cuban, op. cit.
the very organization that many advocates thought would be swept away in a flood of paperbacks. But the deluge did not have this effect, something that might have been inferred from inspection of earlier episodes in the same drama. At the beginning of the 19th century, educational reformers argued that American schooling would be greatly improved by the then-novel practice of printing texts and other books for students' and teachers' use. New points of view about subjects and how to teach them could be introduced, and reliance on whole-class work—dominated by teacher talk and slates—could be reduced. Classrooms could move away from lecture and recitation to more individualized work. But by the middle of the century educational writing was full of complaints about the rigidity of whole-class teaching, the prevalence of teacher talk, and the lack of much attention to individual students.

Publishing was more sophisticated by the later 19th century, and many reformers, amazed at the flood of new students in elementary schools, saw salvation partly in the greater variety of texts and other books that were becoming available. The more varied student population could be accommodated by using these materials to permit students to work at their own pace. Plans for flexible grading, grouping, and promotion proliferated: The Dalton Plan, the Winnetka Plan, and others offered ways to individualize learning within a mass-education system, through a combination of flexibly scheduled assignments, individualized evaluation of students' work, personalized learning contracts, and diverse instructional materials. But when educational researchers began investigating classroom work shortly thereafter, early in our own century, they found virtually no trace of these plans. Classrooms were rigidly organized for lecture and recitation. Texts and teacher talk ruled supreme. Researchers complained that they saw none of the flexibility promised by new plans for organizing instruction, and few flexible uses of printed materials.

Textbooks and other print materials improved, diversified, and grew in volume between the World Wars. Great stress was placed on devising materials that would meet and excite the interests of an increasingly diverse body of students. According to researchers and educators, considerable progress was made in this area. But studies of classroom work sang the same sad tune, as teachers and students did not take much advantage of the greater flexibility that was available. Most classrooms seemed as rigid as they had been decades before. Classroom researchers sing the same tune today, after a revolution in publishing that produced an unprecedented avalanche of diverse material.

Ironically, one reason things turned out this way is that books are a very flexible technology. They can be easily adapted to a variety of instructional

---

4One of the earliest studies was a doctoral thesis at Columbia, concerning the persistence of traditional recitation: Stevens, R. (1912). *The question as a measure of efficiency in instruction*. New York: Teachers College.

organizations. The very attribute that innovators thought would revolutionize education made it easy for schools to adapt this innovation to existing organization and purposes.

My point in this little recital is not that public education is an organizational mastodon, frozen in its own cozy little glacier. It has changed swiftly and fundamentally in some ways. For instance, an entire system of public secondary education was built between 1890 and 1940, and a new mass system of public higher education was built between World War I and 1970. But, as Larry Cuban has shown, the more intimate organization of instruction has changed much less dramatically than the large organization of school provision. During this same period, reforms that sought more flexible, child-centered instruction in schools seem to have produced only small changes: the style of work in most classrooms today appears to be strikingly similar to that of 8 or 9 decades ago. And this conservatism has persisted in spite of a print technology that progressively opened up more and more opportunities for flexibility in the organization of instruction, and in spite of steadily increasing demands for such flexibility.

We can probe this point a bit further by considering the ways in which innovative content in this technology (one might think of it as new software for textbooks) has been used. My example is the new curricula that were devised in response to school criticism in the 1950s—in part because it seems timely, and in part because there are some data.

The chief worry then, as now, was that quality education was getting short shrift in schools, as the result of a flabby egalitarianism. One leading response was an unprecedented national investment in new curricula. Some of the best minds in the country went to work on what students would read, and within a relatively short time much new material was in print.

In some important respects the results were a real success. The textbooks greatly improved subject matter content and presentation over what had gone before. These improvements encouraged more and better instruction at the top of the high school curriculum. More students with the will and the wit were able to study advanced science and math, for instance. Such courses multiplied rapidly between the middle 1950s and the early 1970s. But these changes did not occur at the instructional core of public education. The top track was marginal to that core. It also was the one place where there was both support for change and no powerful opposition to it.

There also were some broad adoptions of the new texts: Biology books seem to have found homes in high school classes for students at all levels. And some other books seem to have stimulated change more by inspiring imitation in

---

\(^{a}\)For a nice discussion of this point, see Cuban, L. (1986). *Teachers and Machines* Chap. 3. New York, Teachers College.

\(^{b}\)Cuban, *How teachers taught*, *op. cit.*

\(^{c}\)Powell *et. al.*, *op. cit.*, (pp. 282-92).
commercially written texts than by supplanting them in the market. The new curricula were thus successful in several different ways: They were a substantive improvement; they were used widely in some cases and deeply in others; and they were imitated.

But successful invention, diffusion, and adoption are only the first steps for any innovation. They make a novelty available for use, but they guarantee nothing about how it will be used. How were the new materials employed in teaching and learning? Whereas research on this point is embarrassingly thin, the available evidence is much less impressive than the data on diffusion and adoption. For the instructional uses of the new materials seem to have diverged from authors' and sponsors' expectations in several different ways.

First, little seems to have changed in the actual organization of instruction. Whole-class, lecture-recitation continued to be the order of the day. Teachers seemed to talk just as much after using these materials as before. The livelier and more inquiry-oriented content did not seem to much change classroom discourse.

Second, most teachers seem to have used these materials as packages. There were explicit and implicit invitations to diversify reading and other work. There was some diversification at the margins, in AP and honors classes. But there seems to have been little diversification in most classes.

Third, when we turn to the content of teaching and learning, the results seem to have been quite mixed. Some teachers understood the new content and used it to good advantage. But many more appear instead to have taught these inquiry-oriented materials as literal truth. For instance, a math text might present three different ways of representing the answer to this problem in the multiplication of two-digit numbers:

\[ 12 \times 12 = ? \]

\[
\begin{align*}
4 \text{ times } 12 &= 48 \\
3 \text{ times } 48 &= 144 \\
10 \text{ times } 12 &= 120 \\
2 \text{ times } 12 &= 24 \\
12 + 12 + 12 + 12 + 12 + 12 + 12 + 12 + 12 &= 144 \\
12 + 12 &= 144 \\
\end{align*}
\]

Such different representations seek to encourage understanding of the nature of multiplication, rather than just memorization of the conventional algorithm. But most teachers seem to have taught such thoughtful stuff by having students memorize it, just as they would have directed memorization of the conventional algorithm, or the 13 causes of World War I. The means of instruction would thus defeat the novel content of the materials, perhaps introducing more confusion about multiplication than the old method of instruction alone would have done. The texts intended to open up subjects for inquiry and argument, and to introduce students to critical thinking about them. But most teachers
seem to have used the texts instead as a vehicle for their established, much more traditional approach to instruction, submerging the new conceptions of subjects in the old ones.

So, while the new curricula were used, they were used within the extant organization of instruction. In a minority of cases this meant they were used intelligently and sympathetically, but even in these cases the new content did not bring radical change in the ways that classes were conducted, that teachers taught, or that students learned. But in most cases, the new curricula were assimilated to an inherited and rather rigid organization of subject matter, teaching, and learning. In either case, it seems fair to say that the new materials seem to have changed the organization of instruction in any dramatic way. More often than not, the extant organization changed the materials. In a sense it is fair to say that the new materials failed, despite the opportunities they created to free students and teachers from whole-class, lock-step, batch-processed instruction. But it is also fair to say that the curricula failed precisely because they created such opportunities. Classroom work changed little because the new materials were flexible and could be adapted. Had such adaptation been impossible, use would have been much less. In any event, by the early 1980s most traces of the new content appear to have vanished, carried away on later waves of innovation.

I return to these points a bit further on but wish first to consider one other educational technology—television. What do we know about the uses of television that was devised for schools?

Larry Cuban has shown in his recent book on teachers and technology that despite extravagant claims for the revolutionary effects of educational programming in this medium, it has been used only a little in the schools. He explains this result in part as the result of a poor fit, between the kinds of materials that were available for viewing and the demands of regular classroom instruction. For instance, programs were not keyed to the curricula that teachers had to use and did not fit into the school schedule well. His account suggests that innovators attended more to the new technology and its possibilities than to the organization of instruction in which the technology would be used.

This point can be amplified a bit in the uses of television in higher education. For this technology is used as a medium of undergraduate instruction in many American universities. When so used, TV seems to be an ancillary means of extending a conventional pedagogy: Professors’ lectures are videotaped, and cassettes are made available to students for viewing at their convenience. I have found courses in which more than 4,000 students are taught in this fashion. In other cases, lectures are broadcast live to students watching monitors in other rooms; or both. There are few reports of such technology

---

*Cuban, Teachers and machines, op. cit.
use in small colleges, or in selective private universities. TV seems to be used more often in large public institutions, where huge classes are more common. This seems utterly unsurprising: everyone can think of reasons why Brown and Wesleyan would be allergic to practices that Indiana or Michigan State would embrace.

Why do high schools not follow the Big Ten example? After all, most secondary schools closely resemble land grant universities in ideology, and organization: Both are inclusive; both offer extraordinarily comprehensive curricula; and both aspire to provide a peoples' education. Pedagogy in both also seems well adapted to a flat-footed use of TV: Most teachers talk while students listen or at least don't disrupt the lecture.

At least part of the answer is that university teachers are no longer assigned custodial responsibility for their students, whereas high school teachers still have heavy duties in this department. Leaving a room full of high school adolescents alone with each other and a television set would still seem problematic today. But we have gotten used to the idea that doing the same thing with their slightly older brethren in college is not likely to cause trouble—or that if it does, the trouble is not their teachers' business. This view is a relatively recent development in the history of higher education. For a long time, colleges and universities assumed extensive responsibility for student manners and moral discipline. Had there been educational television in 1890, it might have seemed as troublesome in universities as it now seems in high schools.

My account, admittedly speculative, suggests that the social organization of education is an important influence on technology use. In institutions that have given up most social and moral oversight of students, and in which student discipline is not seen as an educational matter, an instructional technology that permits students more autonomy from their teachers—even if it is a curiously routinized and even remote autonomy—is not problematic. But technology that permits such autonomy presents difficulties for educational institutions that make student discipline a central educational mission.

Adult and continuing education programs have capitalized somewhat more on television's possibilities for decentralized instruction. The Open University, for instance, uses television to deliver higher education to adults. Students can watch at home, do assignments and exams by mail, and work to a large extent on their own schedules. The technical capacity for this mode of delivering higher education exists in many American public higher education systems, and some universities use TV to deliver some of their lifelong education programs. But these are kept quite separate from undergraduate and graduate education—the academic and budgetary core of U.S. universities. There is no technical reason for such separation: Undergraduate or graduate students could take their classes in their rooms, their parents' homes, on in downtown hotels. It would be cheaper and easier to wire up a university for educational TV than for computers. Indeed, universities could reduce many of their costs if they seriously used this technology. Why has no one seized the opportunity?
At least part of the reason is that each advantage of such an innovation is also a serious organizational drawback. For one thing, radical decentralization of instruction could eliminate many classes. While this might not be a great pedagogical loss, given the quality of instruction in most universities, it would be a great change in the organization—and the theatre—of higher education. And the change would raise questions about the value of university campuses, dedicated as they are to classrooms. It also would raise nasty questions about the faculty. For if classes can be preserved, packaged, and rebroadcast, why keep the likes of us around, soaking up salaries by annually offering courses that might better be taped once every 5 or 10 years? And finally, this technology would eliminate the need for universities to provide daycare for superannuated adolescents: The costly and burdensome administration of dormitories, health services, counselling, and related services could be reduced or eliminated. But such measures might produce hostile reactions among parents and students, eager for relief from each other.

These considerations suggest some reasons why TV has not captured the heart of university education, and they help to explain why it has spread instead at the periphery. Continuing education is a sector of higher education in which the organizational barriers to this technology are weak. For these programs rarely have permanent faculty. They have few students in need of a home away from home. They have no great costs sunk in physical plant. And they have few alums wishing to renew fond memories of dozing through Western Civ in Blow Hall 100.

Past Uses of Technology

What does this discussion suggest about patterns of technology use in education?

First, there is plenty of evidence that technology is used. If educational television did not deliver on its promises for elementary and secondary schools, it is used in higher education. If the new curricula were often not used as intended, some were taken in sizable doses, nonetheless. In thinking about the newest technology, we should be as prepared to explore unintended uses and nonuse as faithful adoption.

How can these things be described? Explained? In the recent past, adoption and use have most often been explored in terms of what might be termed organizational management: Variations in use have been ascribed to the extent to which the change process accommodated the interests, concerns, and situations of the various parties involved\textsuperscript{1}\textsuperscript{1}. This concern seems appropriate,

\textsuperscript{1}There has been an outpouring of research along these lines in the past 15 or 20 years. One of the chief studies was Berman, P., & McLaughlin, M. (1977). Federal Programs Supporting Educational Change (Vol. 7). Santa Monica: RAND. Another was Weick, K. (1976). Educational organizations as loosely coupled systems. Administrative Sciences Quarterly, 21, 1–19.
but it might usefully be broadened. In the cases just sketched, for instance, it often looks as though very broad organizational considerations that reach beyond the change process—such as the structure of adult and continuing education, or the social organization of higher education—may help to explain the uses and nonuses of technology. And in other instances it seems as though very specific features of the organization of instruction—such as the demands of whole-class instruction—also affect technology use.

In what follows, I explore the relation between the social organization of instruction, written large and small, and instructional technology. This is a tall order. Researchers have probed each of these departments in some detail, but they rarely have explored them together, or explored their connections. With a few exceptions, researchers have not tried to understand the relations between what we call practice (the instructional form or content of a technology, or the organization of instruction itself), and what we call policy and organization (programs to reform instruction, the structure of school systems, and the like). This is a messy subject, but a fascinating one.

One issue concerns the relative importance of technology and social organization: Much of the programmatic literature on new technologies portrays them as powerful interventions into troubled or moribund organizations. But many studies of innovation tell stories about new instructional technologies being swamped by the organizations into which they were introduced. Can one make sense of these contrary claims?

The dominant view, at least in America, is to regard technology as a powerful independent force for organizational change. The impact of new manufacturing technology on the creation of assembly line production is the classic example of this view. But it is not the only example. Nearly all the new technologies pressed on schools since WW II, from paperbacks to microcomputers, have been advertised as agents that would change education by making students less dependent on teachers, and by reducing whole-class, lock-step, batch-processed teaching and learning. Americans persistently dream about the liberating effects of technical innovations. There is a St-Simonian, almost utopian quality about these hopes, a sense that technology itself can break the chains that bind us to a dreary, work-a-day routine. Much of the promotion for microcomputers, among other educational innovations, attends little to their potential for school instruction, focusing instead quite selectively on their most extraordinary possibilities.

This view of technology seems more plausible if one focuses just on the possibilities for learning and teaching that new technologies might open up. But new possibilities alone will not drive social organizations to realize them. Incentives are required to encourage the changes that new technology requires; work often must be reorganized to accommodate new modes of production;

---

11Cuban, Teachers and machines, op cit., presents such a story for most technical innovations in education.
decisions must be taken. A little analysis of the old assembly-line example reveals that technology did not drive change in the organization of production. It only opened up opportunities for such change. Workers and managers still had to decide whether changes would be made, what they would be, and how they would be made. Work still had to be reorganized to accommodate these changes. Technology alone reorganizes nothing. If we view technology as an enabler rather than a driver of organizational change, we can ask a question that enthusiasts and commentators alike have often ignored: What might it take, in addition to the possibilities opened by the new technology, to change an organization so that it could take advantage of the new technical possibilities?

Such a query would be salient in the study of technology and social change in any sector of society. It would be particularly salient in sectors whose production technology was relatively weak (whether because it was weakly understood and thus poorly used, or simply weak). For in such sectors we would expect that the lesser influence of technology on production might be complemented by a greater influence of nontechnical, social factors. Education is such a sector. In addition, posing that question would encourage us to consider differences, among sectors, in the capacity of organizations to take advantage of new technical possibilities. Public education seems relatively poorly situated in this respect. Unlike most private firms, it is not organized as a market activity. Therefore decisions about technology use, among others, are not much affected by economic incentives. And, unlike most private firms and some public organizations, education does not have results that can be relatively easily summarized in things produced, services performed, net sales, or profit and loss. Nor have educators been able to find means to reliably produce the results they do seek.

Under these circumstances, one would expect that the innovations most widely adopted would be those that presented the fewest problems. For lacking other powerful incentives to adopt and use a new technology, and suffer through the attendant disruptions, one powerful influence on the uses of any novelty would be its general compatibility with ongoing practice.

One way to illustrate this point is to compare CAI with the more recent microcomputers. CAI was little used. Yet it was only a slightly earlier incarnation of a technology that, even after only a few years, is now fairly widely used. Why?

CAI was problematic in part because computers were expensive and scarce. But worse, they were relatively inflexible. Most ordinary schools or classrooms would have had only one terminal. Because most instruction is whole-class work, most teachers could not have used the new machines without creating queuing problems. Even if teachers already knew everything they required to use CAI, they would have had to cope with turntaking at the terminal, and its impact on what everyone else would be doing. That would have added another classroom management problem to the many teachers already had. That would have chilled the enthusiasm even of teachers who desperately wanted CAI.
By contrast, the new technology can easily adapt to the social configuration of school instruction. Because the new machines are relatively cheap, and getting cheaper while getting better, some schools already can afford to have all students in a class work simultaneously on their own machines. More may be able to afford it in the near future. And because the technology is much more powerful than it was 15 years ago, and getting more so, it is already possible to program computers so they can be used quite flexibly—in some cases, nearly as flexibly as books. The machines are much more capacious and much smaller. Partly as a result of their greater capacity, the programming is more flexible, and sometimes quite ingenious. As a result, there are quite a few programs that allow students to work at their own pace, without disturbing others. There are some programs that even allow students to work, by themselves, on topics that might interest them. My point is not that all schools will adopt computers. It is only that they could, without creating the kinds of organizational problems that CAI would have produced.

But if technologies vary, so do organizations. Although public education generally exhibits weak incentives for the adoption of innovations that would cause internal stress, it is not utterly homogeneous in this respect. There is internal variation in possibilities for educational innovation.

What type of variation? I find it useful to distinguish between the core and the margins of educational organizations, when considering the adoption and use of new instructional technology. The barriers to serious innovation in the core instructional program are imposing. But many innovations have found a home on the margins of the schools. They do so by defining a distinctive clientele and a distinctive instructional approach, and enclosing them in an organizational subunit that is not seen as central to the organization’s work.

Support for this view can be drawn from studies of high school organization, and from evidence on educational innovation more broadly defined. The research on American high schools that Arthur Powell, Eleanor Farrar, and I reported recently, in *The Shopping Mall High School*, noted rather sharp differences between kinds of instruction that could be found in various boutiques—i.e., programs for students whom the schools saw as “special”—and the instruction found in the much larger programs for ordinary students. Some boutiques offered crack academic work, some offered vocational studies, and others were for special education students. But teaching in the boutiques often was more personalized and of good quality. By contrast, instruction in the core was much less personalized and only infrequently did it rise above the routine. Instruction at the margins also was much more likely to incorporate various recent instructional and curricular innovations.

We noted some organizational differences between boutiques and supermarkets. The boutiques were small and specialized, but the supermarkets were large and unspecialized. The boutiques seemed to be on the fringes of the
schools' organization and purpose, whereas the supermarkets were at the core\textsuperscript{12}. Even though they were less good and less distinctive, these large programs for ordinary students were the educational mainstream.

What does that mean? Part of my assignment in \textit{Shopping Mall} was to investigate why high schools had turned out as they had. I noticed two telling developments. Between 1890 and 1950, enormous energy was devoted to creating an organization and instructional forms that were specifically designed to accommodate students who were thought to be uninterested in learning very much, or untalented at learning very much, or both. The result was an educational program that was almost entirely vocational - that is, although there were different subspecialties, nearly all were aimed at different occupations, and most course work was turned in a practical, vocational direction. Only the small, top, academic track included courses aimed at mental cultivation, and even these were thought to point toward professions. Most high schools had four or five curricula, but most sought to provide practical studies, easily completed, for students who were thought to care little for learning. All this was thought to be a great victory for democracy over aristocracy and classicism in education\textsuperscript{13}. It still composes the core of instruction and organization in secondary education.

But between 1950 and the 1980s, the schools were struck by wave after wave of criticism and reform. They responded by permitting or encouraging change around the edges of the already-established core. In a few cases this required only the adaptation of an extant subunit, as in the case of better course work for the college bound in the 1950s. More solid courses were added to this small segment of the organization, and existing courses were redefined. In most cases it required the creation of the new educational specialties and/or organizational subunits. One such departure was the Advanced Placement Program. This was a new organization of instruction for the most talented students, inspired by 1950s concerns about poor instruction in high schools. It was a bold departure in several respects. Though offered locally, it was in some respects a national program. Teaching and curriculum in special classes were referenced to uniform national examinations. In addition, the program linked high school performance to college work in a hitherto unheard-of way: Students' scores on these exams could gain them credit for work in the first year or two of college. The first of these changes marked the advent of a selective, European-style approach to education in a distinctly un-European system of mass-access higher education. And the second marked an effort—unique in this open and forgiving system of mass higher education—to offer strong incentives for quality work in high schools, and to tie them to specific measures of performance in specific curricula.

\textsuperscript{12}Powell \textit{et. al.}, (pp. 9-65).
\textsuperscript{13}\textit{Op. cit.}, (pp. 245-79).
These remarkable changes owed a good deal to the marginality of the concerned students, teachers, and curricula. For by the early 1950s secondary education was already mostly oriented to weak academic performance. The high schools had abandoned their selective character five or six decades before and oriented most offerings to a clientele that was believed to have neither the will nor the wit for serious academic work. The system of secondary education that was built by the late 1920s was a large-scale, batch-processing enterprise, oriented to getting the largest number of students in and out with the least difficulty. By the 1950s that had been the core of secondary instruction for more than a generation. The genius—and the chief limitation—of the AP program was that it opened up new possibilities for high-quality work within such a system, without challenging the core of the system. It did so by creating a new educational specialty at the margin. The program has proved to be quite effective, and durable.

A similar account could be given for a wide range of innovations. Consider special education, for instance. Prior to 1968, handicapped students typically got more warehousing than instruction in public schools. Many students were kept in separate rooms—margins of a kind. The changes made since then have been called mainstreaming—i.e., bringing disabled students out of various educational closets into regular classrooms. This picture is not incorrect, for PL 94–142 increased contact between disabled and regular students. But it is somewhat misleading. For instance, many high schools now offer something close to an entire curriculum for special education students. Special classes in elementary schools have increased, not diminished. A new subspecialty of teachers, who teach only disabled students, has developed. They see themselves as a cadre: Specially qualified, with a distinctive mission, teachers who are different and better than their regular colleagues. Many students spend all or most of their time with these teachers.

Although mainstreaming is a good slogan, a better description is that a new subsector of education has developed. There has been some mainstreaming of students, but special education was not absorbed in the mainstream. It is mainstream in the sense that it is out of the closet, near the center of debate and discourse, relatively well funded and prestigious. But it is not at all mainstream in the sense that special education has been diffused in the central core of education, or of individual schools.

---

14The subsector reaches beyond schools to special education research, development, teacher training, and evaluation. All have multiplied, improved, and made connections that cross the boundaries of governments and educational organizations. And all are part of a remarkably effective political network, dedicated to secure better services for disabled students that has grown up to protect, revise, and extend the legislative and legal victories won two decades ago.

Other examples of the same phenomenon come easily to mind: bilingual education, Headstart, and Upward Bound. These are marginal in the several senses used here. The students are special and are highly identifiable populations. They are believed to require unusual treatment in schools because of some special condition or problem. They have well-organized constituencies that have
The point can be extended to the two-year-old struggle to improve education for disadvantaged children. The available analyses seem to show that there has been little or no sustained improvement in students' academic performance as a result of exposure to ESEA Title I (now Chapter I) programs. The reasons adduced for this rather modest showing cover everything from fragmented programs to inadequate resources. But my arguments about innovation suggests that Title I remains a problem partly because it failed to create a distinct subsector, in which distinctive educational services could be provided for a special population. Instead, program advocates launched a frontal attack on the way disadvantaged students were managed within the educational mainstream. Innovators were thus in the odd position of demanding special attention for students who were agreed to be different in some sense, but also rejecting the strategies that would have made such attention organizationally feasible and appealing. "Pull-out" programs a few hours a day were permitted, but no distinctive subunits, teaching cadre, or instructional approach were developed. In this respect, the program may have been a victim of the egalitarian ideals with which it always has been associated.

Innovations do succeed at the core of public education. But they tend to be superficial. Many have swept across the nation's schools, quickly finding thousands of adoptons but disappearing equally quickly, leaving few traces of their existence. The best current case is effective schools programs. They have been packaged by many entrepreneurs so that a district can "adopt" the innovation by hiring a consultant and making an announcement and disseminate it by holding a few workshops. Another favorite of bygone years was the filmstrip, along with other "audio visual technology." These could be adopted by purchase and disseminated by renaming school libraries: They became "media centers," with the new technology filed inside.

My point is not that instructional change is impossible. It is that there are different kinds of change in instruction, and different organizational locales for it. There is a continual busy flutter at the heart of public education, as one infatuation after another holds sway. While everyone decries these little romances many must find them enticing, for they persist. But when substantial pressure has been mobilized for change at the margins of education, the results often have been fairly impressive. My account suggests that the margins are a flexible and changing locale: As the 20th century has progressed, they have become more densely populated. One implication of my argument is that if we looked for significant instructional innovation in these subregions, rather than looking for it on average, everywhere, we would find more of it.

recently compiled a decent track record in getting what they want from governments. They have cadres of teachers who think of themselves as specially qualified and committed and able to deal with extraordinary demands. Finally, these programs married some important changes in educational technique or technology to important changes in the organization of instruction. A glance over these attributes reveals that they also apply to Advanced Placement programs, honors courses, and the like.
What does my argument imply, concerning the use of the newest new technology?

Chiefly that its great flexibility may make it easy for schools to adapt this technology to the inherited organization of instruction. Many fans of the new technology see its flexibility as the key to its revolutionary impact, but they may well be disappointed. Consider the technology's prospects, in light of the main features of the instructional core that I have been discussing:

1. Most instruction occurs in groups of 25 to 35 students. It tends to be scheduled in small segments of 45 to 50 minutes. These segments seem to be irreversible in high school, and somewhat more flexible in some elementary schools.

2. Classroom instruction is either whole-class work or completely individual; there are few cases in which subgroups' work varies greatly, or that they have had a large role in shaping. There is grouping within classes in elementary grades, but work in these groups generally seems to consist of faster or slower versions of the whole-class agenda.

3. Instruction is teacher dominated, whether whole-class or individual. Whole-class work consists chiefly of lecture and recitation, rather than discussion or other formats in which students take extensive responsibility by setting the terms of instruction, probing issues, and the like. Teacher talk dominates such instruction. When students do talk, it usually consists of brief answers to teacher questions. There are few opportunities for teachers to probe students' thinking, to explore the nature of misconceptions, mistakes, innovative ideas, and the like.

4. Most individual work is seat work, in which students labor alone on handouts that are either devised or selected by teachers. The content and format of these worksheets is generally such that teachers dominate as much here as in recitation; students have little responsibility for setting the terms of work, or opportunities to probe issues. As in whole-class recitation, they respond briefly to teacher queries. There are few opportunities for teachers to explore students' thinking.

5. There is a mental organization of instruction that typically accompanies this social organization. In it, academic competence is construed in what some would regard as minimal terms. Knowledge is represented as the mastery of bits of information, and isolated, mechanically mastered skills. Intellectual performance is represented as the correct recapitulation of those bits, and display of the skills.

The new technology can easily fit into the instructional organization. It can be used within the whole-class format discussed previously in points 1 and 2, without disruption due to queuing. Although not yet as flexible as books, the machines and software already available seem to work well within the lecture—
recitation format (point 3). Much of the software currently available is, in effect, an individualized recitation.

But the new technology would not be used widely unless it also was compatible with the intellectual organization of instruction described here (point 5). All reports are that the most common instructional programs are drill and practice. If this industry responds to demand in roughly the same way that other publishers have, such software will continue to be the most popular, simply because it can be easily integrated into mainstream classrooms (point 4). This suggests that the chief barriers to the widespread adoption and use of the new technology may turn out to be financial or administrative, rather than organizational or intellectual.

There are, of course, exceptions to these patterns. Teachers in AP classes, or Special Education classes, some vocational classes, and teachers who specialize in various subject areas all are potential markets for more specialized and possibly more sophisticated software. When instructional software that aims at more than drill and practice is used, it probably will be in such marginal areas of the instructional organization, not in the mainstream. Of course, there are some teachers at work in standard instructional settings whose practice is demanding and sophisticated, and they may use innovative software.

Explanations

Explaining the failure of reform has been an important theme in educational research since the turn of this century, when reformers and commentators first noticed that important instructional innovations were not having the intended effects. Such work developed into a sizeable social science industry in the late 1960s, when a large national program of national educational reform seemed to flop. Three kinds of explanations have been advanced. The oldest refers reform failures to the materials of reform itself: inadequate curriculum, insufficient teacher preparation, too little time, or not enough money. This has long been a popular explanation, perhaps because it permitted reformers and partisan investigators to chalk the persistence of old patterns up to teachers' perversity or stupidity, or to the absence of good alternatives in curriculum or instruction\(^1\). But these explanations are no longer easy to accept, for as Larry Cuban and others have pointed out, the old patterns of teaching have persisted through the provision of many of the alternative curricula and instructional improvements that reformers demanded. They have persisted as well through dramatic improvements in the education of American teachers. This suggests that the barriers to instructional reform are either located elsewhere or are more deeply rooted.

---

\(^1\)John Dewey himself was one of the early figures to use this argument, in explaining the slower-than-earlier-imagined progress of his "new education." See *Experience and education* p. 90. New York: Kappa Delta Pi, 1938.
A second line of work focuses on frailties in the reforms. One common explanation is inadequate management of change in schools and innovative programs, and another is inadequate adjustment between reforms and schools. This line of work is popular, perhaps because the research seems to suggest that reform can work if these problems are repaired. A last line of investigation locates obstacles to change in the schools' organization. The favorite explanation is weak interdependence among subunits of local schools—loose coupling, in one inelegant formulation. This approach seems to imply that reform will not succeed unless schools are reorganized.

All these approaches seem sensible in some respect. Each points to problems that have been found in some instructional reforms and might be found in many more. But other explanations have been offered that have had less attention. I explore three of these next.

Incentives

One explanation for the persistence of traditional instruction is that societies get the schools they deserve, or want. If incentives for serious academic effort are generally weak, it would be foolish to expect anything but superficial innovations, and the continuation of inherited forms. Incentives for instruction can be grouped in three rough categories: those that are broadly social and operate ubiquitously on education, those that are specific to the system of public education and operate within that system, and those that are specific to the terrain of instruction and operate in classrooms, or wherever instruction occurs.

Ubiquitous Incentives. Education is an object of both public needs and private wants. State, local, and federal governments make policies for schools, but parents and students shape education simply by the weight of their private preferences. Both affect the incentives for instruction, but their effect has been paradoxical in America: We are enthusiastic supporters of public schools, but indifferent or hostile to intellectually demanding education. This situation can be seen in public policy, where Americans have pressed public schools to solve social and moral problems more than they have pressed for academic quality.

---

18This has been especially true of the line of research associated with Berman and McLaughlin's work. (Federal Programs Supporting . . .).
19Weick, K., op. cit.
20In debates about whether education should be a public responsibility, in the 1830s and 1840s, juvenile crime and immigrants' alleged lack of proper morals and respect for authority were higher on many reformers' agendas than students' academic performance. Indeed, some early crusaders for public education, like Henry Barnard, argued that public schools were needed to repair a moral crisis, not to improve intellectual performance. Early in the 20th century, the expansion of public education was justified partly as a solution to problems of child labor and family instability. More recently, drugs, teen-age pregnancy, and race relations have become important items on the schools' agenda. These problems may be appropriate for schools to attack, but none require stiff academic standards for their solution.
It also can be seen in the content of private attitudes, in which students and adults consistently give vocational preparation and social adjustment much greater importance than academic work. This preference also pops up in passionate popular crusades against sophisticated literature and cosmopolitan curricula, and for the promulgation of simple pieties in public schools.

Higher education is another important source of incentives for elementary and secondary instruction. One way colleges and universities exert their influence is in the education of teachers for the lower schools, an activity to which they consistently give a very low priority. They devote few resources to the cultivation or study of expert pedagogical knowledge, either in their own faculties or among teachers in the lower schools. And the higher schools impose the weakest standards in admission to teacher education programs, and permit a disproportionately large share of weak candidates to complete their programs and enter the teaching profession. Such teachers have a limited capacity to encourage strong academic performance from students, either by their own example or by more deliberate means.

Colleges and universities also affect incentives for performance in the lower schools with their entrance criteria. These can shape high school performance standards for those students who want to go to college, and perhaps for others in their vicinity. The influence of admissions standards has changed dramatically in our own time: Between 1940 and 1970, a small and rather selective college and university system became a huge and mostly unselective system. American secondary education thus went from a situation in which, on average, only a few students in each high school were directly affected by college admission standards to one in which, on average, perhaps a third or a half the students were so affected.

That seems a vast increase in the leverage that higher schools had on their lower counterparts. But the strongest post-WW II expansion occurred in the weakest academic sectors of higher education: community colleges, state university branch campuses, and state universities. By the late 1960s or early 1970s, students in high school virtually anywhere could get into something called a college, as long as they had graduated from high school. Other academic qualifications were irrelevant. This forgiving system has several advantages when compared with more selective approaches found in most other nations: It offers many students a chance at higher education and thus offers many who have done poorly in high school another chance, or two. But considered as a system, U.S. high education does not reinforce solid standards of academic performance, either within its boundaries or in the schools below.

Labor markets are a third source of generalized incentives for instruction. The old romance of technology and education tells us that technical and industrial progress push the need for education ever higher. But while skill and knowledge requirements have increased in some technical and professional jobs, they have not increased, and probably declined, in many other jobs. This development sends a mixed message: Studying hard will pay off for a minority
who will win skilled jobs, but not for many others who will work in various service industries, or as laborers in old or new industrial firms. We know little about the extent of economic rationality among high school students, but recent studies reveal that many students know that youth unemployment is high, and that skill requirements for many jobs are low. Many know they can get jobs without doing much in school; others doubt that they can find any decent work and wonder why they should do schoolwork. There are incentives for demanding teaching and learning, then, but they are not general through the society. They are found only in selected social pockets. The more ubiquitous incentives are those that encourage or tolerate weak academic performance.

**School System Incentives.** The organization of education systems also affects incentives for academic performance. The U.S. system is inclusive: Everyone old enough to attend is expected to do so, and no admission standards save age are imposed. Universality tends to weaken incentives for academic performance. For in the competitive society, goods or services that are universally available tend to be assigned a lower value than those that are more scarce, other things being equal. Goods or services that are available to all but can only be secured by some, as the result of special effort or achievement, are more highly valued than those that anyone can have without special effort or merit.

Universality alone is not controlling: Internal standards of quality can strengthen performance incentives, even within universal systems. Japanese elementary and secondary schools are roughly as inclusive as our own and so might seem to offer few incentives for strong academic performance. But Japanese schools are organized around highly selective school entrance and leaving exams. These create incentives for academic work because students' educational status, and their progress toward careers depend on their exam performance. Japanese schools balance an emphasis on inclusiveness and diverse educational opportunities with a stress on academic performance.

By contrast, American schools have only minimal standards for internal progress and school leaving. Historically, schools' standards of quality have been eroded, or their formation has been precluded, as education became more popular. As elementary school attendance moved toward universality in the late 19th century, for instance, standards for promotion and graduation steadily weakened. By the end of the century, promotion was based more on social than academic grounds, and graduation could be achieved simply by completing the grades, rather than by producing evidence of adequate academic

---


performance. Roughly the same story was repeated for secondary education in the first four decades of our own century. By World War II, internal standards for promotion and school leaving were so weak that students could complete the required 12 years of education with only minimal academic accomplishments\(^1\). Incentives for weak performance due to the system's inclusiveness are not balanced by pressures for strong performance due to internal selectivity.

Weak incentives for academic work also can be traced to compulsion in education. Students cannot learn much, and teachers cannot teach well unless they make serious commitments to do so. Although such commitment can be encouraged and supported, it is difficult to compel in a relatively free society. For in such a society commitment is associated with choice, and compulsion with punishment, incapacity, or both. Most ordinary law enforcement uses compulsory punishment as its sanction, and mental illness or incompetence also are often dealt with by compulsory assignment to custodial or treatment institutions. But activities that require great personal commitment for success are rarely compelled. Military service is a seemingly contrary case, but the units that require the greatest commitment typically require choice. Membership in elite units, such as the Air Force, paratroopers, commandoes, and the like, are the result of mutual choice: The recruits must apply, and they must also be chosen. In such cases mutual choice helps to build mutual commitment to the goals of the units, to hard work, and to high performance, This is also the case with selective schools, and with some selective programs within schools. But most of public education is compulsory. Indeed, compulsory school attendance originally was motivated in part by fear of delinquent and potentially criminal youth, and by the hope that schools could resocialize them and save society from destruction. Compulsory schooling later grew with renewed worries about delinquency, child labor, and youthful competition with adult workers. Organizations built on such compulsion tend to defeat rather than build commitment to hard work and high performance, save perhaps in times of crisis.

The incentives that are specific to the organization of the public education system are thus one-sided. The corrosive effects of unselective access and the absence of strong internal standards are reinforced by compulsion.

Classroom Incentives. The organization of teachers' classroom work also generates incentives for weak academic performance. One reason for this is that public school teachers have enormous problems of coverage. Most elementary teachers work with a relatively modest number of children, 25 to 35, on average; but they have enormous problems of subject-matter coverage, for most teachers are responsible for all subjects. One can cover mathematics, reading and writing, geography, social studies, and physical and biological science if

---

\(^1\)Powell *et. al.*, *op. cit.*
one more or less blindly follows a text. But it would require extraordinary talents to know all those subject well enough to teach them in an intelligent and demanding fashion. The extraordinary demands of subject-matter coverage in elementary schools presses teachers toward superficial, rote teaching.

High school teachers need not cover so many subjects: Most teach no more than two. But they must cover many more students, not uncommonly 150 or more every day. These students come in four or five daily batches of 20 or 30 each, for 50 minutes per batch. This organization permits deeper knowledge of subject, but it does not encourage thoughtful or demanding teaching of those subjects. Because the constraints of time, schedule, and student numbers make it prohibitive to give much attention to students’ written work, teachers are pressed to use simple multiple choice or fill-in-the-blanks student assignments and discouraged from making many writing assignments. The constraints also discourage much attention to students’ ideas about subjects, save whether their answers are right or wrong.

These pressures are multiplied by the common tendency of school managers and parents to hold teachers responsible for classroom discipline above all else. Teachers are expected to keep their classes friendly and quiet, and to manage discipline problems by themselves. Many principals and parents associate noisy classrooms, or students sent out because they will not work, with teachers’ inability to manage competently. These expectations put teachers in a bind, for many of their students have little interest in academic work. Such uninterested students are a potential discipline problem in any event, and their potential in this department increases as teachers increase academic demands. Teachers thus must often trade off academic demands for classroom peace, and protection from complaining parents and principals.

I am not advancing an organizational determinism. Teachers work within and around the constraints that I have described in many different ways. But much of this variation in teaching lies on other dimensions than academic quality. Some teachers do overcome the constraints and produce impressive classes. They are relatively rare exceptions, though. The incentives that affect public elementary and secondary schools encourage superficiality in teachers’ and students’ contacts with each other, and with academic subjects.

Under these circumstances, one would expect that demanding reforms of instruction would take hold only under special conditions, and that inherited instructional forms would persist. One also would expect that to find widespread adoption and use, innovations would have to make only modest demands of students and teachers and require only modest change in inherited approaches to teaching and learning. The implications for the new technology seem straightforward: Cost and promotion aside, if widely used in ordinary school settings it seems likely to be used for standard and relatively undemanding activities, usually lumped together under the rubric of drill and practice. If used in the service of academically demanding instruction, it seems likely to
be used chiefly in special circumstances, such as those that I earlier termed the margins of public education.

BARRIERS TO INQUIRY-ORIENTED INSTRUCTION

One of the most powerfully appealing features of the new computer technology is the sense that it opens up many possibilities to make teaching and learning more exciting. Many fans see the new technology as a way to nourish students' intellectual curiosity and feed the hunger for learning that is believed to be blocked by backward practice, or inadequate materials. These ideas connect the new technology with two old themes in American efforts to reform instruction and learning. One is that students are naturally curious and inventive, and that school is dull because these attributes are suppressed rather than encouraged. If they were just offered interesting curriculum, students would approach instruction with the same appetites they bring to ice cream. The other theme is that it is not difficult to make teaching lively and interesting while still packing it with deep intellectual content. If teachers could be clever about pedagogy and knowledgeable about their subjects, everyone would learn and love it. John Dewey was the first really famous preacher of this gospel, but he had many predecessors as well as battalions of followers.

Enthusiasm for the latest new technology incorporates many of these old ideas about educational practice. Like many earlier reformers, designers of computer software and advocates of inventive design want to devise materials that would encourage students and teachers to become active inquirers. They want instruction to be inquiry oriented. This is a slogan that covers a multitude of tendencies in educational practice and theory, but most of them share a view of students as active constructors of knowledge, of knowledge as open and evolving, of academic learning as exciting and vital, and of teaching as a stimulus to curiosity and a model of inquiry.

There are, however, important barriers to the success of such instruction that have been little examined, either by reformers or students of instructional improvement. Some arise from the extraordinary intellectual and emotional

---

This section draws on research for a book in progress that I have tentatively titled, Teaching: Policy and Practice. Some parts of the argument are sketched in an essay delivered at The Benton Center at The University of Chicago that is to be published by The National Society For The Study of Education: "Teaching Practice: Plus Que Ca Change . . . ", June, 1987.

These ideas have animated many academic efforts to reform instruction. They include the early 20th century Progressivism of Dewey, George Counts, W.H. Kilpatrick, and others, to the later curriculum reform efforts of Jerome Bruner and his many co-workers and sympathizers, and recent "constructivist" and "cognitivist" psychologists and curriculum reformers. These advocates have found much to argue about with each other, but they seem more similar than different when considered against the background of teaching practice in most public schools.
demands that such teaching makes on teachers and students. The other arises from the weak roots that these reforms have in the social organization of instruction in the U.S. I take up both problems in the following sections.

Instructional Barriers. Some clues that inquiry-oriented teaching and learning may be problematic regularly surface in studies of instruction. Many teachers who seek more thoughtful and exciting classes find that they cannot produce them—the work is too tiring, or otherwise demanding. In addition, students often demur. They complain that the teaching is too demanding, too difficult to understand, or not to their taste. One could dismiss these reports as the result of either teachers' inadequate skill or determination, or students' laziness. No doubt both explanations are sometimes appropriate. But there are other explanations as well. Learning to understand multiplication strikes academics as more gratifying than merely learning to do it. But learning to understand multiplication requires that students take on a formidable intellectual agenda. They must learn several different ways to represent this arithmetical operation. In regular classes it requires that students consider each others' representations, and it quite likely also requires that they probe each others' reasons for representing the procedure in one way and not another. Understanding multiplication also requires that they make plausible arguments, to their teacher and perhaps their classmates, about the representations they have devised.

These requirements strike many professors as exciting—cracking puzzles is our stock-in-trade, after all. But school and university classrooms abound with evidence that students often find such work problematic. Many will tell observers and teachers that they prefer rote learning, in part because it is simpler, easier, and less uncertain. Most reformers and many researchers interpret such statements as evidence that the teaching simply was not good enough, and they redouble their efforts to develop the techniques, or to discern them. There is a sense in which one wants to reject the students' comments: Multiplication learned by rote is deeply mysterious. No explanations for following the procedures are offered, save that the teacher or text says so, or that they produce the right answers. This offends the inquiring mind—or at least the mind that inquires about mathematics. But note that those same minds often reject their garage mechanic's efforts to explain why their Saab stalls in damp weather, or the dishwasher repairman's effort to show them how to load wine glasses properly, or the cleaning person's effort to explain why wax remover, not soap and water, is needed for the kitchen floor. The desired objects of understanding are not equally weighted for all minds. So when many students say they find procedural learning less mysterious, and that they want to only learn the right algorithm, they may only be doing to teachers what many teachers and researchers to do mechanics or cleaning people. When students resist efforts

\[\text{Cohen, op. cit., (pp. 53–63).}\]
to elicit their understanding of ideas and seek the easier surface of academic knowledge, they may be expressing a deep preference, not just reflecting laziness or the lack of adequate instruction.

In addition, inquiry-oriented learning can be as risky as it is difficult. It requires that students tolerate considerable uncertainty: about the nature of arithmetical problems, about the procedures for solving them, about what the answers are, and about how implausible answers can be detected and plausible answers defended. It also requires that students expose themselves more, simply because they must adopt trying out—i.e., hypothesis framing and testing—as a way of life in learning. But many students find it difficult to accept that knowledge entails the acceptance of uncertainty. They find it risky but also contrary to their conception of knowing. Many also resist the exposure of self that a trying-out approach to learning entails, even in tutorial situations. Many more resist in whole classrooms, when a large audience watches and listens. The prefer the certainties of mechanical learning to the risks of more adventurous work.

Turn now from students to teachers. One reason that teachers often find inquiry-oriented approaches to instruction very difficult is that so many students seem allergic to it. For in order to make inquiry-oriented instruction succeed with such students, teachers must take on a large agenda. They must wean students away from the safety of rote learning. They must instruct students in framing and testing hypotheses. And they must build a climate of tolerance and curiosity about unusual answers, among other things. Teachers who take this path must work harder, concentrate more, and embrace larger pedagogical responsibilities than if they only assigned text chapters and seatwork. They also must have considerable additional knowledge and skills to pull it off effectively. They must, for instance, deeply understand the material and grasp how students think about it. They must be able to comprehend students’ interpretations of problems, their mistakes, and their puzzles. And, when they cannot comprehend, they must have the capacity to probe thoughtfully and tactfully. These and other capacities are required to present the material in ways likely to engage students’ minds, to help students to frame fruitful hypotheses and discard unfruitful ones. None of this would be needed if teachers relied on texts and worksheets.

In addition, even if none of their students resist, teachers who seek to open up subjects as fields of inquiry must still take unusual risks. If they proceed in the standard instructional format, they can rely on the authority of text or official position in disputes with students, or when uncertain about how to proceed. But if they offer academic subjects as fields of inquiry, they must support their actions and decisions as intellectuals, not merely as functionaries or voices for a text; that is, they must appeal to rules of inquiry, methods of proof, and canons of evidence for resolving disputes and settling uncertainty. To do so, teachers also must be prepared to share authority. For how could students become active inquirers if their solutions and approaches were not taken seriously, accepted if plausible and well defended, and rejected only if
demonstrated to be implausible? If academic subjects are to be taught as fields of inquiry, students must become inquirers, learning how to frame problems and decide disputes rather than learning how to get the right answer. They must therefore be encouraged to assume the authority that comes with intellectual competence, rather than to fly blind on the authority of texts and teachers.

Sharing authority is difficult for many teachers and students. They find it unsettling, even threatening. But when teachers embark on an inquiry-oriented pedagogy, they open up an entire new regime, one in which students have more autonomy in several dimensions, and in which teachers depend on their students more visibly and acutely. For if students are to become inquirers, they must take a large responsibility for producing instruction—it is, after all, their ideas, explanations, and other encounters with the material that become the subject matter of the class. If students do not pick up these broader intellectual and social responsibilities, this approach to instruction simply will not work. But if students do pick them up, teachers depend on these students more, for the students must produce more of the instruction, and teachers must rely less on texts and worksheets, or even their own lectures, among other things. This is risky stuff. At the same time that teachers' responsibilities expand and their authority seems to become more precarious, their dependence on students increases.

These arguments suggest that inquiry-oriented reforms of instruction make more extraordinary demands on students and teachers than most innovators and researchers have thought. These demands would incline many students and teachers to rather traditional approaches to instruction, whatever the organization and incentive structure of instruction. In the case of U.S. public education, organization and incentives actually amplify these conservative tendencies in practice\(^{20}\), rather than reducing them.

**Historical and Social Barriers.** Educational reforms that seek to orient instruction to inquiry struggle against an old and deeply rooted scholastic inheritance. In this inheritance, teaching is telling, learning is accumulation, and knowledge is facts, strung together by rules of procedure. Contrary to most reformers' beliefs, these views elicit profound attachment from many children and adults. And the attachments do not arise merely from the difficulties of inquiry-oriented teaching and learning sketched earlier. The conceptions and practices that reformers wish to replace are not simply obsolete, boring, and stupid impositions, as Dewey and most reformers since have argued. Traditional approaches to instruction contain coherent and defensible views of knowledge, teaching, and learning. They represent views and practices to which many teachers, students, and parents have deep attachments.

One part of this scholastic inheritance is the widely shared conviction that valid academic knowledge consists of facts. Facts are found in books and

teachers' lectures. Efforts to suggest that there is more to academic knowledge than facts—that it consists of ideas about facts, or that facts have no meaningful status unless embedded in ideas about them, or that students are authors of ideas and therefore creators of academic knowledge—violates this view. For if knowledge does not consist of facts, well established and stored in authoritative locations, how can it be trusted? Anyone can make up ideas. If knowledge is composed or constructed—which is to say, made up—by little children, or even by schoolteachers, how seriously can it be taken? In addition, such a view of academic knowledge raises questions of authority: if knowledge is made up by ordinary people—even by people who are not grownup or much experienced—then how trustworthy can it be?

Another part of the inheritance is the notion that teaching is telling. The teacher is a voice for authoritative knowledge, which originates elsewhere. She is a pipeline for Truth. Teachers' assignment is to pass that knowledge on. Reforms of teaching and learning that reconstruct the teachers' role as interpreters of others' knowledge, and as facilitators of students' knowledge creation, cut across the grain of this view. If teachers are not a voice for what is authoritatively known, then what is the source of their authority to instruct? If teachers are only handmaids to students' inventions, then how valuable is their contribution to education?

A third element in this scholastic inheritance is the idea that learning consists of accumulation. Students are supposed to assimilate knowledge that has valid sources elsewhere. Learners are seen as immature and marginal members of society, not innocents whose fresh perceptions offer a clearer view than inherited ideas and prejudices. Children are regarded as incomplete, undisciplined, and potentially dangerous—impressionable and easily misled. To assert that children construct knowledge is, from this perspective, either to say that their knowledge is not valid or authoritative (precisely because it was constructed by those who are marginal and immature), or that the learners are more mature and/or less marginal than had been assumed. Neither alternative is acceptable to those who hold this view.

These ideas have deep roots in medieval and early modern instructional practices and religious beliefs. They also have sources in passive epistemologies of early modern Europe, and the psychologies later built on them. They are ancient and well established in academic habit. They contrast strongly with the intellectual sources of inquiry-oriented instruction. These reforms draw their inspiration chiefly from relatively recent academic theory and research in the sciences and psychology, and from elite literary and aesthetic culture. They have some sources in the new physics and philosophies of science of the late 19th and early 20th centuries; others in conceptions of the individual, and the power of individual imagination common to Romantic literature and philosophy; and still others in the more recent "cognitive revolution" in

*Op. cit.*, (pp. 15–22).
psychology and information processing. The new ideas are powerful and compelling for many academics and cosmopolitan intellectuals. They have relatively quickly become an important part of academic work in the great centers of university research. But while professors there carry on Romantic traditions of critical individualism in the humanities, and more recent traditions of steady revolution in the physical and biological sciences, theirs is an academic, not a popular tradition. It lacks deep roots in popular thought and culture. By contrast, there is a popular culture of teaching and learning that has broad and deep roots in social practice, in inherited popular ideas and values, and in pedagogy in both the lower schools and the higher academy. This popular tradition lacks the elaborate expositions and justifications with which academics have endowed the new ideas about learning and teaching, but these seem not to be required for its continued vitality.

With respect to the new academic traditions, it appears that most of the inspiration and core ideas for inquiry-oriented instructional reform have emanated from academic intellectuals in elite institutions of higher education. These institutions are the sources of most academic research, whether in the sciences, the social sciences, or the humanities. They also are the most prestigious educational agencies in the United States. Harvard, MIT, The University of Chicago, The University of Illinois, and similar institutions were the source of much criticism of public education as mindless and boring in the late 1940s and early 1950s. They were where the curriculum reforms of the late 1950s were born, and where much of the curriculum development was carried out. They are the institutions in which much subsequent criticism of educational quality in the lower schools has originated, and from which many proposals for reform have been launched. And they are the institutions in which the new psychology, now widely regarded by academics as the chief rationale for instructional reform, now flourishes. These institutions are the center of the academic universe. The knowledge that is produced in them and the academics who produce it would therefore seem to have great standing and influence.

They do. But this standing and influence are sharply limited, at least for the purposes of reforming instruction. For one thing, these central institutions are quite remote from the thousands of higher and lower schools in which nearly all teaching and learning occurs. These other schools are peripheral in terms of prestige and knowledge production, but they are central agencies of instruction and learning. Few faculty members at the top research universities have been graduates of state university branch campuses or community colleges. Few able advanced-degree recipients from the great research institutions spend most of their careers at such low-prestige agencies of mass higher education. By contrast, few public school teachers are graduates of these great institutions at the academic center; most get their schooling in colleges and universities in which little research and much teaching are the rule. To the extent that the education and recruitment of new faculty are a source of influence for
the great research institutions, then, that influence seems to be contained within a relatively modest circle of similar institutions of higher education. The great mass of schools, universities, and colleges find their faculty, and thus many of their ideas about knowledge, teaching, and learning in other institutions that are further from the center.

The elite centers also are remote from instructional practice in most educational institutions because they have devised a unique mission: research. Their distinction is tied in part to the discoveries and academic production of their faculties, and to their education of new generations of producers and discoverers. But the great mass of colleges and universities, like nearly all elementary and secondary schools, exist to teach, to provide day care, to prepare students for further specialized education and work, and to grant degrees. Knowledge production is not part of their mission, nor their faculties’ assignment. As a result, the consumption of new knowledge that has been produced in the great centers is not a high priority either. It is, in fact, superfluous for most purposes of life and work in the academic hinterlands. It can be a way of “keeping up,” and staying in touch. But for those who do not write—which is the huge majority of American teachers, whatever their institution—it is a matter of personal preference, not occupational necessity. Most teachers at the periphery have no good reason, save curiosity, to consume the products of the central academic institutions. And their teaching assignments offer many incentives to read little and write less. This difference in organizational mission and individual work impedes the influence of ideas, produced at the center, on thought and practice at the periphery.

Although new knowledge is produced at the academic center, then, it has more prestige than influence in the institutions of mass higher and lower education in which most instruction occurs. In addition, the universities at the center give little special attention to instruction. The study of education always has been academically marginal in these places, and the improvement of instruction, even in their own classrooms, never has been a high priority. Whereas they speak with great authority in many matters, few academics in these agencies have any special knowledge about or competence in instruction. Few have carefully or even casually studied teaching. These reforming academics have little to offer their colleagues whose careers have been devoted to teaching, aside from critiques. Although criticism can be an essential stimulus to change, it is rarely sufficient.

The relative weakness of inquiry-oriented reforms is not due simply to the social isolation of its chief advocates. It also stems from the existence of a powerful and deeply rooted popular culture of instruction that exists outside academic institutions. In this culture children are supposed to listen and not speak out; adults have answers; children learn by absorbing the answers. These ideas bear a marked resemblance to the scholastic inheritance sketched previously, and they seem to be quite popular in America. Studies of child-rearing and educational attitudes find them at all levels of society. They find them most com-
monly in those sectors that are least cosmopolitan—i.e., in less urbanized regions, among more religious elements, and by members of the working and lower middle class. The recent revival of Protestant evangelism—among other contemporary religious renaissances—has helped to revitalize and refurbish these views of teaching and learning, and to install them in new fundamentalist schools. Recent demands for a return to "basics" also echoed elements of this old inheritance. These ideas are a lively feature of both the politics of education and the daily business of schooling. Pressure groups and public officials push them on school boards, administrators, and teachers. Parents press them on children before they go to school and later when they knock heads over homework.

These attitudes can plausibly be viewed as elements of an old scholasticism. It had accumulated over many centuries, and, contrary to the views of many academic researchers and reformers, it does not rest on outmoded scholarship, nor does it consist only of obsolete teaching techniques. The old scholasticism is transmitted as much by general education as by schools. It rests on a popular culture of knowledge, teaching, and learning that has been passed down unwittingly, and even unwillingly. This inheritance cannot be changed simply by changing research or teaching methods, for its roots are deeper and more extensive than either.

Unlike other professions, then, teaching is taught and learned as part of a popular culture over which professional agencies and official policies have little influence. It is picked up partly in the ordinary transactions of family life, which are little affected by educational policy or professional practice, and partly in the ordinary business of the lower schools, which lie mostly beyond the reach of professional education. There is an informal curriculum of teaching that has a historical life and influence all its own, apart from the curriculum of professional education.

A similar argument can be made about learning. Reformers of instruction have concentrated much effort on the texts and other materials in which academic knowledge is formally presented, trying to make the contents more attractive and up-to-date. Although this makes sense, nearly a century of research has shown that students arrive in school with reasonably well-developed views about what knowledge is, which they have acquired from parents and others, along with ideas about how things are taught and learned. While reformers have concentrated on changing practices in the schools, researchers have been revealing the extensive nonschool influences on learning—which are at least as important as teachers and textbooks. Traditional conceptions of knowledge, like conceptions of teaching, are passed along inside the stream of schooling by teachers and students who are committed to those conceptions. But they also are passed along across generations, outside the stream of school-

---

ing, by families. Although such conceptions can be affected by formal education, they cannot be easily or quickly affected.

My point is not that these reforms should be dismissed. If my account is correct, we may have seen only the opening chapters in a story of continuing crusades to reform teaching and learning. The leaders of these endeavors might usefully be viewed as missionaries for reform, crusaders for new ideas. The curriculum reforms of the late 1950s and early 1960s might be viewed as the academic missionaries' first large-scale foray to the rest of education. Current efforts to press the new electronic technologies into schools may be a second such crusade, though its magnitude remains to be determined.

The missionary metaphor makes sense in part because academic reformers of instruction and learning have been a committed but isolated vanguard. It also makes sense because this cadre relies on the word for authority and results. The reformers are thoughtful persuaders, not arm-twisters, vote-counters, or even demonstrators. They seek conversion by the word and often are startled when it does not work. The missionary metaphor also makes sense because these reformers have been strangers in the lands they sought to convert. They are an elite that is separated from most avenues of intellectual influence within education by great barriers of social organization, occupational specialization, and intellectual culture. They have made considerable progress in one department: Their new ideas have begun to carry the day, in research and writing, in the academic disciplines in the leading institutions of higher education. The new message about learning has begun to percolate through a few of the disciplinary channels that comprise the chief intellectual organization of higher education: Academic psychology, for instance, is revising doctrines about learning, and some approaches to research. But the new doctrine has made little progress anywhere else. Ideas about the nature of knowledge and learning have only just begun to change in the much larger intellectual hinterland of higher education.

In addition, the new ideas have barely established a beachhead in teaching practice, or even in the study of teaching practice, in the elite institutions from which they are broadcast. They have even less of a purchase in the thousands of institutions in which teaching masses of students, rather than producing new knowledge, is the order of the day. For most teachers in these schools picked up much of their subject-matter knowledge and conceptions of practice a generation or more ago, in institutions on the academic periphery. Most teachers are still educated in these peripheral institutions, far from the sources of new ideas about knowledge and learning.

It seems likely, therefore, that these missionaries—including fans of the new technology who relish inquiry—will continue to cry in an academic wilderness for some time, despite their influence and position. And it seems likely that their doctrines will have only slow and modest effects on the instructional practices they wish to change. Mass education institutions are likely to select those technology applications that fit established practices of teaching and learning.
CONCLUSION

Entanglements between the story of the new instructional technology and several older tales has been one theme in this chapter. One is a tale of hope recurrent: Like many earlier innovations, microcomputers have crystallized an exciting vision of schools in which teaching will be challenging, learning will be playful, and creative thinking will be abundant. Another is a story of hopes dashed: Earlier innovations were not used, or, when they were used, instruction did not improve as expected. Still other stories seek to explain these persistently unhappy endings. I have tried to sketch some outlines of a few of these older stories, in hope of relating current efforts to those already forgotten.

A second theme has been the importance of the social organization of instruction to instructional innovation. I sketched an analysis of this organization that distinguished between an instructional core that accommodates most students in a relatively homogeneous, batch-processing instructional format, and an increasingly differentiated set of marginal entities oriented to various special curricula, teachers, and students. I noted that the differences between core and margins include organizational, historical, and curricular features. And I argued that this organization mediates between innovative policies and programs on the one hand, and the instruction that is worked out between teachers and students on the other.

This organization might therefore be viewed as a net, through which innovations are filtered, or as a medium in which they must subsist. But in either case, my account points to some features of practice that will be salient to the adoption and use of innovations (such as the mental structure of content, formats of instruction, and working definitions of purpose). It also suggests some features of innovations that may affect their adoption and use (such as whether they define a specialized clientele and curriculum, and how flexible they are). And it has some implications for understanding patterns in the adoption and use of innovations. Contrary to many reformers’ dreams about the revolutionary effects of very adaptable instructional media and machines, the most flexible innovations have piled up very impressive records of large, lasting, and relatively inflexible use. One reason for this perverse result is that the more flexible the instructional technology, the more easily it can be adapted to the instructional organization of the core. Another reason is that public education lacks strong incentives for innovations that enhance productivity; this gives organizational considerations even more influence than they have in market-oriented firms.

A third theme has concerned the instructional value that many advocates of the new technology press, and the place of those values in the social organization of teaching and learning. I associated these values with what I termed inquiry-oriented instruction. Even before Dewey began writing, academic reformers had sought to replace traditional conceptions of knowledge and instruction with more student-centered, constructivist approaches. Partisans of these reforms more or less naturally turn their attention to schools to imple-
ment them: schools, after all, are the chief organizations of formal instruction, and they are maintained by the state. They seem an obvious lever for change. But academic reformers chronically overestimate the power of these scholastic agencies. Schools do affect knowledge and its transmission, but this work is affected, and often impeded, by broader social organizations of knowledge.

One reason is that knowledge is everywhere: its transmission is part of the ordinary work of ordinary life. Children learn a good deal about knowledge, teaching, and learning before they ever get to school. They continue this ordinary learning all through school. Much research has shown that these ordinary sources of knowledge are at least as powerful an influence on children's learning as their school instruction. And in large parts of America, this ordinary knowledge is quite traditional and is closely tied to the instructional practices that inquiry-oriented approaches to reform have sought to replace. In these cases, reforms must fight against informal instructional practices that children learn before going to school, and regularly relearn outside of school. And in the lower schools, the reforms are at a further disadvantage because the curriculum is quite vulnerable. It is vulnerable to ordinary knowledge because most of the elementary and much of the high school curriculum is relatively unspecialized: The traditional intellectual culture has ready alternatives to constructivist conceptions of arithmetic, or Progressive versions of social studies (though it does not have such alternatives for more advanced and specialized materials, like underwater archeology or advanced algebra). The curriculum also is vulnerable because Americans are deeply, even passionately, attached to the traditional culture of knowledge and instruction and have not been hesitant to press their views on neighborhood schools and locally elected school boards. The lower schools' intellectual vulnerability to the pressure of popular ideas is compounded by their organizational vulnerability to popular political pressures.

Instructional practice in schools thus subsists in popular cultures of instruction that are old, deeply ingrained, and powerful. Even if reformers successfully captured a great deal of the formal instructional program in schools, many children would do poorly, or resist, in part because of the influence of this other culture. But few reformers have even gotten that far, for the reforms also have been undernourished by their own shallow roots in the social organization of academic instruction. Most teachers in the lower school are situated at the distant periphery of an extensive system of formal educational agencies, while most leading advocates of revisionist instruction are situated at the system's center. These two groups are divided by great gulls: Those at the center practice criticism and research, while those at the periphery practice instruction. Those at the center place the highest priority on producing and consuming new knowledge, or new critiques of old knowledge, while those at the periphery place the highest priority on producing students, degrees, and grades. These differences alone make it exceedingly difficult for the leaders of instructional
reform to speak a language that makes sense to practitioners of instruction. The difficulty is compounded by the great gulf of prestige and position that separates leading investigators at the great research institutions from lowly instructors in the undistinguished mass of teaching institutions, higher or lower. Even if there were a common language to speak, it would not be easy to arrange regular and fruitful communications across this imposing—and treasured—gulf.

Instructional practice in American education is therefore removed from major influence by the leaders of revisionist thought about learning and instruction. It also swims in a sea of popular traditional practices of teaching and learning. Considered from the perspective of practice, this has meant that teachers who tried to implement inquiry-oriented reforms typically did so without much helpful leadership, and frequently with much unhelpful resistance inside and outside school. Considered from the perspective of the latest technology, my analysis suggests a paradoxical conclusion: The features that promise the greatest intellectual gains may make the smallest instructional headway.

BIBLIOGRAPHY


Technology in Education: Looking Toward 2020

RAYMOND S. NICKERSON
BBN Laboratories, Inc.

PHILIP P. ZODHiates
Education Development Center, Inc.

LAWRENCE ERLBAUM ASSOCIATES, PUBLISHERS
1988 Hillsdale, New Jersey

Hove and London