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Learning Organizations for Sustainable Education Reform

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

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

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

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

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

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

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

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

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

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

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

WHAT IS THE "CORE" THAT NEEDS TO CHANGE?

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

Core Theory of Learning

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

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

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

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

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

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

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

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

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

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

A Percentage Race

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

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

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

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

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

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

Core Theory of Aptitude

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

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

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

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

Countervailing Voices

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

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

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

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

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

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

WHAT IS THE NEW "CORE"?

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

Knowledge-based Constructivism: The New Learning Theory

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

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

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

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

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

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

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

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

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

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

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

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

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

Effort-based Learning: The New Aptitude Theory

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

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

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

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

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

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

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

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

Socializing Intelligence

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

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

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

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

ORGANIZING FOR KNOWLEDGE-BASED CONSTRUCTIVISM AND EFFORT-BASED EDUCATION

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

CONCLUSION

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

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

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

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

ENDNOTES

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