8

EDUCATION AT ITS BEST

Overhauling the Transmission Model

ANYONE WHO has itemized what is wrong with our schools—and knows why these things are wrong—is already looking at a blueprint for change. By inverting the characteristics described in chapter 3, we create some broad recommendations for superior schools. Thus, in place of superficial facts, we emphasize deep understanding. In place of fragmentation, we seek to integrate; we bring together skills, topics, and disciplines in a meaningful context. In place of student passivity and isolation, we value learning that is both active and interactive.

If there is a unifying theme in all these prescriptions and a common characteristic of the very best classrooms, it is that *kids are taken seriously.* The educators (and parents) who do the most for children are those who honor, and work hard to find out, what children already know. They start where the student is and work from there. They try to figure out what students need and where their interests lie. Superb teachers strive constantly to imagine how things look from the child's point of view, what lies behind his questions and mistakes. All of this represents a decisive repudiation of the Old School, where, as Dewey observed, "the center of gravity is outside the child. It is in the teacher, the textbook, anywhere and everywhere you please except in the immediate instincts and activities of the child himself."[1]

But here we have to be careful. To talk about taking kids seriously—or setting up a "learner-centered" classroom—is not necessarily to be a hopeless Romantic who believes that children are all perfect little angels. It doesn't assume that children possess a pure natural wisdom and always know what's best, and, therefore, the adult's job is to get out of the way so students can educate themselves. Exactly this sort of caricature is drawn by many traditionalists in order to discredit their challengers. This conveniently sets up a false dichotomy where you, the reader, are asked to choose between touchy-feely, loosey-goosey, fluffy, fuzzy, undemand-

ing progressive schooling based on leftover hippie idealism, on the one hand, and, on the other, an old-fashioned defense of academic excellence based on a courageous willingness to face unpleasant realities.

Hmmm. Tough choice. But this dichotomy is a ludicrous misrepresentation of the nontraditional position(s). While some people may call themselves "progressive" and advocate a completely laissez-faire approach to teaching, I've never met any. None of the theorists, researchers, or practitioners whose work I've drawn from in this book take such a position; indeed, the vast majority of educators who embrace such labels as progressive, learner-centered, constructivist, developmental, or holistic explicitly reject a sentimental image of children and a set-'em-loose model of schooling. As Dewey put it, "Nothing is more absurd than to suppose that there is no middle term between leaving a child to his own unguided fancies and likes, or controlling his activities by a formal succession of dictated directions."[2] Piaget's followers are equally critical of the Romantic sensibility attributed to them by traditionalists.[3] Indeed, that sensibility seems to show up only in conservative polemics, where it is kept alive as a way of making the Old School look attractive by contrast.

This strategy has succeeded in causing some schools and scholars to back away from a more humanistic approach to education, and that's a shame, because such an approach not only is justified in shifting the center of gravity back to the student but is based on a solid foundation of psychological theory and research. Much of that research turns on an observation offered earlier: humans by nature are meaning makers. I've tried to avoid educational jargon and technical terms in this book, but I have felt compelled to use—and now, to return to—the word "constructivism" because it refers to a school of thought that is central to creating optimal conditions for our children's learning.[4]

Constructivists argue that it is simply inaccurate to say—indeed, dangerous to assume—that people absorb information passively. We're not blank slates or empty containers. "The pupil's mind," wrote Alfred North Whitehead, "is not a box to be ruthlessly packed with alien ideas." Indeed, he suggested, an entire educational philosophy can be summed up in four words: "The students are alive."[5] More precisely, they—and we—come into every situation already holding a set of beliefs about the way the world works. Constructivism is derived from the recognition that knowledge is constructed rather than absorbed: we form beliefs, build theories, make order. We act on the environment rather than just responding to it—and we do it naturally and continually. It's part of who we are.[6] Learning isn't a matter of acquiring new information and

storing it on top of the information we already have. It's a matter of coming across something unexpected, something that can't easily be explained by those theories we've already developed. To resolve that conflict, we have to change what we previously believed. We have to reorganize our way of understanding to accommodate the new reality we've just encountered.[7]

This is what happens when astronomers suddenly notice vast areas of empty space that shouldn't be there according to widely accepted theories about how the universe began. It is also what happened when my not-quite-two-year-old daughter's own astronomical assumption ("The moon comes out at night") ran smack into contrary empirical evidence: she spotted the moon one sunny afternoon and was forced to revise her theory. Many times, that sort of challenge to one's existing beliefs comes not out of a clear blue sky, so to speak, but from seeing or hearing someone else's very different impression or belief. A student reads a play and constructs a theory about what is going on (this character is being punished for his pathetic indecisiveness)—only to be confronted by a classmate who came up with a very different reading (this character is struggling bravely to deal with forces beyond his control). Thus, the source of intellectual growth is conflict: conflict between an old belief and a new experience, conflict between two beliefs that prove to be mutually exclusive, or conflict between your belief and mine. We make sense of things and then remake sense of things, and we do it from infancy to death.

Permit me to emphasize again: this theory I've been describing is no fad. Not only educational theorists but "virtually all" cognitive researchers today "[sub]scribe to this constructive view of learning and knowledge."[8] And it is a view with powerful practical implications.[9] Because different ways of teaching will be more or less successful at taking account of how learning actually happens, some ways are more likely than others to lead to learning that is impressive and enduring. Our job is to understand and support these approaches.

Making Trouble for Students

What can teachers do that's consistent with what is known about how students learn? Not surprisingly, they can begin by curbing the practices based on a transmission view of learning, such as simply telling students what is true or how to do things. However, as I've been at pains to point out, this doesn't mean they must sit back and wait for ideas to pop into the kids' heads. Progressive teachers are at least as active as their tradi-

tional colleagues, but they are active in different, more challenging ways. Indeed, it takes a lot more skill to help children think for themselves than it does just to give them information.

A first-grade teacher in Massachusetts[10] shoves aside all the classroom furniture and uses masking tape to outline a large boat on the floor. Its the *Mayflower,* she tells the children—the very ship we've been learning about. She hands a piece of paper to a student named Zeb and says it's a message that the king has given him to deliver to the class. Zeb reads aloud that the ship can't sail until we tell the king how big it is. "What should we do?" the teacher asks. "Who has an idea?" After some false starts and some painful silences, a boy named Tom volunteers that it can't be three feet because he knows (having just been measured by the nurse) that he is four feet and the boat looks bigger than he is. Other children now join in, one suggesting that they find out how many times Tom can fit in the boat. It turns out the boat is four Toms long. Problem solved!

But wait a minute, says the teacher. How will the king know what that means? After all, he's never met Tom. She waits for someone to remember that Tom is four feet tall. No one does. Instead, Mark suggests that the boat can be measured with hands. He does this several times (rather sloppily) and gets a different answer each time. After more discussion, the class realizes you have to start right at the end of the boat and then make sure there's no space between your hands when you put them down. Finally Mark concludes to everyone's satisfaction that the boat is thirty-six hands long. Done!

Well, just to be sure, says the teacher, let's have Sue (the smallest child in the class) measure it again. Oh, no! Now the boat is forty-four hands long! Confusion and animated discussion follow. The children realize that all hands on deck are not of equal length. By the time someone proposes using people's feet instead, time has run out. But the teacher has them return to the problem the following day. One child now remembers that the king knows Zeb and argues that the boat can therefore be measured in multiples of Zeb's foot. The class is so excited by this that they decide to use Zeb to measure everything in the room, and the teacher lets them. It isn't until the next day, returning to the topic yet again, that she begins to make the lesson explicit for them. She invites the children to think about the importance of a standard form of measurement. And only after that does she finally introduce them to the use of rulers.

Consider what the teacher does here. First, she poses a problem specifically designed to pull the kids in, making sure it won't be too hard or too easy for most of them. Then she guides their discussion without control-

ling it. (That alone distinguishes her from the vast majority of our children's teachers.) She doesn't correct their mistakes—and, equally important, she doesn't single out certain ideas for praise. Rather, as an expert on math instruction describes it,

> she listens and watches. And only when the children seem satisfied with a solution does she put a further question, leading them to yet another problem, their own problem, which they feel compelled to resolve. As she sees it, her task is to pose questions that will lead *through*—rather than around—puzzlement to the construction of important mathematical concepts. [Such teaching] cannot be scripted; rather, it depends on one's capacity to respond spontaneously to students' perplexities and discoveries.[11]

Some would call this teacher a "facilitator" of learning, but she doesn't facilitate "in the sense of 'making smooth or easy' "; rather, she stimulates learning "by making problems more complex, involving, and arousing."[12] She artfully complicates the situation, challenging the children to think harder and better. She sees the wisdom of " 'throwing a monkey wrench' instead of reinforcing the right answer," in Eleanor Duckworth's words. That may seem a little perverse, but it is precisely the teacher's desire "to be sure that students understand" that explains why she "remains noncommittal, resists early acceptance of a student's understanding, and searches for any soft spots that require more thinking."[13]

The lesson is hands-on—they're doing something rather than just sitting still—but it's not the typical hands-on lesson in which a teacher might, for example, have everyone measure things with rulers after she shows them how it's supposed to be done. Instead, whether or not they're aware of it, the children are grappling with the *idea* of a ruler. More: they're *inventing* the idea of a ruler. They're becoming real mathematicians without using textbooks and worksheets—indeed, one could argue, they're thinking *because* they're not using textbooks and worksheets.

Notice several other characteristics of this lesson. First, it's leisurely: the class is free to take its time with the problem, to explore it and return to it over a period of several days rather than rushing on to the next topic. Second, it's collaborative: students aren't doing solitary seatwork. Too much would be lost by depriving them of one another's ideas and disagreements. Third, it's interdisciplinary: this mathematical problem flows quite naturally from the larger social studies project on the *Mayflower* (which, in turn, probably provides extended practice in reading and writing as well).

These features are routinely used by all great teachers, regardless of the subject matter or the age of their students.[14] Such teachers see their job as providing the conditions for learning. They devise challenges and, if necessary, help illuminate for students what's interesting about those challenges. Sometimes they offer guidance and criticism, directions and suggestions—and sometimes they keep their mouths shut. They might reflect back to a student what she said, subtly reframing her idea when necessary, using different words to bring out the underlying issues. Rather than being the source of most ideas, teachers serve as "mediators," standing between the students and the idea. They offer what is needed for kids to take charge of their own learning, sometimes helping them along, offering temporary support (a strategy known as "scaffolding")[15] until the students get it. And they aren't afraid to leave some questions unanswered, some explorations unfinished, because, well, that's how life is.[16]

Again, to teach like this requires a sharp reduction in direct instruction—that is, the traditional practice of delivering information to students by giving lectures or showing them how to do a problem. An Oregon teacher in her fifties once summarized her professional growth to me in one short sentence: "The longer I teach, the less I talk." She'd come to realize that only by making sure she didn't monopolize the classroom was there a real chance for her students to talk—and therefore to learn. Given how much silence (that is, students' silence) is valued in the Old School, that last idea may be counterintuitive, but, as a British educator explained, "Talking is not merely a way of conveying existing ideas to others; it is also a way by which we explore ideas, clarify them and make them our own."[17] Every minute a teacher is doing the talking is a minute this isn't happening.

Still, that doesn't mean the teacher is completely silent. I believe there is room for some direct instruction; the amount will depend on several factors. The first variable is age: while high school or college students shouldn't have to spend whole periods listening to lectures, there should be even less lecturing to younger children—a few minutes here and there at most.

Second, the kind of knowledge is relevant. If the lesson involves logical thinking and requires students to understand ideas, then telling won't do. But on those occasions when the teacher just wants students to know some arbitrary convention, such as how to address an envelope, where to put a footnote, or the fact that September has thirty days, then it's less objectionable for the information to be given to them.[18] (Even here, though, the burden of proof should be on the teacher to show that stu-

dents can't, or for some reason shouldn't, find these things out themselves.)[19]

Finally, even when direct instruction seems appropriate, the timing is important. Usually it should occur after students have had the chance to explore, to observe at first hand, to talk and experiment and try things out. Had that first-grade teacher given the children a didactic lesson about measurement at the beginning, she would have preempted those lively exchanges and precluded much of their thinking. The teacher ties things together, makes things explicit, gives things names, checks for understanding. What she sees herself doing has implications for when she does it.

Beyond the Right Answer

Some years ago I saw a sign posted in a classroom that said MISTAKES ARE OUR FRIENDS. I interpreted this to mean that the teacher didn't want students to feel bad about themselves when they got things wrong. Only later did I realize it was more complicated than that. This teacher understood the limits of a right-answer-oriented education. She realized not only that mistakes are an inevitable part of learning, but that learning could be described as the process of coming to make more sophisticated kinds of mistakes. Moreover, confusion drives us to understand more deeply. "You master the idea much more thoroughly if you have considered alternatives, tried to work it out in areas where it didn't work, and figured out why it was that it didn't work," says Eleanor Duckworth.[20] Teachers who want to encourage intellectual growth give students time to be confused and create a climate where it's perfectly acceptable to fall on your face.

This message can be sent in different ways. First, while students are trying to figure things out, the teacher will usually hold back rather than jumping in to correct them, mindful that "productive discussions often spring from misguided notions."[21] (Eventually the teacher will see to it that blatant errors are corrected—by the student herself, by a peer, or, if necessary, by the teacher.)[22] Second, a teacher required to give traditional grades will make sure that students have the chance to bring up those grades, if only to make it clear that "errors are part of the learning process and not indicative of failure to learn."[23] Finally, a teacher who isn't sure how to help students overcome their fear of being wrong (which they've often acquired in traditional classrooms) can simply ask them what they think would make mistakes seem less scary. As a rule, the best

teachers have learned that the answer to any number of instructional challenges is to consult the students themselves.

A classroom where mistakes are "our friends" isn't a place where anything goes or accuracy doesn't count. It's a place that has transcended a behaviorist model of learning and, consequently, a place where students feel safe, take chances, and ultimately can learn more successfully. "Good schools promote displays of incompetence (strange as that may sound) in order to help students find their way to competence," in the words of Ted Sizer, who founded the Coalition of Essential Schools.[24]

But we can go even further. Mistakes typically aren't random: they reflect a particular way of (mis)understanding and thus provide a teacher with priceless information about what and how the student is thinking. To correct students promptly, or even to overvalue being right, is to lose access to that information. So we could say that great teachers don't talk very much for two reasons: to maximize student talking but also to maximize teacher listening. Like the reassuring sign on the wall about mistakes, a posture of caring and genuine interest in what students are thinking isn't just a matter of being friendly. It's a matter of being an effective educator. The teacher's explicit use of questions ("Why do you think that happened?" "What led you to say that?") is matched by a tone, a demeanor, a classroom culture, that invites students to reflect on and explain how they are making sense of things. Only when the teacher has a feel for that can he help kids make better sense of things.

Thus, if a child announces that four plus five equals ten, the teacher doesn't have to say "Wrong!" or "Ooh, you're close; try again" (a nicer way of saying "Wrong!"). Sarcastic claims by traditionalists notwithstanding, that doesn't mean the teacher is obliged to say "OK, sure, honey, if that's a valid answer for you, we'll say it's ten." Not at all. The teacher might simply ask, "How'd you get ten?" Alternatively, he could ask, "Did anyone else get a different answer? Let's talk about it." What's more, both of these responses are just as appropriate when a child announces that four plus five equals nine. It may be even more important to help students reflect on—and therefore allow the teacher to understand—how they got the *right* answer.

One day a teacher in Michigan,[25] struggling to make sense of and apply these ideas, asked her third-grade class how many legs an insect has, and a boy promptly replied that it might have "eight or ten or fifteen." The teacher's impulse was just to correct him, but she decided it might be useful to "get a feeling for what he was thinking." She asked if he could give her an example. He mentioned caterpillars, and this opened up a class discussion that suggested other students would have answered the same way. A long conversation ensued about adult insects versus larvae and

about the possibility of mutations (since, in fact, all insects don't have six legs). Because the teacher asked a question rather than making a statement, this conversation was able to happen. She reflected later that this conversation also gave her alternative "ways of assessing what they know," which is one reason (among many) that great teachers don't need to give a lot of tests.

Someone once said that a student who gives a wrong answer actually may be answering another question. The teacher's job is to find out what that question is.[26] More broadly, his job is to see things from the student's point of view, to get in the habit of imagining how an idea or assignment is likely to appear to children of this particular age. How can you help students understand fractions without having a sense of how odd it is to see, for the first time, one number sitting on top of another? A terrific teacher even tries to understand how that concept will be understood differently by Sasha than by Sam, based on what she knows of how each has made sense of other math concepts.

Beyond trying to learn what students don't understand in order to help them, it's also true that teachers whose first instinct is to listen also learn how much their students already do know. I once heard an educator from Maine quote a colleague as follows: "My kids know all about my creativity in the classroom, and I just realized I know very little about theirs." A math teacher who shows students exactly what to do, then grades them on how well they imitate her, may have no idea how inventive even very young children can be in solving problems. Similarly, when one reading teacher stopped dominating discussions and transmitting facts, even some of the quiet kids began to speak up. "I was absolutely amazed by some of the responses," she reported. "The level of discussion was so high. . . . I could see thinking going on I had never seen before."[27]

To take a backseat sometimes, instead of always being the one with the answers, is to present oneself as a fellow learner—someone who is perpetually curious and, like the students, often at a loss. Such a teacher distinguishes herself from her colleagues who act like trial attorneys, never asking a question to which they don't already know the answer. Indeed, she may deliberately do things she's "no good at . . . so they can see [her] struggling."[28] That sort of deliberate vulnerability requires courage. It's as hard to be a real person in front of kids as it is to treat kids like people. That's why so many teachers, for example, wouldn't dream of letting children call them by their first names. They say it's about respect, but often it's really about their need for distance and protection. (If a teacher requires the formality of a surname to feel respected, something is very wrong.)

More generally, and more important than the name by which he's

known, the kind of teacher who creates a formal environment in which he has all the power and is the source of all the knowledge is likely to be secretly ridiculed and ultimately ignored. I've come to believe that this aspect of traditional classrooms—formality—helps to explain why those classrooms are so unsuccessful. Similarly, I've noticed from visiting countless classrooms that the teachers who excel in all the other respects described in this chapter also tend to be the ones who talk with students in an open way, not all that differently from the way they talk to adults. The atmosphere in their classrooms is loose, relaxed, friendly, often jocular. "The more informal the learning environment, the greater the teacher's access to the learners' representations, understandings, and misunderstandings."[29]

It's not that such a teacher isn't—or doesn't want to be—respected; it's not that he's pretending to be one of the kids. Paradoxically, he's more likely to be respected (as opposed to merely feared), and the learning is most likely to be serious, in the kind of place where the teacher says, "Oh, wait a minute, you guys. I almost forgot. How are you doing with those chapters you're writing in the style of a famous author?" Even students with a reputation for being troublemakers in traditional classrooms often respond to this climate, no longer feeling the need to take a stand against an authority figure.

To some extent, the degree of formality reflects the personality of the teacher. For that matter, the whole package I've been describing says something about individual attitudes. But it's important to realize that attitudes and techniques can result from pressures that originate outside schools and from the structure *of* schools. For example, small classes—and large blocks of time in them—are vital so teachers can learn what students know. No wonder the best teaching is so rare at the high school level: how easy can it be for a teacher who has 120, 150, or even more students over the course of a day—and who has them for only forty-five or fifty minutes at a time—to do what I'm describing here?[30]

Bad teaching doesn't just happen. It's practically demanded by systemic factors. If students are under pressure to beat their classmates for some artificially scarce recognition, it's going to be hard for the teacher to figure out how their minds work; they'll be throwing her off by trying to impress her with how smart they are. If parents insist on the familiar sight of a teacher in front of the class presenting a conventional lesson, it's going to be hard for the teacher to grow past that model. If a very specific curriculum is imposed on teachers, with rigid requirements for what children must know at each grade level, teachers are going to be permanently set on Play rather than Record. If we allow our legislators and school boards to make schools "accountable" for producing higher

standardized test scores, you can bet our children will receive an education completely out of step with the best thinking about how people learn.

Deep Thinking

Consider the following fraction problem: Which is larger, $\frac{4}{11}$ or $\frac{5}{13}$? This is a question I routinely pose to parents and teachers, and very few of them (especially the math teachers) get it right because very few of them think about curriculum content from the student's point of view.

The correct answer is: Who cares?

To forget that this is the correct answer—and indeed, that it's the answer to more questions than we can count—is to leave students out of the picture, to persist in teaching bare facts that don't matter to them and therefore may not be learned by them. This, in turn, practically guarantees that schooling will continue to be experienced as an exercise in futility for all concerned. That fact is not altered just because you may happen to believe that kids ought to know which fraction is larger.

However, as I hope is clear by now, this doesn't mean we should excise fractions from the curriculum. It means we should teach them differently. In describing the role and style of effective teachers—posing problems, asking questions, welcoming mistakes, and so on—I've already offered some details of effective nontraditional instruction. What follows is a closer look at some ideas for changing the fundamentals of instruction—and thereby increasing the chances that our children will become successful learners.

Deborah Meier and her colleagues, who founded the highly regarded Central Park East schools in New York City, have anchored their teaching in what they call five "habits of mind." They contend that the study of virtually any topic in any discipline will benefit from raising questions about *evidence* ("How do we know what we know?"), *point of view* ("Whose perspective does this represent?"), *connections* ("How is this related to that?"), *supposition* ("How might things have been otherwise?"), and *relevance* ("Why is this important?").[31] The last of these, nominated by Meier as the one that matters most, recalls the response "Who cares?" It is both a stimulus for adults to think about what matters enough to teach[32] and an organizing principle for thinking (with students) about how to teach it.

To develop these habits of mind is to spend a fair amount of time in

conversation and, inevitably, in disagreement with other people. The constructivist premise that learning is based on conflict meshes nicely with the idea that the best classrooms are those where people argue a lot. Of course, they argue in a way that's friendly rather than nasty, the point being to figure things out together rather than to win a debate. We're not talking about picking fights here but about stimulating minds.

A clash of ideas is inevitable when subjects are complex and controversial, and those are the subjects that ought to occupy our children in school most of the time. If a fact isn't controversial ($\frac{5}{13}$ is indisputably greater than $\frac{4}{11}$), it can be made controversial: How do we know that? Are some ways of finding out better than others? Students have to be given tasks that require interpretation and involve uncertainty, the kind where you can't always specify how to do something and you don't always end up with a tidy solution. Thinking is messy, and deep thinking is really messy. Traditional education, by contrast, is nothing if not orderly.

In practice, this means that the sort of activities regarded as "enrichments" (and typically reserved for the elite students) ought to constitute the bulk of the curriculum for everyone. For example, students can be invited to think about and discuss why dinosaurs became extinct, a question that will likely require them to acquire—and give them a reason to acquire—a fair amount of knowledge about how dinosaurs looked, when they lived, and what they ate. (If a unit on dinosaurs is *limited to* how they looked, when they lived, and what they ate, our children are being shortchanged.) Similarly, instead of memorizing a list of battles, students can be asked to put the Civil War in its historical context and to plumb its human costs. Perhaps each of them could take on a different role (physician, journalist, undertaker, economist, uniform manufacturer, child of a soldier) and evaluate the significance of what happened from that person's point of view. They can invent an imaginary soldier's diary, write a newspaper editorial on whether Lincoln should have just let the South secede, or prepare a speech for a conference of historians arguing for a novel parallel between the U.S. Civil War and a crisis presently taking place somewhere else in the world.

Such explorations take the place of (or swallow up) fact-based lessons, but because a fair amount of time is required, they also represent an alternative to another style of teaching mentioned in chapter 3: skimming the surface of too many things. Ted Sizer has offered a three-word slogan for a revolution in high school teaching: "Less is more."[33] (This is also the watchword for some of the best theory and practice in early childhood education.)[34] As a thought experiment, Howard Gardner likes to invite teachers to pretend they've been given only one hour with students

to do something on the subject of an entire course they teach. Figure out what you would do in that single hour, he says, and then do that all year.[35] Carve off a small chunk of content and teach it thoughtfully, deliberately, deeply, presenting it from different angles. I witnessed that sensibility one morning when I visited a geometry class in Massachusetts and found to my surprise that the teacher was allowing students to spend a full class period arguing about the definition of a pyramid. As Steven Zemelman and his colleagues have remarked, "Covering less in more depth not only ensures better understanding, but increases the likelihood that students will pursue further inquiry of their own at later times."[36]

Covering less in more depth, however, is only the first step toward better education. Ultimately, we want to call into question the whole idea of a curriculum to be "covered" and to think instead about ideas to be discovered. If learning is a function of making one's own meanings and reorganizing one's own theories in response to an encounter with new ideas, then we need to maximize the impact of that encounter. As much as possible, students ought to discover things directly rather than just reading or hearing about them. They ought to explore, do, see—and reflect on what they've explored, done, and seen. This means changing what goes on in classrooms, and it means providing plenty of opportunities for students to get out of the classroom and into the community. Gardner argues that schools should incorporate the best of two models of learning: a museum, which encourages open-ended exploration, and an apprenticeship, which provides a more structured environment for practicing meaningful skills in an authentic, real-life context.[37]

The common element is giving students a chance to *do*. If you want them to learn about the conduction of heat, ask them to design a restaurant take-out container that will keep a customer's dinner hot.[38] If you want them to learn the geography of an area (and why it matters), ask them to find the major cities "on a map that contains physical features and natural resources but no place names."[39] If you want them to understand how a story is structured, invite them to dissect an episode of their favorite TV situation comedy, paying attention to the way problems are introduced and resolved—and then to write their own scripts.

In a fifth-grade social studies class in Seattle,[40] I watched as the children studied colonial Boston—by recreating colonial Boston. They built miniatures of period houses and invented period characters (specifying their ages, occupations, and Loyalist or Patriot sympathies). Then, over a number of weeks, they assumed those identities to discuss actual historical events. One day, for example, they debated whether the Boston Tea Party was morally justified, meeting with their "families" to hammer out

a position, then writing a letter to a friend explaining their decision. (The teacher used these letters to get a sense of how well each student understood what was going on.)

To promote discovery, some teachers focus on the importance of careful observation, which is central to becoming a good scientist, a good thinker, or a good writer. They might tell students to light a candle and watch it vigilantly, writing down everything they see. They might have students surreptitiously record everything they notice about a friend's (or parent's) style of nonverbal communication. They might send students to a city street or a mall and ask them to notice what's impressive and what's frustrating about the way the area was designed—or to say as much as they can about the place based only on what can be heard and smelled.

Discovery learning usually entails hands-on activity, but as we saw in the distinction between using a ruler and inventing a ruler, it is also more than that. I once dropped in on a sixth-grade class in Illinois where the "hands-on" lesson consisted of gluing cotton balls on pieces of paper to represent various cloud types, whose names the students had to memorize. Completely absent were all of the ingredients that give active learning its power: the discovery of something new, a challenge to existing beliefs, interaction with other students, and sustained reflection. Similarly, it's one thing for a class to keep a garden; it's something else for the garden to prompt systematic thinking about cause and effect ("Why do you suppose these bean plants are so scrawny?") or an exploration of the plight of the American family farm.

An administrator in Florida once gave me a marvelous example of how a conventional activity can be transformed into something truly worthwhile. Visiting a middle school[41] one day, she noticed that the students were lugging around mock infants (weighted dolls) wherever they went, this being a fairly standard way of trying to convey to adolescents a sense of the responsibility entailed by parenthood. "Hey, how's your baby?" she called out cheerfully to one boy, only to be caught off guard when he replied, "Not so good. He has meningitis." Certain babies, it turned out, had been randomly designated as having a medical problem (ranging from lactose intolerance to spina bifida), and the students were obliged to research the causes and treatment, as well as to figure out how to stay within a budget for child care.

Starting with a Question

To take children seriously is to value them for who they are right now rather than seeing them as adults-in-the-making. Thus, what we ask them to do should have "horizontal relevance," to borrow the phrase of the early childhood specialist Lilian Katz. It ought to be "meaningful to them at the time"—for example, related to something that could happen on the way home from school. Mere "vertical relevance" isn't enough: there's reason to be concerned if the only justification for learning something is that students will need to know it later—for example, as part of the following year's curriculum.[42]

On what basis, then, is (horizontal) relevance constructed and a curriculum designed? The trick is to *start not with facts to be taught or disciplines to be mastered, but with questions to be answered.* That may sound straightforward, but it's actually quite rare for learning to be organized around questions. In fact, it's even rare for classroom questions to reflect a commitment to real learning. What we find instead are those fact-based questions that Old School teachers are so fond of putting to the class: "Who can tell me . . . ?"—or the practice of "guiding children to answers by [asking] carefully chosen leading questions," which isn't much different "from just telling them the answers in the first place."[43]

No, we're talking here about questions that matter, questions that students sincerely wonder about or at least those that teachers believe students will wonder about once they're posed. These are the questions that can drive exploration and learning. Sometimes they come up naturally, and the teacher's job is to take advantage of such situations.

- In a New Jersey kindergarten,[44] recent floods in the bathroom provided the impetus for helping children think scientifically about where the water was coming from and what could be done about it.
- In a school in Illinois[45] where noisy construction was taking place right outside the window of a third-grade class, a potential headache was transformed into a learning opportunity: students watched the building to figure out what was going on at each stage, took notes in their journals, and discussed what they'd seen as well as the best words for describing it.
- In a combination first- through third-grade class in Virginia, the teacher[46] was always alert for "teachable moments" that might yield interesting questions. One day a girl brought in a small motor she had built from a kit. She attached a circular disk to the shaft and

made it spin. Before she could attach an oval disk, though, the teacher stopped her and created a little suspense, asking the class to predict what it would look like when the motor was turned back on. The question was intriguing because the answer wasn't obvious.

- Another elementary school teacher deliberately left the walls bare on the first day of school so the children could figure out together how they wanted *their* classroom to look. (It took her several summers to work up the nerve to do this.) They decided, among other things, to put up blue construction paper on one wall, which would be reserved for their own papers and projects as the year progressed. But participation can be habit-forming: having been consulted about the use of the wall, the kids wanted to do the decorating themselves. They quickly discovered that the construction paper wouldn't look nice unless it had been carefully measured. To measure it, however, they needed to know something about fractions. The teacher obliged for what may have been the most efficient fraction lesson in history.

In this last example, we have a satisfactory answer to the question "Who cares whether one fraction is bigger than another?" We care, say the children. The question is answered, not because it appears in a textbook or the teacher's lesson plan or a state standards document, but because it's directly related to something that matters to them. And even when there is no bulletin board to be decorated, the same question can arise when kids express curiosity about how fast they're growing or the fairest way to divide a pizza. Great teachers are always looking out for real-life opportunities to help students play with words, reason with numbers, and think systematically in general.

The questions that drive learning come in many varieties. Some can be answered fairly quickly; others will take a long time and, in fact, may never be completely resolved. The broader questions in particular should be open-ended enough to be challenging while still being focused.[47] The learning inheres not so much in the answers but in the process of figuring out how to ask the questions better—and how to track down the answers. As students investigate, they acquire information and come to understand important ideas more fully. The answers they devise may suggest new questions, and the learning spirals upward.

Imagine, for example, the intellectual benefits of trying to answer questions such as "Why were the Founding Fathers so afraid of democracy?" or "How could you improve the human hand?"[48] Answering questions on this scale becomes, quite literally, a real project. Back in 1918, William Kilpatrick wrote a famous article laying out what he called the

"project method": a curriculum based on "wholehearted purposeful activity proceeding in a social environment . . . the essential factor [being] the presence of a dominating purpose."[49]

In progressive classrooms, that kind of learning is alive and well today, offering a model for what all our children should have the chance to do. In a fifth-grade class near Chicago, for example, one hour every morning is devoted to individual or team projects and another hour every afternoon is set aside for class exploration. The teacher describes the scene:

> Walk into our classroom during project time, and you might see children sprawled on the rug taking notes from books on the habitats of beavers or on medieval life, or two students across the room watching a videotape on Jane Goodall, or others conducting tests on the aerodynamics of paper airplanes. Go to the library down the hall (past students rehearsing a play they have written), and you might find members of the other half of the class conducting research on virtual reality or the history of Halloween. If you then go to the computer lab, you'll see, for example, one student inputting survey data while another learns to write a new computer language. In short, you never know what you might experience next, or, most important, what the students might experience next. . . . Discipline problems are minimal because students are interested in what they are doing—they see their pursuits as having *purpose.*[50]

The project approach to learning has been pursued by different educators working quite independently. Extended projects that take students out of the classroom to study the environment are among those supported by a group called the Autodesk Foundation, which sponsors conferences and publications on this approach to learning.[51] Meanwhile, Lilian Katz and Sylvia Chard have revolutionized preschool education by rejecting the two dominant models for very young children: fun and games that fail to engage the mind, on the one hand, and drill and practice to learn isolated skills such as letters, numbers, and colors, on the other. Typically they either spend their time "making individual macaroni collages" or they're put to work to satisfy "our quick-fix academic fervor."[52] The third alternative consists of creating extended studies of rich themes, such as babies or hospitals or the weather.[53] The children may spend a month learning about such a topic, visiting, drawing, discussing, thinking.

A remarkably similar approach to learning has been developed at the other end of the educational continuum. The idea of "problem-based

learning," involving the extended investigation of realistic questions, began at the medical school of McMaster University in the 1960s. The idea was to teach future physicians by inviting them to seek out and apply information to solve clinical problems rather than by filling students with masses of facts that they were expected to integrate and apply some time down the line.*

This idea of using skills in a realistic context offers a refreshing alternative to the conventional high school or middle school curriculum, too. In one eighth-grade class, for example, students are designated as official "inspectors," charged with reviewing a staged drunk driving accident: they interview witnesses, visit the scene of the crash, review the medical reports, and ultimately make a recommendation to the state's attorney's office. Solving this problem requires them to distinguish between fact and opinion, to perform lab experiments to determine blood alcohol levels and reaction times, to calculate the speed of the cars, and finally to draft a report.[54]

Whether it's called "problem-" or "project-based" or "Group Investigation"[55]—or something else entirely—this approach to learning isn't a matter of gluing an occasional activity onto the regular curriculum. It replaces the regular curriculum, turns it inside out, incorporates facts and skills in the service of doing something that is as real and practical as it is intellectual and scholarly. Typically, the project leads to a real product or a presentation for a real audience.[56]

The point is that the learning has a point. By contrast, as Kilpatrick remarked long ago, the kind of instruction that consists of "an unending round of set tasks in conscious disregard of the element of dominant purpose in those who perform the tasks" tends to produce students who "at the close of a course decisively shut the book and say, 'Thank gracious, I am through with that!' How many people 'get an education' and yet hate books and hate to think?"[57] There may be no more powerful argument for project-based learning.

Notice that such projects almost inevitably involve learning across the disciplines—providing another crisp counterpoint to traditional instruction, which takes place in separate fields and rarely bothers to help students connect what they have been taught in each one. Slightly better are

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* Ironically, traditionalists sometimes cite the example of how many facts doctors must know as a way of justifying a back-to-basics model. The reality is quite different: medical education, like other kinds, is at its best when it starts with the big picture, when it is experiential, holistic, thematic, question-driven—in a word, progressive. This has become increasingly clear to me not only as a reader of research but as the husband of a physician whose medical training I followed with some dismay.

belated efforts to combine the facts that were presented in the separate disciplines,[58] although this practice is ultimately as contrived as teaching skills in a vacuum and then injecting them back into meaningful problems.[59] If we do it right and start with the questions, students will become more competent at a range of things that can be classified as math, science, foreign languages, art, reading, and so on. "Understanding . . . does not have to be tied to the basic nature of the discipline," says Nel Noddings. "Rather, it is properly defined with respect to legitimate purposes, capacities, and interests."[60]

Figuring out what led to a car crash is one example of how the best learning is interdisciplinary. Another example began at the daily meeting of a school in southern Vermont[61] where third- through eighth-grade students get together to share news and solve problems. One morning, a ten-year-old girl from Mexico told everyone that she was very concerned about a recent earthquake in Guatemala. She held up a newspaper photo of a child caught in the rubble of his house and wanted to know what could be done to help him. The room immediately filled with questions. The children asked where Guatemala is, how many people live there, why they didn't leave before the earthquake, whether they were already being helped. Besides, they wanted to know, what causes earthquakes? Can they happen here? The teachers made a list of their questions and began organizing what turned out to be a two-month project that spanned reading and writing, English and Spanish, the natural sciences and the social sciences. In the midst of graphing earthquake intensities, the children also managed to collect money for the victims and "adopt" a Guatemalan boy.

Less spontaneous but no less engaging is a model developed for middle schools by James Beane, a pioneer in "curriculum integration," and his wife, Barbara Brodhagen. At the beginning of the year, students are asked to list all the questions they have about themselves (How long will I live? Will I be like my parents?), after which they meet in groups to share their individual lists and look for areas of overlap. Then they repeat the process for questions they have about the world (Why do people hate each other? How did religions evolve?), again listing them individually before finding areas in common. Next they're asked as teams to compare the two sets of topics to see where *they* overlap. Finally, as a whole class, the students try to reach consensus on the broad areas of concern they seem to have in common—and, with the teacher's help, design units of study to answer their questions. These investigations, on themes such as "Living in the Future" or "Conflicts and Violence," form the basis of the entire year's course of study, requiring the students to draw as necessary

from (and weave together) virtually all the conventional disciplines. Experience with this method suggests that teenagers become highly motivated scholars because the curriculum is centered "on life itself rather than on the mastery of fragmented information within the boundaries of subject areas."[62]

Decision-Making in the Classroom

When someone finally gets around to compiling a list of the ten most astonishing discoveries about education, here is one finding that won't be on it: students learn most avidly and have their best ideas when they get to choose which questions to explore. In fact, this proposition follows rather predictably from another unsurprising fact: all of us tend to be happiest and most effective when we have some say about what we are doing. If we are instead just told what to do (or, in the case of schooling, deprived of any opportunity to make decisions about what we're learning), achievement tends to drop—right along with any excitement about what we're doing.[63]

The more obvious this idea seems, the more remarkable it is that people are systematically denied the chance to make decisions about what affects them in real schools, real families, and real workplaces. Perhaps no other principle in our society is at once so commonly endorsed and so rarely applied as the value of democratic participation. Some years ago, a group of teachers from Florida traveled to what was then the USSR to exchange information and ideas with their Russian-speaking counterparts. What the Soviet teachers most wanted from their guests was guidance on setting up and running democratic schools. Their questions were based on the assumption that a country like the United States, so committed to the idea of democracy, surely must involve children in decision-making processes from their earliest years. The irony is enough to make us wince. As one survey after another has confirmed, students are rarely invited to become active participants in their own education, whether they are in kindergarten or college.[64] Indeed, the story of American schools is—and always has been—the story of doing things *to* students rather than working *with* them.

The opposite of being controlled is to be able to make decisions, to have one's voice heard. This goes well beyond conventional opportunities to choose, in which each individual selects one option from a menu: which book (from a prepared list) to write a report on, which (elective) course to take in high school or college, which activity to pursue during a narrow block of free time. Mind you, such choices are fine as far as they

go; school would be a lot better if kids had more to say about what they read and what they write about or even where to sit (or stretch out) while they are doing it.

But this kind of choosing is limited, to begin with, by the quality of their options. Whenever I see children being invited to complete "any five problems" on a worksheet—or to pick a country, any country, and then go to the library and collect some facts about it—I think of Shakespeare's observation that "there's small choice in rotten apples."[65] And even when the options are more valuable, authentic decision-making consists of being able to *generate* the possibilities rather than just choosing among those provided by someone else. Nor does choice always have to be an individual matter: the benefits are multiplied if students can come together to decide. They learn to listen, to consider others' points of view, to argue carefully, to anticipate problems and work things out.

Bringing kids in on the process of designing their own education is particularly terrifying to the staunch defenders of traditional education, whose tightly regulated classroom procedures represent the polar opposite of something messy, something unpredictable—something, well, democratic. Nevertheless, it is breathtaking to be part of, or even to watch, a classroom where students have some control over what happens, where their questions and concerns help to shape the course of study, where they help to decide what they're doing, and when, and where, and how, and with whom, and why[66]—as well as how their progress will be assessed when they're done. Why, when you stop and think about it, should a teacher unilaterally determine all these things and impose them on the students? Children learn to make good decisions by making decisions, not by following directions. Besides, this model represents the ultimate in taking kids seriously, putting them at the center, helping to generate the interest that fuels excellence.

Of course, the extent to which students make these choices (individually or collectively, on their own or with the teacher) will vary depending on their age and on certain nonnegotiable requirements.[67] It's not all or nothing. One first-grade teacher in Ohio speaks in relative terms, challenging herself to be "as democratic as I can stand to be"[68]—a good motto, as long as the teacher pushes herself to be able to stand more with each passing year. Once again, the teacher continues to play a vital role in such a classroom. But the rule of thumb is that the more students' questions and decisions drive the lesson, the more likely that real learning will take place. That's why the best teachers constantly ask themselves, "Is this a decision I have to make by myself or can the students be involved?"

What does all this look like in practice? We've already seen Beane and

Brodhagen's process, a far-reaching attempt to design a curriculum around the issues that concern students. But even teachers who introduce more conventional units in the separate disciplines can involve students. Consider a sixth-grade teacher in Texas[69] who had to teach a unit on atoms and molecules. He didn't ask the students whether they wanted to learn about the whole topic, but he did introduce it by inviting them to look through books on the subject and list the questions about atoms and molecules that occurred to them. The students then came together to construct a master list, sorting the questions by category and deciding which ones they most wanted answered. The whole lesson took off from there, even though some of the questions were so tough that outside resources had to be brought in to answer them. When it was time for the teacher to evaluate the students' learning, he had them answer the questions they themselves had posed earlier.

Whether launching a study of Shakespeare or sharks or the stock market, some teachers routinely begin by checking in with students. One popular format is to ask students what they already think they know about the topic, listing their answers on a blackboard or flip chart. Then they may be asked what they want to find out, followed by how they can do so. Afterward, the teacher talks with them about what they ended up learning.[70] This framework exemplifies what I like to call a "sandwich" model of teaching, in which anything to be learned is nestled between a discussion of what we are about to do and reflection about what we just did.[71]

Even when students aren't allowed to choose what to study, they can decide how to study it and how to frame the relevant questions. Imagine a continuum of student involvement with respect to a unit about the colonial period. At the bottom, the most unimaginative and uninvolving lesson would consist of the teacher's telling students to read a textbook chapter about Adams, Franklin, Washington, Jefferson, and Henry. Slightly better would be an assignment to go dig up information about one or more of these men. Better than that, such an investigation would take place in the context of having the students decide who is worth learning about—which is to say, who were the most influential figures during that period of history? Best of all, the teacher could even involve the students in deciding on the relevant criteria for such a decision: On what basis should we choose the most influential figures?[72]

This degree of participation (and intellectual sophistication) isn't limited to older students. Once, visiting a second-grade class in Missouri,[73] I watched the teacher call everyone together to describe a party she intended to give for her son, who was about to graduate from high school.

On a flip chart, she wrote down what she needed to buy (cake, juice, ice cream) and worked with the children to estimate the number of portions she would need and the price of each item. Then she asked a question no teacher ever asked me in second grade—or in secondary school, for that matter: What's left to be figured out? After a few minutes of discussion, everyone agreed that the most important remaining question was the total cost of the party. They got into groups of three to try to find the answer to this question, which they had essentially set for themselves.

These examples only hint at all the variations on giving students more of a role in decision-making. My purpose here isn't to present an exhaustive account of how this works, a response to all possible objections, or a guide for teachers of different age levels. But if we are looking for what separates traditional from nontraditional education—or for a basic feature by which to judge the quality of our children's classrooms—we could do worse than to pay attention to how actively students are involved in making choices about their learning.

Cooperating to Learn

Coercing students to learn is so patently counterproductive (if, indeed, it is possible at all) that we should not only stop doing it but take the affirmative step of doing the opposite—that is, helping students play an active role in their own education. In exactly the same way, making students compete against one another in the classroom is so destructive that we should not only stop doing it but take the affirmative step of helping students learn with and from one another.

Any number of theorists have argued that learning at its root is a social rather than a solitary act. Some have even suggested that the very idea of intelligence is best applied to what goes on among people rather than what happens in each person's head.[74] The exaggerated individualism of American culture has often blinded us to the role that interactions with others play in our coming to understand ideas. Success in school is a function not only of the relationship between each student and the text, or even the relationship between each student and the teacher, but also of the relationship among the students: how they show and watch, talk and listen, assert and rebut. What must be justified, therefore, are not classroom arrangements that encourage cooperation but those that separate students from one another.

Interestingly, many theorists who aren't in the habit of viewing intelligence as social, and who aren't even committed to cooperative models of

classroom learning, have been convinced by the strength of the evidence. Researchers who started out "with purely individual definitions of what they were trying to teach . . . arrived at the need for social interaction more through pedagogical trial and error than through theoretical analysis."[75] They may have begun with no other goal than, say, to have young children make sense of challenging mathematical ideas, but they quickly realized there has to be plenty of opportunity for "collaborative dialogue" in order for that to happen.[76] The bottom line is that students generally learn better when they learn together.

Collaboration can take place at the level of the whole class as well as in small groups. Some progressive educators are understandably suspicious of the whole class format because in most classrooms that means the teacher runs the show, spewing out information, calling on students to regurgitate it, and tightly controlling any discussion. But it is possible for a class to meet for an authentic exchange of ideas in which students address one another directly. (When I visit classrooms, one of the first things I look for is the number of exchanges between one student and another.)[77] When a student reads aloud three possible endings to the story she is writing and then calls on a few of her classmates to explain which version they prefer—or when a class brainstorms possible essay topics from which individuals can choose—their time together is truly well spent.

Meanwhile, an entire movement has grown up around the other major format for learning together, usually known as "cooperative learning."[78] At its best, the practice of having students meet regularly in pairs or small groups not only helps them develop social skills and fosters each child's concern about others, but also turns out to be powerfully effective in intellectual terms. This is true for several reasons.

1. A student struggling to make sense of an idea may understand it better when it is explained by a peer (who only recently figured it out himself) rather than by an adult.

2. The student who does the explaining can achieve a fuller understanding of the subject matter by having to make it understandable to someone else. This is why cooperative learning has been shown to benefit the one giving the explanation at least as much as the one hearing it.[79]

3. Having a group tackle a task is typically far more efficient than having one person do it alone, since students can exchange information and supplement one another's investigations.

4. Cooperative learning often leads students to become more motivated to learn; their attitude improves, and that, in turn, facilitates their achievement.[80]

5. Finally, remember that constructing meaning typically takes place through conflict, and conflict happens when students have the chance to challenge one another—in an environment that feels caring and safe. Disagreement doesn't imply an adversarial encounter; it's a "friendly excursion into disequilibrium," in the lovely phrase of David and Roger Johnson.

Not all versions of cooperative learning provide these advantages. A teacher who exclaimed, "Thank goodness for cooperative learning. Now I can get through all those boring units students hate without them complaining"[81] is unlikely to witness much intellectual growth in her classroom. Students have to be solving complex problems, pursuing meaningful projects, discussing controversial questions. A "bunch o' facts" curriculum is just as much of a dead end for groups as it is for individuals. One study found that causing students to be "fixated on finding the right answers . . . interfered with their attempt[s] to regulate each other's process of problem-solving."[82] Similarly, if the teacher exerts too much control over the process, or uses rewards (including grades) to manipulate students into cooperating,[83] the outlook is not promising.

The idea of collaboration extends beyond the use of specific strategies like cooperative learning. Ultimately, learning is most likely to be engaging and effective if it takes place in a classroom that feels like a caring community. As a rule, students need to feel safe and valued before they will take risks. They need to know they will not be laughed at or otherwise made to feel stupid before they will ask a question or propose an idea. (The same is true for adults, by the way—including teachers.)[84] Teachers who provide activities that give students a sense of belonging and connection are creating a fertile environment for the free exchange of ideas and thus for learning. They do this not by exhorting children to "work together" or reminding them to share, but by structuring opportunities for them to meet as a class, to solve problems together, to collaborate with classmates on a regular basis. Moreover, such teachers are likely to anticipate and skillfully deal with instances of exclusion, cruelty, prejudice, and competition that threaten a fragile sense of community.[85]

Yet even that is not enough. Ultimately, schoolwide changes have to be made in order for students to be able to cooperate effectively. Parents ought to be familiar with—and lend their support to—the structural factors that make it easier for collaboration to take place. One is small classes, something that teachers can't create on their own. Virtually all of the debate about class size has focused on academic achievement (often measured by standardized test scores). The best research does indeed tend to find, with certain qualifications, that kids learn better in signifi-

cantly smaller classes.[86] But less attention has been paid to an indisputable proposition: students are more likely to be heard, to really know their classmates, to come to think in the plural, when there are fewer people in the room. That may be all the reason we need to keep down the numbers.

Interestingly, some prominent educators, including Deborah Meier, Thomas Sergiovanni, and the late John Holt have argued that the size of each class is less important than the size of the school.[87] Echoing Dewey, who believed no school should have more than a couple hundred students, these and other writers maintain that such a scale allows students (and teachers!) to be known, to participate directly in making decisions, and to feel part of a learning community—rather than getting lost and overwhelmed in what may feel like a factory. "There is enough evidence now of such positive effects [of small school size]—and of the devastating effects of large size on substantial numbers of youngsters—that it seems morally questionable not to act on it."[88]

Among the other changes that facilitate cooperation and community are: providing more time for each high school class, a reform usually known as "block scheduling" (see p. 270*n*11); letting an elementary school class, including its teacher, stay together for two or three years, which is known as "looping";[89] and teaching children of different ages in the same classroom, which is known as multiage or nongraded education.[90] These alternative arrangements have emerged from solid data about the significance of classroom relationships; when they have been tried, they've often encouraged teachers to rethink their basic assumptions about the nature of teaching and learning, thereby enhancing the quality of instruction.

Where It All Comes Together

Now and then I see an example of classroom learning that braids together the different strands of nontraditional education, a lesson that is collaborative, interdisciplinary, project-based, dedicated to discovery, animated by student decision-making, and grounded in the construction of meaning. That was the case with Donna Migdol's third-grade class on Long Island, where the children were devoting a significant amount of class time every week over a period of more than half a year to constructing and analyzing animal habitats.

At first, they just grappled with the idea of a habitat, wandering through the halls with clipboards to collect information that would help them decide whether their school qualified as a habitat. Next, they were

informed that a (fictitious) zoo curator had hired them to make wooden, desk-size models of real habitats for specific animals. The children were divided into teams to begin investigating the geography and resources of the native place of their assigned animal (Australia for the kangaroo, Florida for the dolphin, and so forth) as well as how these natural features affected the area's cultural life. While they were writing up their findings on scrolls to be placed inside the habitats, they were also learning about vertices and perpendiculars in order to construct the boxes. And they were honing their arithmetic skills by keeping a running log of the costs associated with the materials to make sure they stayed within the budget allotted by the curator.

On too many classroom walls you find commercially printed posters about the rules of grammar or reminders to listen. Here a visitor instead discovers lists of "problems we faced when designing and constructing" the habitats as well as elaborate graphs comparing the temperature in New York with those in the places they'd been studying. Here, in short, was evidence of complex thought, perseverance in overcoming problems, and classwide cooperation. No wonder Donna was able to report that parents' concerns about the project ("Where are the textbooks?" "How much longer are they going to be working on this?") tended to dissolve once they accepted her invitation to come and see for themselves what was going on.

Each habitat included some plants indigenous to their assigned region, as determined by the students' research. At the time I happen to drop by, they're describing experiments on evaporation that they had not only conducted but designed. (It was logical for them to do some of their investigations at home, so that's where they did them. This reflects a view of homework as out-of-school learning reserved for occasions when it seems appropriate rather than tasks assigned for their own sake.) One boy is talking about the fate of a drop of water on a hot pan in his kitchen the night before, and Donna gently asks him what he was trying to prove, prodding him to think more clearly and come up with the language to explain exactly what he was up to. Eventually he concludes that heat is related to the speed of evaporation.

Everyone agrees, so Donna decides to push the children further. "Steve found something that's making me ask a million questions," she announces, then asks him to explain. It turns out his experiment had consisted of leaving out two cups of water, one in the sun and the other in the shade. The difference in evaporation rate was predictable, but he also noticed "a white rough stain on the bottom of the cup" and wondered if this was some kind of leftover water. Peter pipes up: "I think it's chemi-

cals in the water." Donna asks how they can find out for sure. Various suggestions are offered, and she reminds them to write down these ideas in their logs so they can try them out later. (The whole animal habitat project is recorded by each student in a variety of logs and journals, thereby ensuring extensive writing experience.)

Throughout the discussion that continues about evaporation, Donna emphasizes the relevance of their findings to the habitats. She responds to assertions by students with a trademark challenge: "Prove it!" A comment about "how long the plants are" is met with an invitation to "come up here and show me what you mean by 'long' "—an indication of how important it is to Donna to understand the student's point of view. She is an integral part of the conversation, guiding without telling, relaxed but requiring (and receiving) the kids' full attention to these ideas.

Earlier, the students had been encouraged to delve into the realm of what experts call "metacognition": thinking about how they are thinking. One team of three students made an entry in their habitat journal about what had been going on in this classroom. We "came up with an answer about what learning really means," they wrote. "We thought about it for a while and we thought the kids ask the questions and we go exploring to find the answer on our own instead of the teacher asking the questions and giving the answer. You are the traveler and Ms. Migdol's the north star." A drawing of a star illustrated this metaphor.

Good news: because this school uses looping, these students will navigate by the same star next year.