Making Change: Instruction And Its Improvement

If many attempts to improve instruction have failed, the last two decades have seen remarkable efforts to learn from that experience and to devise better interventions, the authors point out.

BY DAVID K. COHEN AND DEBORAH LOEWENBERG BALL

ONE MORNING, as they stand by the mailboxes before school, Ms. Kim and Mr. Jackson, both third-grade teachers, compare notes on their school's new "reform-oriented" mathematics textbook. Unfortunately, the school board balked at spending money both on professional development and on a textbook adoption in the same year; thus, other than one orientation session led by the publisher's representative last summer, the teachers have been finding their own way. Mr. Jackson asks Ms. Kim how it is going. She replies that her students like the problems and are beginning to discuss their solutions. Mr. Jackson groans and says, "Really? Not *my* kids. They say the work is too hard, and they are constantly getting me to do the work for them. I think this book expects more than my kids are ready-for. I have to supplement the book a lot. Especially if they are going to be ready for the Comp Test next month." Ms. Kim shrugs her shoulders. "I should probably worry about that more," she admits. "Do you think the newspaper will print the list of failing classes again this year?"

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As they go back to their classrooms, Ms. Kim thinks how differently the two of them react. She wonders what their other third-grade colleagues think about all of this, but they rarely have opportunities to discuss anything. There are no times when they are expected to meet, nor are there common tasks that they are expected to do together.

Later that morning, Ms. Kim is working on a coin problem from the new textbook with her class:

> I have pennies, nickels, and dimes in my pocket. Suppose that I pull out three coins. How much money might I have?[1]

One boy shouts out, "That's easy. Three cents!"

"Good, Raymond," says Ms. Kim, "although I don't want people to shout out answers. Now, put that in your notebook, and then think: What *other* solutions can you find?"

The children set to work, finding solutions. After about 20 minutes, Ms. Kim calls the class together and conducts a discussion of the problem. She records the different solutions that students propose in a chart, ordered from the least amount to the most, at the same time modeling the invention of notation (ppp, pnn, etc.) to organize and record the different coin combinations for each amount:

coins	amount
ppp	3
ppn	7
pnn	11
ppd	12
nnn	15
pnd	16
nnd	20
pdd	21
ndd	25
ddd	30

Ms. Kim asks children to justify their answers and sometimes to explain another student's answer. Near the end of the period, she asks, "Are we done? Do we have all the answers?" Several students nod. She presses: "How do you know we have them *all*? Can we *prove* that?" Excited, several students shoot their hands into the air, and a discussion ensues of different methods of establishing that there are no more than these 10 solutions to this problem.

A few days later, Mr. Jackson is on the same lesson. He assigns the problem and gets his students started working independently. A few students ask how many coins were in the person's pocket. Mr. Jackson peers at the text. "I guess they don't tell you," he shrugs. Several ask him for help, and he shows them that they can combine coins and see what the amount is. "There are a few different answers," he tells them. As the children finish, they turn their papers in. He glances at a few. They have answers written on them — different amounts of money on some, combinations of coins on others. He hands back a paper that has only one answer. "You can do more than this," he says to Danny. He stacks a practice worksheet next to the finished-work basket so that the students who finish more quickly have something to do.

In these classrooms, we find two third-grade teachers working with the same new mathematics textbook. They teach in the same school, with classes of the same size; they are led by the same principal and measured by the same tests. The students come from the same neighborhood, and the two classes are substantially equivalent. Yet the two mathematics lessons are as different as can be. Despite what many reformers have long hoped, curriculum materials cannot determine the curriculum of classrooms, and innovative curricula alone cannot produce instructional improvement.

Knowing what it would take to improve mathematics instruction in this school requires understanding the differences between Ms. Kim's and Mr. Jackson's lessons. Some might infer that Mr. Jackson knows mathematics less well than Ms. Kim, that Ms. Kim is more motivated, or that Mr. Jackson got a disproportionate share of the third-graders who are having trouble learning. But even if all those hypotheses proved correct, they would not fully account for the differences. The contrast between the two classes rests in the *instruction* — in what the teacher and students are actually doing together. Many efforts at improvement fail precisely because they do not take account of the dynamics of teaching and learning.

THE NATURE AND PRACTICES OF INSTRUCTION

We offer a perspective on the dynamics of teaching and learning as they relate to instructional improvement.[2] First, we set out a framework for understand-

ing instruction, and then we ask: What does this portrait imply for efforts to improve instruction? We then outline some elements of an answer.

Although many people think of instruction as what teachers do, it consists of interactions involving teachers, students, and content. The interactions occur in such varied settings as small groups in classrooms, informal groups, tutorials, large lectures, and situations involving distance learning. Ms. Kim's and Mr. Jackson's lessons were not the result simply of what they themselves knew and did, or of the mathematical task from the textbook, or of differences in their students' capabilities and levels of motivation, but of how the teachers and students interpreted and interacted with one another and with the task. In the ways in which they attend, listen, and respond, teachers in effect shape who their students are and what those students produce as they learn.[3] Similarly, individual students understand and make use of their teachers in different ways. And teachers' interpretations of the content have an impact on what is available to students to learn, and so on.

But instruction also takes place in *environments*, which offer potential constraints, opportunities, and resources, such as policies, district curriculum guidelines, testing, parents' concerns, curricular emphases in other subjects, other teachers' views about what students should learn, principals' directives, and fiscal resources. As environments are unwittingly imported or noticed and used — and in either case responded to — by teachers and students, they influence instructional interactions. The environments in which Ms. Kim and Mr. Jackson work offer a variety of potential signals, but the teachers interpret them differently — the upcoming mathematics achievement test, for example, or their principal's concerns. We note also that their environments offer only weak resources for learning: the decision of the school board not to fund professional development and the lack of opportunities in their school to work on teaching and learning.

If instruction is interaction, it must be dynamic. The active elements include teachers' and students' perceptions and *use* of one another, of the academic tasks in which they engage, and of their environments. Students' *learning practices* — how they go about the work of learning — shape the enactment of tasks, the teacher's role, and the influence of environments. Teachers' *teaching practices* — how they frame and use academic tasks, acquaint themselves with what students know and can do, enact the instructional discourse, and mediate the environment — also influence how teaching and learning unfold and hence the opportunities for learning that students have and can use. Ms. Kim sees more capability in her students than does Mr. Jackson. She asks questions of them that, in turn, encourage them to engage in particular forms of mathematical thinking, and they do. Mr. Jackson merely assigns the coin problem and never takes up the question of whether the class has all the solutions. His students do not press into these elements of the problem, and he does not push them there.

Amid these streams of interactions that produce instruction, teachers and students contend with three problems. These problems arise for instruction whether or not teachers are aware of or work on them consciously. Still, how they are managed matters for the quality of instruction.

Coordination is the first problem. Because instruction consists of interactions between teachers, learners, content, and environments over time, uncoordination is the default state. Students may come to a given lesson differently prepared, not having learned the same things in the previous grade. Mr. Jackson's students may play or doodle while he is teaching. Both Ms. Kim and Mr. Jackson face mixed signals from the district — the new high-stakes test and this new textbook. Parents may disparage the new curriculum, and students may feel torn. How well teachers and students manage these — and a host of other — sources of uncoordination will make a difference for instructional coherence.

Resource use is a second central problem. Resources — including everything from learners' work to teachers' content knowledge to state policy — become active only as they are used. Adding more money or excellent curriculum materials will not help unless teachers and students can use such resources well. Of course, teachers and students cannot use resources that do not exist, but for those that do, both teachers and students must be able to make productive use of them. Ms. Kim and Mr. Jackson have the same textbook, and yet they use it differently. They also use their students differently. Teachers' knowledge — of students, of content, of pedagogy, among other things — and how they use

that knowledge in instruction powerfully influence what they notice, what they use as instructional resources, and how they use these resources.

Managing incentives is a third problem. Teaching and learning of any sort require effort. The more difficult the work, the more effort it may take to attack and accomplish it. Incentives are required to mobilize that effort, and the more ambitious the work, the greater the incentives must be. There is a conflict here. On one hand, teachers do have good reason to press their students to do challenging work, for if their students succeed, the teachers will also be successful. Learners also have reasons to work hard: to satisfy their curiosity and their desire to learn, to enhance their sense of competence, and to meet teachers' and parents' hopes. But, on the other hand, both teachers and students also have incentives to do less ambitious work, for it entails less risk of failure. Teachers who press for more ambitious work are more likely to encounter learners' resistance, frustration, and failure, whereas teachers who reduce the complexity of students' work can produce success — albeit with simpler goals.

What might strengthen the incentives for ambitious intellectual work? Working with a coherent curriculum increases the chances that teachers and students will succeed in their work, and success generates incentives within the work to continue and to invest more energy. Teachers who are knowledgeable also increase the chances, as does work with academic tasks, curricula, and assessments that are designed to build success and thus serve to mobilize incentives for more investment in teaching and learning. External incentives also count, including how much parents encourage good work, how hard employers and universities press for it, and how doing well is portrayed in the adolescent and popular culture. Incentives such as money, recognition, or tests affect instruction as they are mediated by these other internal and external incentives.

INTERVENING TO IMPROVE INSTRUCTION

The district in which Ms. Kim and Mr. Jackson work is, like many, trying to improve instruction. Deliberate efforts to improve instruction are enormously varied, including everything from very complex "comprehensive" school reform designs to new curriculum to extensive programs of professional development. We begin with two premises.

First, interventions entail learning, among other things. Because interventions in instruction aim at improvement, and therefore change, they depart in some degree from current practice. Therefore, enacting them requires practitioners, students, and others to learn new knowledge, skills, and practices; to relearn forgotten knowledge and skills; or to mobilize the will to use more effectively what they already know and can do. Many interventions also imply organizational changes and thus entail collective as well as individual learning. The more ambitious the interventions are and the more they depart from conventional practice, the more learning is required. The more learning is needed, the more likely it is to require explicit teaching, rather than quick self-instruction on the job. Enactment of more ambitious interventions depends even more heavily on learning and teaching and the mobilization of will.[4]

Second, instructional interventions are designed and enacted in environments. Since instruction is permeated with elements of its environment, so too are efforts to change instruction. It is common for interventions to be designed and launched as though they were independent of the environments in which they will be enacted: cases in point include MACOS (Man: A Course of Study) and the "new math" of the 1950s and 1960s and, most recently, many state standards-based reforms. But since intervention also entails intervention in popular conceptions of schooling and schools as institutions,[5] failure to attend to common ideas about schooling and the institutional features of schools brings many interventions to grief.

The history of instructional interventions reveals a thin record of success. Typically what results is surface-level enactment, with adoption of highly variable selected elements.[6] Many interventions do not last long in schools; rapid turnover and idiosyncratic accumulations of past interventions are common. Why is this the case? We offer three possible explanations.

First, no intervention can be completely comprehensive, but most have been very partial. They often take aim at only one element of the complex dynamic of instruction. Many, especially in mathematics and science, have centered on innovative curricula. Some focus on teachers' learning, some restructure school time and space, others aim at incentives — salary programs, merit pay, accountability for outcomes. But few intervene directly on the multiple elements of *instruction* — the teachers, students, content, and environments — and their interactions. One consequence is that school professionals are left with significant problems of coordination. For example, the enactment of a new curriculum depends on professional development and assessments that coordinate with the content. In our example, none of these were dealt with.

Second, many interventions thus leave much to be filled in by teachers and schools. They offer visions, principles, and directions but elaborate little more. Common American attitudes about teacher autonomy resist more elaborated plans, based on the curious view that true professionals must find their own way. However, the more that an intervention departs from conventional practice, the more important it is to elaborate that intervention, because much more is unfamiliar. The new mathematics book that Ms. Kim and Mr. Jackson used did not provide information about students' likely approaches to the problem, or how to extend and use the coin problem to accomplish significant mathematical work, or even what mathematics the students should learn from this task. Without such help, our teachers used the task differently and created significantly different mathematical opportunities. Instructional designs that are extensively elaborated clarify interventions and their operating features, thereby reducing uncertainty and the chances of weak enactment.

Third, rarely are interventions designed to enable the learning that enactors need to do to enact the intervention. Few interveners provide substantial learning opportunities for teachers, school leaders, students, and parents. Either they assume that the instructional design itself will be sufficient to animate effective enactment, or they leave others to design and enable their own learning. Ms. Kim's and Mr. Jackson's new curriculum had no learning materials for teachers, who had much to learn about mathematics, about students' thinking, and about teaching. The district's decision that the new books were sufficient to support better mathematics instruction left the necessary learning to individual teachers, without design or support.

NEXT STEPS: LEARNING ABOUT INSTRUCTION AND INTERVENTION

One way to read the history of efforts to improve instruction is as an unrelieved story of dismal failure. But if many attempts have failed, the last two decades have seen remarkable efforts to learn from that experience and to devise interventions that are better designed for instruction and enactment. Our current longitudinal research on interventions and instructional improvement focuses more extensively on the relationship between them than any previous inquiry.[7] It is designed to help us learn from this new generation of reform efforts and to contribute knowledge that will be useful for the improvement of the practices of intervention, teaching, and learning.

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1. This problem is adapted from one discussed on page 28 of the *Curriculum and Evaluation Standards for School Mathematics*, published in 1989 by the National Council of Teachers of Mathematics.

2. Our work on instruction has been influenced and helped by the ideas of others, including Carol Lee, Magdalene Lampert, Milbrey McLaughlin and Joan Talbert, and Brian Rowan.

3. Carol Lee and Magdalene Lampert each provide close portraits of the ways in which teachers can see and make use of their students' resources to enable them to learn intellectually challenging content. Lee discusses high school English in an urban school, and Lampert, elementary mathematics in a multicultural school. See Carol D. Lee, "Is October Brown Chinese? A Cultural Modeling Activity System for Underachieving Students," *American Educational Research Journal,* in press; and Magdalene Lampert, *Teaching Problems* (New Haven: Yale University Press, 2001). Milbrey McLaughlin and Joan Talbert offer evidence of how differently high school teachers behave in order to enable their students. See Milbrey W. McLaughlin and Joan E. Talbert, *Professional Communities and the Work of High School Teaching* (Chicago: University of Chicago Press, forthcoming).

4. The extent of departure from conventional practice is a function not only of what particular learners know, can do, and are committed to doing but also of what particular environments support (or do not support) with norms, professional culture, local concerns, and history.

5. For a treatment of schooling and institutionalism, see Marshall W. Meyer and Brian Rowan, "The Structure of Educational Organizations," in Marshall W. Meyer and Associates, *Environments and Organizations* (San Francisco: Jossey-Bass, 1978), pp. 78-109.

6. See David Tyack and Larry Cuban, *Tinkering Toward Utopia* (Cambridge, Mass.: Harvard University Press, 1997).

7. The Study of Instructional Improvement at the University of Michigan is co-directed by Deborah Ball, David Cohen, and Brian Rowan. It is supported by grants from the Office of Educational Research and Improvement, through the Consortium for Policy Research in Education and the Center for Teaching Policy, as well as from the Interagency Education Research Initiative.