TEACHING FOR UNDERSTANDING

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In a small town near Boston, a teacher of mathematics asks his students to design the floor plan of a community center, including dance areas, a place for a band, and other elements. Why? Because the floor plan involves several geometric shapes and a prescribed floor area. The students must use what they have studied about area to make a suitable plan.

In a city not far away, a teacher asks students to identify a time in their lives when they had been treated unjustly and a time when they had treated someone else unjustly. Why? Because the students will soon start reading works of literature, including To Kill a Mockingbird, that deal with issues of justice and who determines it. Making connections with students' own lives is to be a theme throughout. In a classroom in the Midwest, a student, using his own drawings explains to a small group of peers how a certain predatory beetle mimics ants in order to invade their nests and eat their eggs. Why? Each student has an individual teaching responsibility for the group. Learning to teach one another develops secure comprehension of their topics (Brown, et al., in press). In an elementary school in Arizona, students studying ancient Egypt produce a National Enquirer style, four-page tabloid call King Tut's Chronicle. Headlines tease "Cleo in Trouble Once Again?" Why? The format motivates the students and leads them to synthesize and represent what they are learning (Fiske, 1991, pp. 157-8).

Quirky, perhaps, by the measure of traditional educational practice, such episodes are not common in American classrooms. Neither are they rare. The first two examples happen to reflect the work of teachers collaborating with my colleagues and me in studies of teaching for understanding. The second two are drawn from an increasingly rich and varied literature. Anyone alert to current trends in teaching practice will not be surprised. These cases illustrate a growing effort to engage students more deeply and thoughtfully in subject-matter learning. Connections are sought between students' lives and the subject matter, between principles and practice, between the past and the present. Students are asked to think through concepts and situations, rather than memorize and give back on the quiz.

These days it seems old-fashioned to speak of bringing an apple to the teacher. But each of these teachers deserves an apple. They are stepping well beyond what most school boards, principals, and parents normally require of teachers. They are teaching for understanding. They want more from their students than remembering the formula for the area of a trapezoid, or three key kinds of camouflage, or the date of King Tut's reign, or the author of To Kill a Mockingbird. They want students to understand what they are learning, not just to know about it.

Wouldn't it be nice to offer the same apple to all teachers in all schools? . . . an apple for education altogether. However, teaching for understanding is not such an easy enterprise in many educational settings. Nor is it always welcome. Teaching for understanding? . . . the phrase has a nice sensible ring to it: Nice . . . but is it necessary?

Yes. It is absolutely necessary to achieve the most basic goal of education: preparing students for further learning and more effective functioning in their lives. In the paragraphs and pages to come, I argue that teaching for understanding amounts to a central element of any reasonable program of education. Moreover, once we pool insights from the worlds of research and from educational practice, we understand enough about both the nature of understanding and how people learn for understanding to support a concerted and committed effort to teach for understanding.

WHY EDUCATE FOR UNDERSTANDING?

Knowledge and skill have traditionally been the mainstays of American education. We want students to be knowledgeable about history, science, geography, and so on. We want students to be skillful in the routines of arithmetic, the craft of writing, the use of foreign languages. Achieving this is not easy, but we work hard at it.

So with knowledge and skill deserving plenty of concern and getting plenty of attention, why pursue understanding? While there are several reasons, one stands out: Knowledge and skill in themselves do not guarantee understanding. People can acquire knowledge and routine skills without understanding their basis or when to use them. And, by and large, knowledge and skills that are not understood do students little good! What use can students make of the history or mathematics they have learned unless they have understood it?

In the long term, education must aim for active use of knowledge and skill (Perkins, 1992). Students garner knowledge and skill in schools so that they can put them to work--in professional roles--scientist, engineer, designer, doctor, businessperson, writer artist, musician--and in lay roles--citizen, voter, parent--that require appreciation, understanding, and judgment. Yet rote knowledge generally defies active use, and routine skills often serve poorly because students do not understand when to use them. In short, we must teach for understanding in order to realize the long-term payoffs of education.

But maybe there is nothing that needs to be done. "If it ain't broke, don't fix it." Perhaps students understand quite well the knowledge and skills they are acquiring.

Unfortunately, research says otherwise. For instance, studies of students' understanding of science and mathematics reveal numerous and persistent shortfalls. Misconceptions in science range from youngsters' confusions about whether the Earth is flat or in just what way it is round, to college students' misconceptions about Newton's laws (e.g., Clement, 1982, 1983; McCloskey, 1983; Nussbaum, 1985). Misunderstandings in mathematics include diverse "malrules," where students over-generalize rules for one operation and carry them over inappropriately to another; difficulties in the use of ratios and proportions; confusion about what algebraic equations really mean, and more (e.g., Behr, Lesh, Post, and Silver, 1983; Clement, Lochhead and Monk, 1981; Lochhead and Mestre, 1988; Resnick, 1987, 1992).

Although the humanistic subject matters might appear on the surface less subject to misunderstanding than the technically challenging science and mathematics, again research reveals that this is not true. For instance, studies of students' reading abilities show that, while they can read the words, they have difficulty interpreting and making inferences from what they have read. Studies of writing show that most students experience little success with formulating cogent viewpoints well supported by arguments (National Assessment of Educational Progress, 1981). Indeed, students tend to write essays in a mode Bereiter and Scardamalia (1985) call "knowledge telling," simply writing out paragraph by paragraph what they know about a topic rather than finding and expressing a viewpoint.

Examinations of students' understanding of history reveal that they suffer from problems such as "presentism" and "localism" (Carretero, Pozo, and Asensio, 1989; Shelmit, 1980). For instance, students pondering Truman's decision to drop the atomic bomb on Hiroshima often are severely critical because of more recent history. Suffering from "presentism," they have difficulty projecting themselves into the era and pondering the issue in terms of what Truman knew at the time. Yet such shifts of perspective are essential for understanding history--and indeed for understanding other nations, cultures, and ethnic groups today. Moreover, Gardner (1991) argues that students' understanding of the humanistic subject matters is plagued by a number of stereotypes--for instance those concerning racial, sexual, and ethnic identity--that amount to misunderstandings of the human condition in its variety.

So understanding is "broke" far more often than we can reasonably tolerate. Moreover, we can do something about it. The time is ripe. Cognitive science, educational psychology, and practical experience with teachers and students put us in a position to teach for understanding--and to teach teachers to teach for understanding (Gardner, 1991; Perkins, 1986, 1992). As the following sections argue, today, more than ever before, teaching for understanding is an approachable agenda for education.

WHAT IS UNDERSTANDING?

At the heart of teaching for understanding lies a very basic question: What is understanding? Ponder this query for a moment and you will realize that good answers are not obvious. To draw a comparison, we all have a reasonable conception of what knowing is. When a student knows something, the student can bring it forth upon call--tell us the knowledge or demonstrate the skill. But understanding something is a more subtle matter. A student might be able to regurgitate reams of facts and demonstrate routine skills with very little understanding. Somehow, understanding goes beyond knowing. But how?

Clues can be found in this fantasy: Imagine a snowball fight in space. Half a dozen astronauts in free fall arrange themselves in a circle. Each has in hand a net bag full of snowballs. At the word "go" over their radios, each starts to fire snowballs at the other astronauts. What will happen? What is your prediction?

If you have some understanding of Newton's theory of motion, you may predict that this snowball fight will not go very well. As the astronauts fire the snowballs, they will begin to move away from one another: Firing a snowball forward pushes an astronaut backward. Moreover, each astronaut who fires a snowball will start to spin with the very motion of firing, because the astronaut's arm that hurls the snowball is well away from the astronaut's center of gravity. It's unlikely that anyone would hit anyone else even on the first shot, because of starting to spin, and the astronauts would soon be too far from one another to have any chance at all. So much for snowball fights in space.

If making such predictions is a sign of understanding Newton's theory, what is understanding in general? My colleagues and I at the Harvard Graduate School of Education have analyzed the meaning of understanding as a concept. We have examined views of understanding in contemporary research and looked to the practices of teachers with a knack for teaching for understanding. We have formulated a conception of understanding consonant with these several sources. We call it a "performance perspective" on understanding. This perspective reflects the general spirit of "constructivism" prominent in contemporary theories of learning (Duffy and Jonassen, 1992) and offers a specific view of what learning for understanding involves. This perspective helps to clarify what understanding is and how to teach for understanding by making explicit what has been implicit and making general what has been phrased in more restricted ways (Gardner, 1991; Perkins, 1992).

In brief, this performance perspective says that understanding a topic of study is a matter of being able to perform in a variety of thought-demanding ways with the topic, for instance to: explain, muster evidence, find examples, generalize, apply concepts, analogize, represent in a new way, and so on. Suppose a student "knows" Newtonian physics: The student can write down equations and apply them to three or four routine types of textbook problems. In itself, this is not convincing evidence that the student really understands the theory. The student might simply be parroting the test and following memorized routines for stock problems. But suppose the student can make appropriate predictions about the snowball fight in space. This goes beyond just knowing. Moreover, suppose the student can find new examples of Newton's theory at work in everyday experience (Why do football linemen need to be so big? So they will have high inertia.) and make other extrapolations. The more thought-demanding performances the student can display, the more confident we would be that the student understands.

In summary, understanding something is a matter of being able to carry out a variety of "performances" concerning the topic--performances like making predictions about the snowball fight in space that show one's understanding and, at the same time, advance it by encompassing new situations. We call such performances "understanding performances" or "performances of understanding".

Understanding performances contrast with what students spend most of their time doing. While understanding performances can be immensely varied, by definition they must be thought-demanding; they must take students beyond what they already know. Most classroom activities are too routine to be understanding performances--spelling drills, true-and-false quizzes, arithmetic exercises, many conventional essay questions, and so on. Such performances have their importance too, of course. But they are not performances of understanding; hence they do not do much to build understanding.

HOW CAN STUDENTS LEARN WITH UNDERSTANDING?

Given this performance perspective on understanding, how can students learn with understanding? An important step toward an answer comes from asking a related but different question: How do you learn to roller skate? Certainly not just by reading instructions and watching others, although these may help. Most centrally, you learn by skating. And, if you are a good learner, not just by idle skating, but by thoughtful skating where you pay attention to what you are doing--capitalize on your strengths, figure out (perhaps with the help of a coach) your weaknesses, and work on them.

It's the same with understanding. If understanding a topic means building up performances of understanding around that topic, the mainstay of learning for understanding must be actual engagement in those performances. The learners must spend the larger part of their time with activities that ask them to generalize, find new examples, carry out applications, and work through other understanding performances. And they must do so in a thoughtful way, with appropriate feedback to help them perform better.

Notice how this performance view of learning for understanding contrasts with another view one might have. It's all too easy to conceive of learning with understanding as a matter of taking in information with clarity. If only one listens carefully enough, then one understands. But this idea of understanding as a matter of clarity simply will not work Recall the example of Newton's theory of motion;

you may listen carefully to the teacher and understand in the limited sense of following what the teacher says as the teacher says it. But this does not mean that you really understand in the more genuine sense of appreciating these implications for situations the teacher did not talk about. Learning for understanding requires not just taking in what you hear, it requires thinking in a number of ways with what you heard-- practicing and debugging your thinking until you can make the right connections flexibly.

This becomes an especially urgent agenda when we think about how youngsters typically spend most of their school time and homework time. As noted earlier, most school activities are not understanding performances: They are one or another kind of knowledge building or routine skill building. Knowledge building and routine skill building are important. But, as argued earlier, if knowledge and skills are not understood, the student cannot make good use of them.

Moreover, when students do tackle understanding performances--interpreting a poem, designing an experiment, or tracking a theme through an historical period--there is often little guidance as to criteria, little feedback before the final product to help them make it better, or few occasions to stand back and reflect on their progress.

In summary, typical classrooms do not give a sufficient presence to thoughtful engagement in understanding performances. To get the understanding we want, we need to put understanding up front. And that means putting thoughtful engagement in performances of understanding up front!

HOW CAN WE TEACH FOR UNDERSTANDING?

We've looked at learning for understanding from the standpoint of the learner. But what does learning for understanding mean from the standpoint of the teacher? What does teaching for understanding involve? While teaching for understanding is not terribly hard, it is not terribly easy, either. Teaching for understanding is not simply another way of teaching, just as manageable as the usual lecture-exercise-test method. It involves genuinely more intricate classroom choreography. To elaborate, here are six priorities for teachers who teach for understanding:

1. Make learning a long-term, thinking-centered process.

From the standpoint of the teacher, the message about performances of understanding boils down to this: Teaching is less about what the teacher does than about what the teacher gets the students to do. The teacher must arrange for the students to think with and about the ideas they are learning for an extended period of time, so that they learn their way around a topic. Unless students are thinking with and about the ideas they are learning for a while, they are not likely to build up a flexible repertoire of performances of understanding.

Imagine, if you will, a period of weeks or even months committed to some rich theme--the nature of life, the origin of revolutions, the art of mathematical modeling. Imagine a group of students engaged over time in a variety of understanding performances focused on that topic and a few chosen goals. The students face progressively more subtle but still accessible challenges. At the end there may be some culminating understanding performance such as an essay or an exhibition as in Theodore Sizer's (1984) concept of "essential schools." Such a long term, thinking-centered process seems central to building students' understanding.

2. Provide for rich ongoing assessment.

I emphasized earlier that students need criteria, feedback, and opportunities for reflection in order to learn performances of understanding well. Traditionally, assessment comes at the end of a topic and focuses on grading and accountability. These are important functions that need to be honored in many contexts. But they do not serve students' immediate learning needs very well. To learn effectively, students need criteria, feedback, and opportunities for reflection from the beginning of any sequence of instruction (cf. Baron, 1990; Gifford and O'Connor, 1991; Perrone, 1991b).

This means that occasions of assessment should occur throughout the learning process from beginning to end Sometimes they may involve feedback from the teacher, sometimes from peers, sometimes from students' self evaluation. Sometimes the teacher may give criteria, sometimes engage students in defining their own criteria. While there are many reasonable approaches to ongoing assessment, the constant factor is the frequent focus on criteria, feedback, and reflection throughout the learning process.

3. Support learning with powerful representations.

Research shows that how information is represented can influence enormously how well that information supports understanding performances. For instance Richard Mayer (1989) has demonstrated repeatedly that what he terms "conceptual models"--usually in the form of diagrams with accompanying story lines carefully crafted according to several principles--can help students to solve nonroutine problems that ask them to apply new ideas in unexpected ways. For another example, computer environments that show objects moving in frictionless Newtonian ways we rarely encounter in the world can help students understand what Newton's laws really say about the way objects move (White, 1984). For yet another example, well-chosen analogies often serve to illuminate concepts in science, history, English, and other domains (e.g. Brown, 1989; Clement, 1991; Royer and Cable, 1976).

Many of the conventional representations employed in schooling--for instance, formal dictionary definitions of concepts or formal notational representations as in Ohm's law, I = E/R--in themselves leave students confused or only narrowly informed (Perkins and Unger, in press). The teacher teaching for understanding needs to add more imagistic, intuitive, and evocative representations to support students' understanding performances. Besides supplying powerful representations, teachers can often ask students to construct their own representations, an understanding performance in itself.

4. Pay heed to developmental factors.

The theory devised by the seminal developmental psychologist Jean Piaget averred that children's understanding was limited by the general schemata they had evolved. For instance, children who had not attained "formal operations" would find certain concepts inaccessible--notions of control of variables and formal proof, for example (Inhelder and Piaget, 1958). Many student teachers today still learn this scheme and come to believe that fundamental aspects of reasoning and understanding are lost on children until late adolescence. They are unaware that 30 years of research have forced fundamental revisions in the Piagetian conception. Again and again, studies have shown that, under supportive conditions, children can understand much more than was thought much earlier than was thought.

The "neo-Piagetian" theories of Robbie Case (1985), Kurt Fischer (1980), and others offer a better picture of intellectual development. Understanding complex concepts may often depend on what Case calls a "central conceptual structure," i.e., certain patterns of quantitative organization, narrative structure, and more that cut across disciplines (Case, 1992). The right kind of instruction can help learners to attain these central conceptual structures. More broadly, considerable developmental research shows that complexity is a critical variable. For several reasons, younger children cannot readily understand concepts that involve two or three sources of variation at once, as in concepts such as balance, density, or pressure (Case, 1985, 1992; Fischer, 1980).

The picture of intellectual development emerging today is less constrained, more nuanced, and ultimately more optimistic regarding the prospects of education.

Teachers teaching for understanding do well to bear in mind factors like complexity, but without rigid conceptions of what students can and cannot learn at certain ages.

5. Induct students into the discipline.

Analyses of understanding emphasize that concepts and principles in a discipline are not understood in isolation (Perkins, 1992; Perkins and Simmons, 1988; Schwab, 1978). Grasping what a concept or principle means depends in considerable part on recognizing how it functions within the discipline. And this in turn requires developing a sense of how the discipline works as a system of thought. For example, all disciplines have ways of testing claims and mustering proof--but the way that's done is often quite different from discipline to discipline. In science, experiments can be conducted, but in history evidence must be mined from the historical record. In literature, we look to the text for evidence of an interpretation, but in mathematics we justify a theorem by formal deduction from the givens.

Conventional teaching introduces students to plenty of facts, concepts, and routines from a discipline such as mathematics, English, or history. But it typically does much less to awaken students to the way the discipline works--how one justifies, explains, solves problems, and manages inquiry within the discipline. Yet in just such patterns of thinking lie the performances of understanding that make up what it is to understand those facts, concepts, and routines in a rich and generative way. Accordingly, the teacher teaching for understanding needs to undertake an extended mission of explicit consciousness raising about the structure and logic of the disciplines taught.

6. Teach for transfer.

Research shows that very often students do not carry over facts and principles they acquire in one context into other contexts. They fail to use in science class or at the supermarket the math they learned in math class. They fail to apply the writing skills that they mastered in English on a history essay. Knowledge tends to get glued to the narrow circumstances of initial acquisition. If we want transfer of learning from students--and we certainly do, because we want them to be putting to work in diverse settings the understandings they acquire--we need to teach explicitly for transfer, helping students to make the connections they otherwise might not make, and helping them to cultivate mental habits of connection-making (Brown, 1989; Perkins and Salomon, 1988; Salomon and Perkins, 1989).

Teaching for transfer is an agenda closely allied to teaching for understanding. Indeed, an understanding performance virtually by definition requires a modicum of transfer, because it asks the learner to go beyond the information given, tackling some task of justification, explanation, example-finding or the like that reaches further than anything in the textbook or the lecture. Moreover, many understanding performances transcend the boundaries of the topic, the discipline, or the class room--applying school math to stock market figures or perspectives on history to casting your vote in the current election. Teachers teaching for a full and rich understanding need to include understanding performances that reach well beyond the obvious and conventional boundaries of the topic.

Certainly much more can be said about the art and craft of teaching for understanding. However, this may suffice to make the case that plenty can be done. Teachers need not feel paralyzed for lack of means. On the contrary, a plethora of classroom moves suggest themselves in service of building students' understanding. The teacher who makes learning thinking-centered, arranges for rich ongoing assessment, supports learning with powerful representations, pays heed to developmental factors, inducts students into the disciplines taught, and teaches for transfer far and wide has mobilized a powerful armamentum for building students' understanding.

WHAT SHOULD WE TEACH FOR UNDERSTANDING?

Much can be said about how to teach for understanding. But the "how" risks defining a hollow enterprise without dedicated attention to the "what"--what's most worth students' efforts to understand?

A while ago I found myself musing on this question: "When was the last time I solved a quadratic equation?" Not your everyday reminiscence, but a reasonable query for me. Mathematics figured prominently in my precollege education, I took a technical doctoral degree, I pursue the technical profession of cognitive psychology and education, and occasionally I use technical mathematics, mostly statistics. However, it's been a number of years since I've solved a quadratic equation.

My math teacher in high school--a very good teacher--spent significant time teaching me and the rest of the class about quadratic equations. Almost everyone I know today learned how to handle quadratic equations at some point. Yet most of these folks seem to have had little use for them lately. Most have probably forgotten what they once knew about them.

The problem is, for students not headed in certain technical directions, quadratic equations are a poor investment in understanding. And the problem is much larger than quadratic equations. A good deal of the typical curriculum does not connect--not to practical applications, nor to personal insights, nor to much of anything else. It's not the kind of knowledge that would connect. Or it's not taught in a way that would help learners to make connections. We suffer from a massive problem of "quadratic education."

What's needed is a connected rather than a disconnected curriculum, a curriculum full of knowledge of the right kind to connect richly to future insights and applications (Perkins, 1986; Perrone, 1991a). The great American philosopher and educator John Dewey (1916) had something like this in mind when he wrote of "generative knowledge." He wanted education to emphasize knowledge with rich ramifications in the lives of learners. Knowledge worth understanding.

WHAT IS GENERATIVE KNOWLEDGE?

What does generative knowledge look like (cf. Perkins, 1986, 1992; Perrone, 1991a)? Consider a cluster of mathematics concepts rather different from quadratic equations. Consider probability and statistics. The conventional precollege curriculum pays little attention to probability and statistics. Yet statistical information is commonplace in newspapers, magazines, and even newscasts. Probabilistic considerations figure in many common areas of life, for instance making informed decisions about medical treatment. The National Council of Teachers of Mathematics (1989) urges more attention to probability and statistics in the standards established a few years ago. Faced with a forced choice, one might do well to teach probability and statistics for understanding instead of quadratic equations for understanding. It's knowledge that connects!

Or for instance, early this year, the Boston Globe published a series on "the roots of ethnic hatred," the psychology and sociology of why ethnic groups from Northern Ireland to Bosnia to South Africa are so often and so persistently at one another's throats. It turns out that a good deal is known about the causes and dynamics of ethnic hatred. To teach social studies for understanding, one might teach about the roots of ethnic hatred instead of the French Revolution. Or one might teach the French Revolution through the lens of the roots of ethnic hatred. It's knowledge that connects!

TAPPING TEACHERS' WISDOM

Where are ideas for the knowledge in this "connected curriculum" to come from? One rich source is teachers. In some recent meetings and workshops, my colleagues and I have been exploring with teachers some of their ideas about generative knowledge. The question was this: "What new topic could I teach, or what spin could I put on a topic I already teach, to make it genuinely generative? To offer something that connects richly to the subject matter, to youngsters' concerns, to recurring opportunities for insight or application?"

We heard some wonderful ideas. Here is a sample:

- **What is a living thing?** Most of the universe is dead matter, with a few precious enclaves of life. But what is life in its essence? Are viruses alive? What about computer viruses (some argue that they are)? What about crystals? If they are not, why not?
- **Civil disobedience.** This theme connects to adolescents' concerns with rules and justice, to episodes of civil disobedience in history and literature, and to one's role as a responsible citizen in a nation, community, or, for that matter, a school.
- **RAP: ratio and proportion.** Research shows that many students have a poor grasp of this very central concept, a concept that, like statistics and probability, comes up all the time. Dull? Not necessarily. The teachers who suggested this pointed out many surprising situations where ratio and proportion enter--in poetry, music and musical notation, diet, sports statistics, and so on.

- **Whose history?** It's been said that history gets written by the victors. This theme addresses pointblank how accounts of history get shaped by those who write it-- the victors, sometimes the dissidents, and those with other special interests.

These examples drawn from teachers should persuade us that many teachers have excellent intuitions about generative knowledge.

POWERFUL CONCEPTUAL SYSTEMS

It's important not to mix up generative knowledge with what's simply fun or doggedly practical. We might think of the most generative knowledge as a matter of powerful conceptual systems, systems of concepts and examples that yield insight and implications in many circumstances. Look back at the topics listed earlier. Yes, they can be read as particular pieces of subject matter knowledge. But every one also is a powerful conceptual system. Probability and statistics offer a window on chance and trends in the world; the roots of ethnic hatred reveal the dynamics of rivalry and prejudice at any level from neighborhoods to nations; the nature of life becomes a more and more central issue in this era of test tube babies and recombinant DNA engineering; civil disobedience involves a subtle pattern of relations between law, justice, and responsibility; ratio and proportion are fundamental modes of description; the "whose history?" question basically deals with the central human phenomenon of point-of-view.

If much of what we taught highlighted powerful conceptual systems, there is every reason to think that youngsters would retain more, understand more, and use more of what they learned. In summary, teaching for understanding is much more than a matter of method--of engaging students in understanding performances with frequent rich feedback, powerful representations, and so on. Besides method, it is also a matter of content--thoughtful selection of content that proves genuinely generative for students. If we teach within and across subject matters in ways that highlight powerful conceptual systems, we will have a "connected curriculum"--one that equips and empowers learners for the complex and challenging future they face.

WHAT NEEDS TO BE DONE?

At the outset, I called teaching for understanding an apple for education. It's the apple, I've argued, that education needs. The apple of course is the traditional Judeo-Christian symbol of knowledge and understanding. It was Eden's apple that got us into trouble in the first place, and the trouble with apples continues. Our efforts to serve up to students the apple of plain old knowledge seem to be serving them poorly.

What it all comes down to is this. Schools are providing the wrong apple. The apple of knowledge is not the apple that truly nourishes. What we need is the apple of understanding (which of course includes the requisite knowledge).

So what should be done? What does it take to organize education around the apple of understanding rather than the apple of knowledge? What energies must we muster in what direction to move toward a more committed and pervasive pedagogy of understanding?

Although the problem is complex, we have been exploring pathways toward such pedagogy in collaboration with a number of teachers. An early discovery encouraged our efforts. We found that nearly every teacher could testify to the importance of the goal. Teachers are all too aware that their students often do not understand key concepts in science, periods of history, works of literature, and so on, nearly as well as they might. And most teachers are concerned about teaching for understanding. They strive to explain clearly. They look for opportunities to clarify. From time to time, they pose open-ended tasks such as planning an experiment, interpreting a poem, or critiquing television commercials that call for and build understanding.

Our teacher colleagues also helped us to realize that, in most settings, understanding was only one of many agendas. While concerned about teaching for understanding, most teachers distribute their effort more or less evenly over that and a number of other objectives. Relatedly, the institutions within which teachers work and the tests they prepare their students for often offer little support for the enterprise of teaching for understanding. In other words, as Theodore Sizer and many others have urged in recent years, better education calls for a simplification of agendas and a deepened emphasis on understanding (Sizer, 1984). This in turn demands some restructuring of priorities (as expressed by school boards, parents, and mandated tests) and of schedules and curricula that work against teaching for understanding.

Finally, our teacher colleagues help us see that teaching for understanding in a concerted and committed way calls for a depth of technique that most teachers' initial training and ensuing experiences have not provided. Thinking of instruction in terms of performances of understanding, arranging ongoing assessment, tapping the potential of powerful representations--these have a very limited presence in preservice and in-service teacher development. So a second strand of any effort to make pedagogy of understanding real must be to help teachers acquire such techniques.

Fortunately, many teachers are already far along the way toward teaching for understanding, without any help from cognitive psychologists or educational researchers. Indeed, some of our most interesting work on teaching for understanding has been with teachers who already do much of what the framework that we are developing advocates. They are pleased to find that the framework validates their work. And they tell us that the framework gives them a more precise language and philosophy. It helps them to deepen their commitment and sharpen the focus of their efforts.

Frankly, we should all be suspicious if the kind of teaching advocated under the banner of teaching for understanding came as a surprise to most teachers. Instead it should look familiar, a bigger and juicier apple: "Yes, that's the kind of teaching I like to do--and sometimes do." Teaching for understanding does not aim at radical burn-the-bridges innovation, just more and better versions of the best we usually see.

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