making time. ['What's that mean?' a student asks.] Well, that's harvesting the hay and, that was a very important part of farm life then . . . now too. Anyway, hay making is coming up in a couple of chapters. I think you'll enjoy that section."

These examples of foreshadowing take a term or an idea that crops up and create a brief image of what it will be like or what it will be about. This is done so that when the students get to that point, it's not totally strange territory. "Oh, I remember we talked about that last week," a student may say to himself and start assimilating the ideas into his cognitive framework. Foreshadowing moves may crop up as moments of opportunity during instruction and are often unplanned. For instance, in the case of the second example above, the students had commented on how hard Laura works around the house, and their remarks made the teacher think of the days of hard labor she spent with her father making hay, so she brought it up for comparative purposes, knowing it's coming up in a few chapters.

When teachers end a lesson with an introduction or a forecast of what the students will be doing next, that is foreshadowing of a kind, but we tend to see that kind of a move as a cognitive transition: "Ladies and gentlemen, we're going to be using these vocabulary words today in our essays, so keep them handy and in a safe place." The difference is that a cognitive transition makes direct links between what has just been completed and what's immediately to come in the flow of instruction—even if *immediately* is interrupted by overnight. Foreshadowing puts intellectual markers or hooks in place for items that are down the road and will not be dealt with the very next time the students work on this subject.

Getting Inside Students' Heads: Cognitive Empathy

Cognitive empathy means the teacher is viewing the learning experience from the student's perspective and making decisions from that frame of reference. It is central to clarity and to good teaching in general because it enables teachers to know when students don't understand and then to zero in on what or what part of the material they don't understand.

Knowing when students don't understand and then determining what they don't understand are two different skills. Knowing when students don't understand suggests that teachers have means of checking for understanding during instruction. Determining what students don't understand implies that teachers have ways of unscrambling confusions that identify the specific points of misunderstanding and deal with them. Since both skill areas are important to clarity, we need to consider separately how teachers perform each.

Checking for Understanding

We use the word *checking* to describe when teachers are trying to determine whether students are confused. When teachers are checking, they are reacting to the class, reaching out to students, and making a "yes . . . no . . . who?" judgment about whether understanding exists. There are four kinds of performance to consider here:

- Pressing on
- Reading body language
- Asking checking questions
- "Dipsticking," a term popularized by Madeline Hunter in the 1970s. It means taking a reading on the learning just as the oil dip-

stick in an auto engine gives you a reading on the oil level in the reservoir.

These are not mutually exclusive; we might be employing several of them at different points or simultaneously during the same lesson.

The first of these, *pressing on,* means we are not aware of or responsive to students' lack of understanding: *we just press on* with our explanations. Or, not being aware of the potential for confusion, we fail to give any directions for tasks that require explanation. Not checking and pressing on can occasionally be appropriate in fast-paced reviews of material previously taught if there has been thorough checking in the past and today our purpose is to highlight key terms or concepts. Even here, however, since checking takes so little time, it is wise to do it.

Second, we may check for understanding by *reading body language* that signifies confusion (postures and facial expressions, for example). Only when we notice such cues do we pause in our instruction. Relying on whether students appear to understand, however, can be risky. Students may provide no readable cues even though they are not following the instruction. For example, in a study of student thought processes during instruction, Peterson and Swing (1982) describe how students fooled observers who judged them to be attending to the lesson:

> Melissa's responses to the stimulated-recall interview suggested that she was not attending [although observers judged from her behavior that she was] and instead seemed to be spending much of the time worrying about her performance and the possibility of failure. For example, when asked what she was thinking after viewing the first videotape segment,

Melissa replied: ". . . since I was just beginning, I was nervous and I thought maybe I wouldn't know how to do things." After viewing the second segment, Melissa said the following: "I was thinking that Chris would probably have the easiest time because she was in the top math group." After viewing the third segment Melissa responded: "Well, I was mostly thinking about what we talked about before—I was making a fool of myself." Finally, after the fourth segment, Melissa stated: "Well, this might be off the subject. I was thinking about my crocheting meeting 'cause I wanted to have it done" [p. 485].

Third, we may check more directly for general student understanding with periodic questions. We probe to see if students are still successfully comprehending the instruction. This checking may concern general understanding of content, procedures, or directions. It is worth pausing here for a minute to consider the use of recall and comprehension questions in checking for student understanding.

Recall questions call for factual answers that come directly from the material presented—for example, "What is the formula for finding the area of a triangle?" Comprehension questions can be answered only if students truly understand a lesson's concepts or operations. For example, the answer to, "What would you multiply to get the area of this triangle [one that has measurements marked, but no terms labeled]?" requires both the recall of the formula and an understanding of how to apply the formula to a specific triangle. Comprehension questions are those that can be answered only if students understand the concept being checked. Another example, "Why couldn't 'gobble' be on the page?"—where the guide words on the

dictionary page are "hunt" and "mound"? Students can only answer that question if they understand how guide words bound the range of entries on a dictionary page.

Note that during "checking" we sometimes think we are getting a reading on comprehension, but in reality we are only checking recall of key words. "So the key elements of photosynthesis are . . . (chlorophyl) right and (sunlight) right; and one more . . .(carbon dioxide). Right. OK, you really do understand photosynthesis."

A fourth kind of checking for understanding involves *dipsticking*. Dipsticking occurs when the teacher is monitoring student understanding frequently and broadly across many students simultaneously. Hunter and her colleagues teach students to use signals—thumbs up, thumbs down, thumbs to one side—to send periodic messages to teachers about how well they understand something. There are any number of other forms of dipsticking teachers use to accomplish the same thing. For example, asking students, "Nod your head if you're with me so far," or calling for unison responses from the class can give a general reading according to how many students respond and how emphatic the response is.

These signals call for student self-assessment of whether they understand, but they may think they do when actually they don't. A more developed form of dipsticking gets an actual content answer from each student. In trigonometry, a teacher says: " When I call for the signal, hold up one, two, three, or four fingers to show in which quadrant the angle will terminate." In an English class, each student has cards that say S (for sentence), F (for fragment of a sentence), and RO (for run-on.) The teacher says, "Hold up the appropriate card after I read each of the following."

These forms of dipsticking involve students' sending signals with their hands, cards, or another device. But dipsticking can be accomplished with-
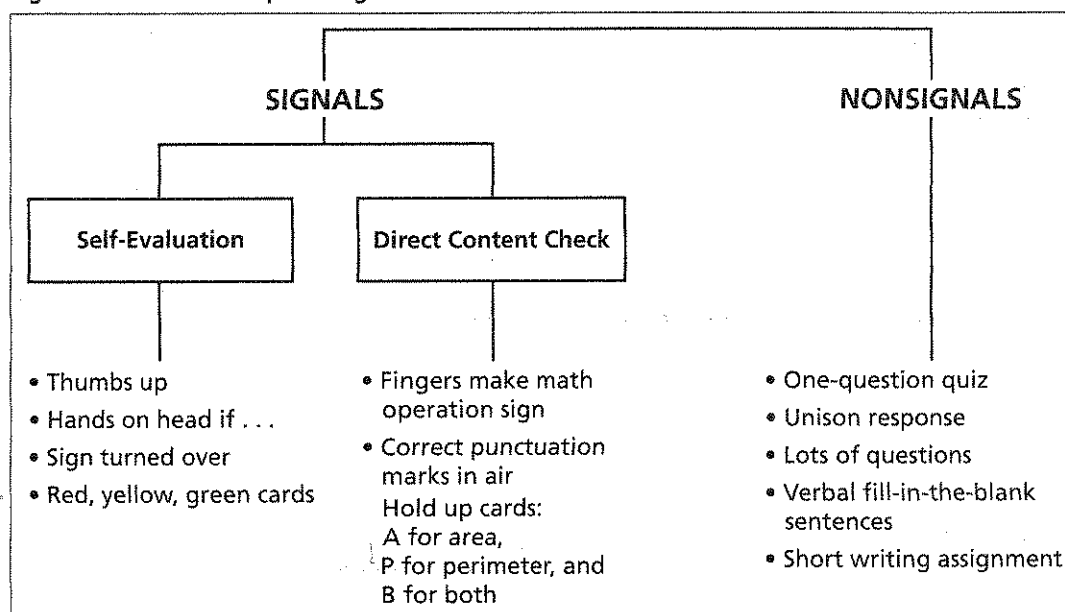
out signals. Some teachers pause in the middle of classes and give one-question quizzes . . . and then circulate and look over shoulders as students are writing to see how everyone is doing. Small numbers of college teachers around the country use electronic response devices at each student seat for a kind of dipsticking (Draper and Brown, 2004). This takes only a minute or two and gives an accurate reading of how well the students are understanding the material. The diagram in Figure 9.6 shows the relationship between signal and nonsignal forms of dipsticking.

Good performance on dipsticking is indicated when there is evidence that a teacher is taking constant readings across all (or at least most) of the students in the class to see if they're still understanding. Frequency and breadth characterize these readings of student understanding. Teachers may get these readings by simply asking a high volume of questions for a large number of students.

One can do dipsticking, that is, checking that is frequent and broad across the class, at either the recall or the comprehension level or both. But just because one is asking recall and comprehension questions doesn't necessarily mean dipsticking is taking place. They are overlapping but not necessarily inclusive sets. For example, one could be asking comprehension questions of individual students and moving on when the right answer was produced, thus not finding out if the rest of the students also understood (this is a frequent pattern in recitation lessons).

Dipsticking does not have to be a constant feature of every lesson. It could be out of place in a true discussion where a line of argument is being developed or in a conceptual change lesson when students are encountering events in conflict with their native theories, constructing new theories to account for what they've observed, and testing the new theories. But even here there will be benchmarks when we will want to check students' under-

Figure 9.6. Forms of Dipsticking

SIGNALS		NONSIGNALS
Self-Evaluation	**Direct Content Check**	
• Thumbs up	• Fingers make math operation sign	• One-question quiz
• Hands on head if . . .	• Correct punctuation marks in air	• Unison response
• Sign turned over	Hold up cards:	• Lots of questions
• Red, yellow, green cards	A for area,	• Verbal fill-in-the-blank sentences
	P for perimeter, and	• Short writing assignment
	B for both	

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standing of something everyone should know. At those times, taking a true dipstick reading will provide much-needed information about who does and who doesn't understand.

Unscrambling Confusions

When we detect that students are confused, the next clarity task is to find out what the students are confused about and tailor reexplanations accordingly. We call this *unscrambling confusions,* and it has a number of options to draw on:

- Do nothing at the moment.
- Reexplain.
- Isolate the point of confusion with pinpoint questions.
- Have a student explain his or her own current thinking.
- Persevere and return.

The first option, doing nothing in the moment, means making no response to the per-

ceived confusion. There might be times when we acknowledge the confusion but do nothing to unscramble it right away: "I know this is a little difficult to see just yet, but hang in there, and I think it will make sense with a few more examples."

A second option is to launch into a reexplanation of the item. It may be slower or more detailed than the first explanation, or it may be a reexplanation using a different explanatory device. In either case we are presenting the same thing over again without any venture into the students' thinking.

A third option is to pose pinpoint questions to discover precisely where in the sequence of learning the student became confused. When that point is isolated, we swing in, economically omitting reexplanation of anything the students have already assimilated and move on with the reexplanation from there.

A fourth option is to ask students to describe or explain their thinking, to probe for how a student thinks about the concept or operation. This means to truly listen to the student and try to

understand the student's frame of reference or way of conceptualizing the item. Questions can draw out the understanding:

- "How did you get that answer?"
- "How do you approach this kind of problem? Can you tell me what you did or thought about it?"
- "What did you try first? Why?"
- "What do you think this might mean?"
- "What does *city government* mean to you?"

In this way, sometimes we discover that apparently "wrong" answers aren't really wrong at all if we understand the student's assumptions and logic. As well, using the student's frame of reference with its meaning orientation enables us to reexplain the concept (or ask a series of questions that will bring the student closer to self-discovering the concept) from a vantage point that will have more meaning for the student. We might also discover that the concept turns out to be outside the boundaries of the student's thinking system, in which case it's an inappropriate objective altogether. And that is quite an important thing to find out.

The final option, persevering and returning, might be an integral part of the previous three but with an additional element: the return. We persevere when we find a student confused. We stick with the student who is confused, perhaps have several exchanges with him if time allows, and then, most important, come back to him later in the period to see if he really got it. This return visit may be accomplished by review questions or by asking the student to apply the idea in some other context to make sure he really understands it.

Sometimes there isn't time in the period for a teacher to unscramble all the confusions of all the students—a reality we all live with. In that case, what a perseverant teacher does is to note or record who specifically is still foggy on the new concept

and make some provision for a return engagement with those students (arranging for a short small group session right then and there perhaps, or asking Sam and Olivia to stop by after classes for a few minutes) to ensure that they will receive the support they need. (Notice how this option ties in with sending high expectations messages. In Chapter Twelve, we include students who don't get it yet as one of the ten arenas for sending the three key messages: "This is important; you can do it with effective effort; I won't give up on you.")

Making Students' Thinking Visible

The context thus far for making students explain their thinking has been to unscramble confusions. The notion of making a student's thinking visible, however, has more reach. Consider the following:

> If you can both listen to children and accept their answers not as things to be judged right or wrong but as pieces of information which may reveal what the child is thinking, you will have taken a giant step toward becoming a master teacher . . . [Easley and Zwoyer, 1975].

> It was listening to their own students solve problems that made the greatest difference in [teachers'] instructional practice [Borko and Putnam, 1995].

> My definition of a good teacher has changed from "one who explains things so well that students understand" to "one who gets students to explain things so well that they can be understood" [Reinhart, 2000].

These authors argue for the special importance of knowing what is going on inside students' heads. The behavior they are urging goes beyond the checking and unscrambling behaviors we have profiled so far in this chapter. They are part of a tradition of educational research that advises teachers: