APPENDIX G: TINKERER


Let us imagine, for a moment, the classroom teacher as a tinkerer or an instructional handyman, a do-it-yourself craftsman who can put to use a host of materials lying around at various stages of a construction or repair job. Unlike, say, an engineer, a teacher works seldom with predesigned materials or tools. Nor does a teacher start with a blueprint, but rather reaches for some scrap or surplus material from previous jobs as a project takes shape. These materials meet the particular need that emerges at a specific point and are fashioned to fit this particular purpose. Gradually, of course, the teacher “craftsperson” accumulates a workshop full of materials most likely to be needed at some still-unknown moment for the kinds of things he or she builds or fixes. In *Working Knowledge*, Harper (1987) provides some wonderful, lovingly detailed examples of a virtuoso car mechanic who buys virtually no spare parts but instead turns an old boiler into a car radiator and scrap metal into engine fittings. Finally, as our tinkerer accomplishes a succession of different tasks with ever-varying combinations of the materials at hand or materials made to fit the purposes of each job, he or she develops an increasingly differentiated and integrated set of procedures, representations, and algorithms for deciding the next task to be accomplished and for knowing which materials will be required at the outset.

The image of the tinkerer, or bricoleur, is derived from Lévi Strauss’s (1962) work on primitive thinking and has more recently been used as a metaphor for the teaching process (Hatton, 1989; Huberman, 1988; Perrenoud, 1983; Yinger, 1987). It envisions the teacher as creating or repairing learning activities of different kinds with a distinctive style or signature. He or she adapts the instructional materials that have been bought, given, or scavenged, as a function of the time of day, the degree of pupil attentiveness, the peculiar skill deficiency emerging in the course of the activity, the little unexpected breakthrough on a grammatical rule, and the apparent illogical persons of mathematical bases other than 10. In doing this, the teacher relies heavily on concrete bits of practice that have proved successful in the past but that must be reconfigured as a function of the specific situation in the classroom, in order to make them work.

What we have here is not a teacher who formulates in advance a codified lesson plan containing a series of sequenced, timed routines that are run through serially—for example, presentation of a scripted math lesson for 10 minutes, followed by the working of a few problems at the board by three or four children, then 20 minutes of individual work in the exercise book, and then a 5-minute oral quiz to test levels of understanding and mastery. Rather, the teacher has a general goal for the time period, usually expressed less in terms of what is to be achieved by pupils than in terms of activities that can be undertaken in the time allotted. The core materials for these activity formats are prepared and ready at hand, and the teacher begins the sequence as planned. As soon as he or she sees, however, that several children are squirming in their seats or wrinkling their brows in apparent confusion or that the two problems worked at the board entail faulty algorithms, the remainder of the sequence is cast aside, and our teacher begins improvising with a series of ad hoc responses to the new situation. The teacher puts up, say, two problems that test mastery of the operations prerequisite to those introduced earlier, works them through with the class, and then digs some remedial exercises out of the closet and has the whole class work on them as he or she circulates among the pupils. As the teacher monitors work on the exercises, he or she decides to divide the class into four groups and invents a slightly more difficult problem for each group. Each pupil in the group is to see the solution independently and then compare and justify his or her solution with the others. While this is going on, the teacher gets out the materials for the work on reading comprehension to follow on, if a secondary school teacher, moves quickly from group to group to make certain that the task is accomplished before the period is over.

In this example, the unraveling of the math lesson is a continuously reinvented process, with dozens of decision points at which the teacher moves on to the next activity format, which has only just emerged as a likely follow-on exercise, or switches to another exercise as a result of the
drift of pupils' oral responses, the level of pupils' task engagement, the time remaining until recess or the end of the period, or, more likely, all these factors. The continuous readjustment results from what Lévi-Strauss (1962) has called, felicitously, "engaging in a dialogue with the situation" as that situation unfolds. To tinker well here seems to depend on how quickly and accurately the teacher can read the situation—can call up from a store of similar situations a range of likely responses, can choose a procedure quickly, can find or cobble together the materials needed to engage the pupils, and can move the class smoothly into the new task environment—all without breaking the flow of the lesson.

Before moving on, a few remarks are warranted. The first is that the teacher in our illustration could have gone ahead with the original plan: the lesson, blackboard work, individual exercises, and an oral quiz. Many—possibly most—teachers do just that, especially at the secondary level, with its tight 45- to 50-minute lesson cycle. The material would then have been "covered," and the math program would have "advanced." In terms of pupils' levels of representation and mastery of the material, however, it's a fair bet that the initial format would have been inappropriate for 45 percent to 60 percent of the class and that these pupils' difficulties would have increased when slightly more demanding material was presented the following day or week. In other words, the kind of interactive, responsive, and dynamic mode of instructional management implicit in the tinkerer model is likely to be more motivating and meaningful to a greater number of pupils and, in terms of their representation of or proficiency with the task, more efficient than a highly scripted instructional sequence. Apart from the obviousness of this point, some modest empirical work lends support to it (Yinger, 1986).

The second remark is that unlike the procedures used in more stable or predictable fields of application, such as engineering, medicine, or architecture, the tinkerer model assumes that there is no set of nomothetic knowledge—theories, concepts, and principles—that is valid across all instructional situations from which a specific sequence of actions can be derived to resolve the instructional problem at hand. In other words, to return to our illustration, there is no prescriptive theory of mathematics learning that could have dictated in advance the appropriate activity or response formats for this set of pupils at this point in their progression. In fact, it is precisely the craftsmanship or artistry of the tinkerer in this situation that compensates for the inadequacies in the knowledge base (Gage, 1985). Teaching, like other highly complex, unstable, and furious interactive tasks, poses what Churchill (1971) calls "wicked problems," problems whose solutions are not inherent in the problem space itself and thus which need to be progressively transformed into simpler problems for which the solutions at hand are likely to be appropriate.