

How To Keep Thinking Skills from Going the Way of All Frills

Success in teaching thinking skills results when content objectives are *contingent* on activities that also promote thinking and when thinking skills *permeate* the entire curriculum.

CARL BEREITER

Perhaps no one will be so indiscriminate as to call thinking skills instruction a frill, but it is often treated as one, just one more burden on an already heavily loaded curriculum, one more competitor with the things teachers are held accountable for. Consequently, no matter how readily teachers agree that more should be done to promote thinking skills, it is reasonable to predict that thinking skills instruction will tend to be passed over by more standard activities directed toward the three R's and subject-matter instruction.

Carl Bereiter is a Professor in the Centre for Applied Cognitive Science, Ontario Institute for Studies in Education, Toronto, Ontario.

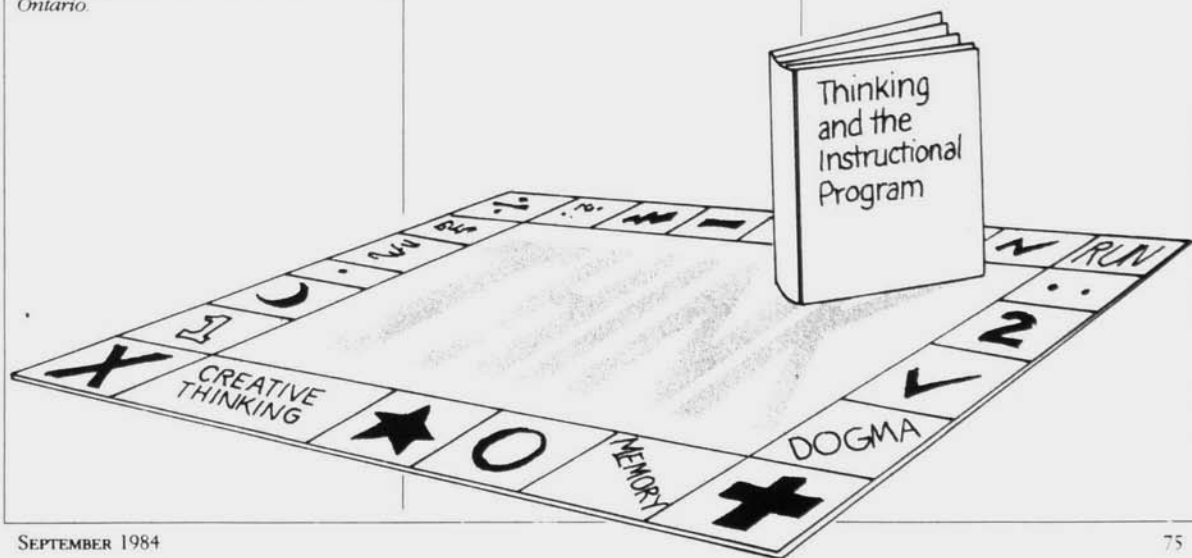
This article's message is fairly simple, but it is distilled from 15 occasionally frustrating years of school-based experiments on promoting thinking skills. As methods of teaching thinking skills, two approaches do not usually succeed: treating thinking skills (1) as enrichment or (2) as subject matter. Conversely, there are two main ways to guard against failure.

1. Make thinking skills activities an integral part of other, already-accepted instructional objectives (a *contingency strategy*).

2. Permeate the instructional program so thoroughly with thinking skills activities that they cannot be isolated and reduced to verbalized subject matter (a *permeation strategy*).

If It's Fun, This Must Be Friday

Games are a natural medium for teaching thinking skills. They provide motivation, feedback, and a structure within which it is easy to adjust the level and type of intellectual challenge. But because of their inevitable association with the lighter side of life, they are also especially susceptible to being regarded as nonessential. This fact was brought home to me during a three-year field test of the effects of thinking games. We had developed and tried out on a short-term basis about 60 games designed to foster various kinds of thinking skills.¹ For the field test, 12 teachers volunteered



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to devote a minimum of two hours a week to these thinking games. In follow-up questioning they expressed enthusiasm for the games and pointed to a variety of cognitive benefits they claimed to have seen in their students. Yet by their own reports they had devoted an average of only 45 minutes per week to the games, and spot checks by our research staff suggested that 45 minutes was more the maximum than the average amount of time spent.

The fact was that thinking games were relegated to Friday afternoon doldrums and occasional odd moments when some group of children needed to be kept independently occupied. Not a bad use of the thinking games, certainly, but not a use that could be expected to produce much effect on developing thinking skills—and the test results showed this. There was not a trace of difference in reasoning and creativity test scores between classes that had used the games and those that had not. (On the other hand, questionnaires revealed that control group teachers had also made use of spare-time games and thinking activities.)

The Contingency Strategy Applied to Mathematical Games

The group I have been working with over the past 12 years in developing an elementary mathematics curriculum² decided at the outset that mathematical thinking activities should be part of the daily activities of all students from

kindergarten up. Games represented only one of several channels for bringing thinking skills into the mathematics program, but a very important one.

To ensure that games were actually used, we determined that they should have a dual function. They should involve some kind of mathematical reasoning or problem solving, but at the same time they should play a significant role in reinforcing specific mathematical concepts or skills. We wanted to be able to insist legitimately that if the games were omitted, students would be missing out not only on thinking skill activities but also on important work related to the more conventional mathematical objectives, such as computational skills.

A typical example of such a game is “Make a Problem” in which players roll dice to generate the digits to fill in, for instance, a multidigit addition problem. The object is to produce the problem that yields the largest sum. The game provides addition practice, obviously. However, since winning depends on getting the largest digits into the farthest-left columns, it is also a vehicle for promoting familiarity with the base 10 structure of our number system. Therefore, it is possible in good faith to tell teachers that if they skip the game, they will be short-changing students on a crucial mathematical concept. Students who play the game not only exercise their base 10 and computational skills but also play a game of strategy involving considerations such as the probability of rolling a number higher or lower than the

digit they are about to put in place. This example illustrates the essence of the *contingency strategy*—making already recognized instructional objectives contingent on activities that also promote thinking skills.

Experience with several hundred field test classes indicated that games of this dual-purpose kind were indeed treated differently. Teachers who approved of the mathematics games used them regularly as part of their instructional programs. A few teachers, usually in the upper grades, didn't think games were proper vehicles for instruction. But that is a difference of opinion one can respect and accept.

Teaching Thinking vs. Teaching About Thinking

An example from one of my colleagues illustrates another important point about the teaching of thinking skills. A teacher of educational psychology gave her students a long difficult article and told them they had ten minutes in which to learn as much from it as possible. Almost without exception they started with the first sentence and labored along as best they could until their time was up. Later, they all admitted they knew rules for handling that kind of task—skim for main ideas, consult section headings, and so forth. Somewhere along the line, all had apparently been taught high-level reading strategies. More precisely, they had been taught principles that, if translated into procedures, would constitute high-level reading strategies.

I am not suggesting that there is anything wrong with teaching verbalized principles of thinking. Such declarative knowledge can be an important first stage in acquiring cognitive skills.³ But this step needs to be followed by a proceduralization stage in which that knowledge becomes manifested in the actual behavior of the learners. This is not a simple matter of reinforcing principles through practice. It means actually *constructing* the cognitive strategy that is referred to by the verbal rules.

The trouble is that, whereas cognitive strategies are hard to teach direct-

ly and take a long time to learn, verbalized rules are easily transferred to a textbook and can be thoroughly taught in a few lessons. Thus, we find textbooks purporting to teach mathematical problem-solving strategies and reading comprehension strategies when all they do is list a few rules, provide some examples, and then offer a few exercises in which students are urged to apply the rules (after having been carefully told which rules to apply where). This illustration shows what I mean by reducing thinking skills to subject matter. I fear we are going to see a lot more of that.

The Permeation Strategy

Condensing the teaching of cognitive strategies into a few pages and covering it in a week fits the conventions of instructional programming and the desire of textbook publishers to make their goods visible at a glance. Overcoming such tendencies is not easy. The permeation strategy probably cannot overcome this tendency but can possibly provide a counterforce. The essence of the permeation strategy is to apply a set of principles for promoting thinking skills in *every possible aspect* of the instructional program. Thus, thinking skills can never be wholly reduced to verbalized subject matter. For example:

Don't let decisions that ought to require thought become automatic.

This principle has always been with us in developing the elementary mathematics program referred to previously. Don't group together word problems that all require the same operation, lest students stop thinking about what operation to use. Don't give consistent verbal clues (such as "more" always means "add"), lest students stop paying attention to what the problem means. Include problems that don't require computation at all (such as "If one greyhound can jump over a ditch two meters wide, about how wide a ditch can six greyhounds jump across?"). Include these with ordinary computational problems. Don't put them in a special section that warns students what to watch for.⁴

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Both the contingency strategy and the permeation strategy spring from the same basic idea, which is that the promotion of thinking skills should be deeply embedded in the whole fabric of an instructional program. This means encouraging and challenging thinking. But it means something deeper as well. It means that some reasonably adequate cognitive theory ought to underlie all instruction. We are not likely to see that happening in published instructional materials until those responsible for selecting them start sharpening their demands. The question to ask textbook suppliers is not "Where do you teach such-and-such cognitive skills?" Instead, open *any* page and say, "How is your approach to teaching thinking represented on this page?"⁵

⁴Valerie Anderson and Carl Bereiter, *Thinking Games 1*; Carl Bereiter and Valerie Anderson, *Thinking Games 2* (Belmont, Calif.: Pitman Learning, 1980).

⁵Stephen S. Willoughby, Carl Bereiter, Peter Hilton, and Joseph H. Rubenstein, *Real Math* (La Salle, Ill.: Open Court, 1981).

⁶John R. Anderson, "Acquisition of Cognitive Skills," *Psychological Review* 89 (1982): 369-406. For an example of the use of explicit principles accompanied by aids in translating these principles into cognitive behavior, see Marlene Scardamalia, Carl Bereiter, and Rosanne Steinbach, "Teachability of Reflective Processes in Written Composition," *Cognitive Science*, 8, 2 (1984): 173-190.

⁷An even more penetrating question, of course, is "What evidence is there that your program does improve thinking skills?" In the case of *Real Math*, we were heartened by an independent study conducted by Robert P. Dilworth and Leonard M. Warren, "An Independent Investigation of Real Math: The Field Testing and Learner-Verification Studies" (La Salle, Ill.: Open Court, 1980). It showed through a time-lag study that mathematical problem solving was one of the skills that did improve significantly when our material was introduced. In many cases, however, it will be difficult to document effects; in those cases the best that can be demanded is a coherent approach to teaching thinking that goes beyond enrichment activities, drill, and the teaching of rules.

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