John D. Bransford, M.Susan Burns, Victor R. Delclos, and Nancy J. Vye

Teaching Thinking: Evaluating Evaluations and Broadening the Data Base

Sternberg and Bhana's concerns about effects of published thinking skills programs are valid, but other research clearly supports a problem-solving approach to teaching regular academic content.

Sternberg and Bhana's article is timely and important. One of the goals of the thinking skills programs they review is to help students learn to evaluate ideas by considering arguments and data. As educators, we need to follow our own advice and undertake a rigorous analysis of approaches to teaching thinking. Even a cursory glance at the history of education illustrates the dangers of enthusiastic acceptance of untested ideas that later turn out to be snake oil (e.g., see Bradley 1983, Brown and Campione in press, and Mann 1979).

The analyses conducted by Sternberg and Bhana are sobering. Based on our knowledge of the literature, we agree that, for the programs they reviewed plus many others (e.g., see Segal et al. 1985), results are mixed at best.

However, anyone who has tried to evaluate an educational program knows that it is not easy. Developers of the programs discussed by Sternberg and Bhana—to their credit—have attempted such a task either by conducting their own evaluations or getting others to do so. In either case, both the collection and interpretation of evaluation data are difficult tasks. Some reasons for these difficulties are discussed below. For example, Sternberg and Bhana conclude that the programs they reviewed are probably beneficial despite the fact that the data are often weak. It is useful to consider some reasons why evaluation data may be poor even though a program is quite good.

One major reason involves issues of implementation. Teachers may not have been trained adequately, insufficient time may have been devoted to the instruction during the school year, the children may have been too young or too old for the program, and so on.

One way to check for the effectiveness of implementation is to assess students' mastery of the components of a program. In Instrumental Enrichment, for example, one can assess students' ability to complete pages from the Organization of Dots and from the other instruments; in Philosophy for Children, one can assess students' ability to solve simple syllogisms. A surprising number of studies attempt to assess transfer to new areas without first checking to see whether students learned to solve the kinds of problems taught in particular programs. For example, a number of investigators have questioned Papert's (1980) claim that learning to program computers in Logo will develop general thinking skills, yet they have failed to measure students' learning of Logo in the first place. Existing data suggest that many ways of teaching Logo do not produce mastery. We should not expect transfer where no basis for it has been acquired (e.g., see Kinzer et al. 1985 and Littlefield et al. 1986).

Checks on the effectiveness of implementation may need to go beyond an assessment of students' abilities to solve the specific problems. It may be necessary to assess their ability to relate concepts and principles to new areas of knowledge. For example, Sternberg and Bhana note that an important component of Instrumental Enrichment involves "bridging"—applying concepts taught through program exercises to other home and school contexts. Without an emphasis on bridging, there is less likelihood of transfer (e.g., Bransford et al. 1985). Many studies do not specify the amount of time teachers devote to bridging exercises; hence it is difficult to know if the program was implemented appropriately. Similarly, many experimental reports do not specify whether the same teacher taught both the thinking skills program and other content areas. Elsewhere we discuss data suggesting that teachers who explicitly help students apply information from a thinking skills program to areas such as reading and mathematics are more likely to see achievement gains in the latter areas (Bransford et al. 1985).

A program's effectiveness also may be strongly affected by the spacing of lessons. For example, two different studies may both include the same number of hours of instruction, yet one may involve classes that meet one hour each day for several months while the other may involve one hour per week for a school year. With too many days between lessons, students may have to spend most of their time relearning information from the previous week.

In addition to implementation problems, the evaluation measures themselves may be insensitive to the types of changes the program helps produce.

Transfer is particularly difficult to measure in thinking programs. Some evaluators use transfer tests that are so different from the skills and procedures taught in a particular program that it seems unreasonable to use them (see Littlefield et al. 1986). On the other hand, if the tests are similar to exercises in a program, one may very well be accused of "teaching to the test." These difficulties are often not encountered in other types of evaluation.

For example, a research team at Vanderbilt recently completed an evaluation of a videodisc-based program for teaching fractions (Hasselbring et al. 1986). As measured by increases in students' ability to solve fraction problems, the program was successful. The tests were composed of new fraction problems, but no one discounted the results because of "teaching to the test." In a like fashion, if one used a similar approach to assess the benefits of thinking skills programs, one would measure the performance of students on "mastery problems"—that is, problems that are novel yet similar to those taught in the program. When mastery problems are used, the evidence we have seen shows that students in the thinking skills program perform much better than students who have not received the program (e.g., Arbitman-Smith et al. 1985).

We are not arguing here that mastery tests are the best way to measure the effects of thinking programs; we advocate the use of more general transfer measures. However, we want to emphasize that the requirements for demonstrating transfer in a thinking program are generally more stringent than are those used for more traditional programs that develop specific concepts and skills.

Other Research Relevant to the Teaching of Thinking

The difficulties inherent in conducting and interpreting global evaluations of programs present a dilemma. We need more complete and carefully controlled evaluations, but conducting them is expensive and time consuming. Another complementary approach—one that Sternberg and Bhana emphasize—is to conduct theory-based studies that are more focused than typical global evaluation studies. We elaborate on their arguments by reviewing some studies that are relevant to the goal of teaching thinking. These studies involve the use of a metacognitive or problem-solving approach to the teaching of important concepts and skills.

The studies we shall review all involve attempts to help students reach important goals such as comprehending written materials, thinking mathematically, and solving complex problems. The design of these studies is to compare the effects of teaching from a metacognitive or problem-solving perspective with the effects of similar instruction that does not emphasize problem solving. Many researchers note that instruction often involves "blind" training in which students are not helped to focus on general processes or strategies nor to understand how new concepts and strategies can function as tools for problem solving (e.g., Brown et al. 1981). Blind instruction does not usually lead to transfer to new tasks.

Consider a case discussed by Hasselbring, Goin, and Bransford (1985), which illustrates how specific lessons can be transformed into lessons involving problem solving. These researchers worked with math-delayed 5th and 6th graders on arcade-like software designed to give them practice at basic addition problems such as 7 + 8. The arcade program awarded points for speed and accuracy. All the students wanted to increase their scores. However, most had little idea of how to "debug" their current approaches to the game. The vast majority paid little attention to the fact that they often counted on their fingers and could not significantly increase their speed until they moved from productive to reproductive strategies (Greeno 1978). Furthermore, students knew the answers to only a subset of the problems. Nevertheless, they did not spontaneously attempt to identify the set of problems that would be most beneficial for them to practice at home. With specific guidance from the teacher, the students were prompted to view the arcade game as a problem-solving situation, and they were helped to debug their current approaches to the problem of increasing their scores. Without that instruction, it is doubtful that the students would have taken a higher-order thinking approach to the development of lower-order skills.

An excellent series of studies conducted by Palincsar and Brown (1983) illustrates the power of a metacognitive approach to teaching reading comprehension. Using a procedure called reciprocal teaching, these investigators helped students learn to monitor their own comprehension processes, in part by acting as teachers who formulated relevant questions for their peers. Data indicate that the procedure was highly successful. Students in the reciprocal teaching groups were much better able to comprehend new passages and to answer questions about them than were students in the control groups. Since the ability to comprehend new information is an important part of thinking and problem solving, these data support the notion that these aspects of thinking can be taught.

Research in mathematics provides further support for a problem-solving approach to teaching. Several researchers argue that typical instruction encourages the use of blind procedures that often result in systematic errors in children's strategies. Given multidigit subtraction problems involving borrowing, for example, researchers have uncovered systematic bugs in children's procedures and have attributed these to a lack of knowledge about the purpose or meaning of these operations (Brown and Burton 1978, Resnick in press). Other researchers have focused on students' approaches to solving word problems and have studied the effects of instruction that emphasizes systematic approaches to their solutions. Research by Shoenfeld (1985) provides particularly informative data about the benefits of such an approach. Wales and his colleagues use a similar approach to instruction in engineering at the college level. They provide several sources of data indicating that the program has beneficial effects (Wales and Stager 1977).

Research on writing also supports the importance of helping students view writing from the perspective of problem solving. For example, Bereiter and Scardamalia (1982) have been able to improve the quality of students' compositions by helping them learn to monitor their approaches to writing tasks. This type of instruction helps students focus on their goals, obstacles to reaching these goals, and strategies for overcoming the obstacles. The instruction is quite different from the writing exercises typically offered in schools.

A final set of data illustrating the importance of a problem-solving approach to teaching comes from the literature on dynamic assessment. In dynamic assessment, the goal is to place students in a learning situation and assess their abilities to profit from instruction (e.g., Brown et al. 1983, Feuerstein et al. 1980, Lidz in press). This is different from static assessments such as IQ and achievement tests—tests for which no instruction is provided. Not surprisingly, the dynamic assessment research suggests that students' abilities to profit from instruction depend on the quality of teaching provided during the assessment. In general, data indicate that, as the instruction focuses on helping students become problem solvers who learn to recognize and monitor their approaches to particular tasks, transfer is more likely to occur (e.g., Bransford, Delclos, Vye, Burns, and Hasselbring in press).

Our goal has been to elaborate on the important article written by Sternberg and Bhana. They argue for a rigorous approach to the evaluation of attempts to teach thinking, and we could not agree more. Perhaps the most important next step is to develop a powerful theory that provides a clear, comprehensible guide to the infusion of thinking instruction into any domain of inquiry (Bereiter 1984). With this approach, we can immerse students in a thoughtful instructional world.□

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John Bransford is professor of psychology in education and director, Learning Technology Center, Box 45, Peabody College, Vanderbilt University, Nashville, TN 37203. **M. Susan Burns** and **Victor R. Delclos** are assistant professors of education, Department of Education, Tulane University, New Orleans, LA 70118. **Nancy J. Vye** is assistant professor of psychology, Department of Psychology, University of Western Ontario, Social Science Centre, London, Ontario N6A 5C2.