The Case for Explicit, Teacher-led, Cognitive Strategy Instruction [1]

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Few people would take a medicine if there were nothing to back up the pharmaceutical company's claims. We should demand no less of our schools.
Al Shanker's last column. February 23, 1997.

The cognitive strategy research of 1975 to 1990 has produced an impressive series of results, and, even more important, has produced a technology for continuing this line of research and practice.

Limits To the Teacher Effects Research

To understand the importance of cognitive strategy research, let us begin by looking at one inadequacy of the earlier work, the teacher effects research.

The teacher effects research, which flourished from 1957 to 1980, was an important accomplishment in American education. It was, as we see in hindsight, a form of expert/novice research. That is, we identified expert teachers -- those teachers whose students had made the greatest gain on an achievement test, and novice teachers -- those teachers whose students had made the least gain on the same achievement test. We then compared the instructional procedures used by these two types of teachers. We did this by observing and recording the instructional procedures these teachers used while teaching. We would say, today, that -- as in other expert/novice research -- we observed the experts and the novices while they were engaged in solving problems. The results of these studies were summarized by Brophy & Good (1986) and by Rosenshine & Stevens (1986)

Although the teacher effects results was and remains a powerful instructional model, there were at least two problems with this research. The first was a political problem because the pattern of instruction used by the expert teachers was a teacher-led model. It was a direct instruction model, a model which, today, is not politically correct or romantically correct. So much for honoring the wisdom of teachers.

The second problem was limits of the results. Although the teacher effects research identified important general instructional procedures, such as the use of frequent review, teaching in small steps, and checking for student understanding, this model was not power-

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ful enough to answer instructional questions such as how does one teach reading comprehension or how does one teach writing.

Put another way, the concepts from the teacher effects research were very useful when we could break a task into series of explicit steps, guide student practice on those steps, and provide support, feedback, and practice to enable students to respond at a high level of success. But the concepts from the teacher effects research seemed less useful for teaching tasks that could not be broken into explicit steps, tasks such a reading comprehension, writing, mathematical and scientific problem solving.

The Cognitive Strategies Research

For teaching these "higher" tasks, a new line of research began in the 1970's and flourished in the 1980's: cognitive strategy instruction. The apparent first use of the term cognitive strategies was in 1976 when Robert Gagne and Ellen Weinstein each began to use the term, Gagne in reference to problem solving (Gagne, 1977, p. 143) and Weinstein in reference to study strategies.

During the 1970's and 1980's there was an enormous period of research on developing and testing cognitive strategies in a wide range of areas: reading comprehension, mathematical problem solving, writing, science problem solving, and study skills. The results of this research are ably summarized in a number of volumes (see Gall et al., 1990; Hyerle, 1996; Lapp, Flood, & Farnan, 1989; Pressley, Woloshyn et al., 1995; Scheid, 1993; and Wood, Woloshyn, & Willoughby, 1995). I consider the cognitive strategy research to be an enormous accomplishment, particularly because this research is primarily based on intervention studies in which student learning has been the outcome measure.

There are two important, related instructional contributions that emerged from this research: the concrete prompts, and the instructional scaffold.

Procedures for Developing Concrete Prompts

In practice, the cognitive strategy approach did not focus on algorithms, on teaching students to use a specific series of steps not on a specific series of steps. Rather, the emphasis was on heuristics, on providing students with guides that support their efforts. A concept map is such a heuristic or guide. The words "who", "what," and "where", words that help students generate questions is such a guide. The Kintsch and van Dijk (1978) procedures for developing a summary are a heuristic. Scardamalia and Bereiter (1985) have called these heuristics "procedural facilitators," and my midwestern students have preferred the shorter term "concrete prompts." (This being social science, there is, of course, an overlap between the terms heuristics and cognitive strategies). These prompts, these guides, that are given to the students to help them develop a specific strategy, are a major component of cognitive strategy instruction.

In practice, these guides have been developed in two ways. Most of the time, these concrete prompts have been *invented* by the developers. The study skill strategies, and the cognitive maps, are inventions. The most famous of the reading comprehension strategies -- teaching students to generate questions by using words such as "who," "what," and "where" -- is an invention.

A second approach to developing these heuristics or concrete prompts is to study and identify the strategies that experts use, and then teach these strategies to the students. Expert strategies have been identified by presenting experts with problems to solve, and asking them to think aloud as they attempted to solve the problems. For example, Kintsch and van Dijk (1978) studied the processes experts were using to summarize text. A number of investigators then taught these cognitive strategies to novices, usually with successful results.

The best example of the use of experts' strategies to develop concrete prompts was the study by Bereiter and Bird (1985). In their study, they presented difficult and ambiguous reading passages to expert readers and then asked the readers to think aloud. Bereiter and Bird then developed a program based on the strategies the experts used, and they taught these strategies to one group of average readers. At the end of the study, the trained readers significantly outperformed the control students on a standardized test in reading. These same guides are currently being used in Val Anderson's (1991) reading program for teen-age problem readers, and her program has obtained similar significant results on standardized tests.

Procedures for Teaching Cognitive Strategies

Once the concrete prompts have been invented or identified, what are the specific instructional procedures one can use to *teach* students to use these heuristics or concrete prompts? The best review on how to teach cognitive strategies was written by Collins Brown and Newman (1989). In that review, they abstracted the procedures used in four major studies and presented their findings on instructional procedures such as modeling, thinking aloud, scaffolding, and coaching. Other summaries of the instructional procedures for teaching cognitive strategies appear in my work with Carla Meister (Rosenshine & Meister, 1994, 1996).

The essence of these instructional procedures is "scaffolding". One does not direct the learner, as one can do when teaching an algorithm, but rather, one *supports* or scaffolds the learner as they develop internal structures. Providing concrete prompts, modeling their use, thinking aloud, and guiding practice are all examples of scaffolding. A summary of the instructional procedures for teaching cognitive strategies that were identified by Collins, Brown, and Newman and by Carla Meister and me is contained in Table 1.

Table 1
Instructional Procedures Used in Cognitive Strategy Instruction

1. Concrete Prompts
- concrete prompts
- provide cue cards
- provide checklists

2. Instructional Procedures
- model using the strategy
- think aloud
- start with simplified material
- complete part of the task for the students
- present material in small steps
- anticipate student errors and difficult areas
- provide models of expert work
- suggest fix-up strategies
- increase student's responsibility

Results With Teaching Cognitive Strategies

How effective has this research been? Meister and I attempted to summarize the results of some of the cognitive strategy studies in reading. We looked at 23 studies where summarization alone was taught, 17 studies where question-generation alone was taught, and 16 reciprocal teaching studies where two or more strategies were taught, which usually included both summarization and question-generation. The results are presented in Table 2. Separate results are given for studies in which a standardized test in reading was used, studies where a short-answer or multiple-choice test was used, and studies where a summarization test was used.

Table 2
Effect sizes for teaching two cognitive strategies in reading comprehension

Cognitive strategy that was taught	Standardized-test	Experimenter-developed test	
		Short-answer test	Summarization test
(1) Summarization only	.03 (2)a	-.08 (6)	.83 (10)
(2) Question- generation only	.35 (7)	.70 (12)	.90 (2)
(3) Studies that taught two or more strategies (Reciprocal teaching)	.20 (10)	.98 (7)	.85 (5
(4) Studies with both a standardized test and an experimenter-developed test	.55 (9)	.85 (4)	.85 (7)
a : Number of studies used to compute median effect size			

Overall, the studies had a median effect size of .82 when experimenter-developed comprehension tests were used. An effect size of .82 means that a student at the 50th percentile of the experimental group would have scored in the 80th percentile of the control group. When standardized tests were used, the median effect size was .32, which means that the average student in the 50th percentile of the experimental group would have scored in the 63rd percentile of the control group.
Alvermann and Moore (1991) summarized the cognitive strategy research for secondary school reading. But it is difficult to compare their results with ours because they did not separate studies in which cognitive strategies were taught from studies in which students were provided with aids such as advanced organizers. However, we should note that she reported significant results in 62 percent of the studies and mixed results (cases where the treatment was significant for one ability level or for one type of outcome measure) in another 12 percent of the studies.

Summing Up

The research using cognitive strategies, from 1970-1990, has produced incredible results, results for which we as a profession can be justly proud.
1. We developed the idea of cognitive strategies for teaching those important educational tasks for which each step cannot be specified.
2. We developed and taught a series of concrete prompts, prompts that served to guide the learners while they developed appropriate internal structures. We developed specific prompts in a number of curriculum areas: reading, writing, mathematics, science, and study skills.
3. Most of these prompts were simply invented by the developers. But we also developed a technology for discovering new prompts. That is, we learned to take the procedures that were developed in the study of experts and novices and use these procedures to study experts in reading and then use the responses of experts to help develop new concrete prompts.
4. We developed and identified a series of instructional procedures that can be used to teach students to use these concrete prompts. These procedures fit the general description of scaffolds and include thinking aloud by the teacher, providing the learner with cue cards and checklists, starting with simplified tasks, and anticipating student errors and difficult areas.
5. We proved the validity of this approach through a series of experimental studies.
These five points represent an enormous accomplishment of which we can be justly proud.

Cognitive Strategy Instruction in Basals

For this paper, Carla Meister and I looked at cognitive strategy instruction in the third grade level of three, current basals reading series: Open Court, Houghton-Mifflin, and MacMillan/McGraw Hill. Despite the statements from some members of last year's panel that they prefer that cognitive strategies be caught rather than taught, -- that is, that direct instruction be replaced by different forms of discovery learning, -- direct cognitive strategy instruction was alive -- and much improved -- in these three basals.

Evidence that cognitive strategy instruction is alive comes from looking at the strategies listed in the lengthy scope and sequence charts that each basal presented. The old favorites are still there. For example, The Houghton-Mifflin basal contained six "independent reading strategies" such as recognizing the main idea as well as seven "higher-level thinking" strategies such as summarizing and determining cause and effect.

But there have also been additions, and improvements. Today, Houghton-Mifflin also teaches students to construct "word webs" when learning vocabulary and to use concept charts for organizing expository material. The MacMillan/McGraw Hill third-grade basal not only contains the usual summarizing, and drawing conclusions, but also has eight "comprehension monitoring (fix-up) strategies" which included asking questions and rereading, as well as a strategy that focuses on teaching students to apply the concept of story elements to a narrative. For Open Court, the scope and sequence charts have also been modified to emphasize the use of these strategies in actual reading. Today, the basal teaches students to "sum up to check your understanding as you read". Question-asking is now "ask questions to check your understanding as you read," and "determine what is unclear." Thus, judging by the current editions of these three basal reading series, a focus on cognitive strategies is alive and improved.

The quality of the cognitive strategy *instruction* in the basals is also much improved compared to 15 years ago. The instructional portion of the Houghton-Mifflin third grade basal is now labeled "instructional support". In the instructional support sections, there was explicit provision for labeling and providing for teacher modeling, thinking aloud by the teacher, checking for understanding, and independent practice and these activities were repeated, for the different strategies, throughout the basal.

We also saw a new emphasis on *application*. In the Houghton-Mifflin basal, after the cognitive strategies of summarization or predicting were taught, the strategies were then applied to the next story. The MacMillan/McGraw Hill basals were consistently focused on applying the strategies to the basal stories. The Open Court series provided each readers with sheets that contained specific prompts in the form of "ask yourself" questions for setting goals, responding to the text, checking understanding, and clarifying unfamiliar words and passages, prompts that are applied to the stories.

In sum, each of these basals is an improvement over the past, and reflects and applies the cognitive strategy research of the past 25 years.

If I had my druthers, I would combine the strategy selection and concrete prompts of the Open Court series with the instruction of the Houghton-Mifflin series and the application of the Open Court and the MacMillan/McGraw Hill basals. But each of these basals represents a thoughtful job.

The Future

1. Should cognitive strategies be taught in school? We have 20 years of highly successful research on the development and teaching cognitive strategies. The three basal series we inspected reflect this research. Cognitive strategies are being taught in schools today, and I believe we should continue to do so.

2. What strategies should be taught, to whom, when?
I believe this decision should be based on the research findings. Those cognitive strategies that have the best support should be taught in schools. Thus, based on the existing research, one would recommend that, in reading, the cognitive strategy of question-generation should be taught. For all expository reading, one would recommend that a study skill strategy that focused on organizing and processing the material should be taught.
The evidence to date has shown that students of all abilities, even high-achieving students, have benefited from being taught these cognitive strategies.
The evidence, to date, based on the studies, supports the teacher-led format used in most of these studies. The evidence does not support teaching the strategy only as the need arises, or only when the "teachable moment" arises, or using an on-the-spot instructional approach.
As an example, the evidence from the reciprocal teaching studies shows that the format that began with teacher-led instruction in cognitive strategies yielded larger effect sizes than the format where the cognitive strategies were taught in the context of practice.

3. How should these strategies be taught?
The cognitive strategy research is very clear in support of explicit, teacher-led instruction in cognitive strategies.

Future instructional research

But even within the teacher-led, cognitive strategy, there remain a good number of interesting instructional questions. These include the following:

Identifying the strategies that experts use. Combining the cognitive strategy research with the study of the processing of experts would appear to be a very powerful idea. Excellent examples include a study in physics by Larkin and Reif in 1976 (!) and the Bereiter and Bird study, where the strategies of experts were first identified and then taught to novices with good success. Val Anderson's program in reading is also built upon the results of the Bereiter and Bird study. I wish we did more study of experts and then attempted to incorporate these findings into cognitive strategy instruction.

Which concrete prompts should be used? Even if one has decided, for example, to teach the cognitive strategy of question-generation, a number of fascinating instructional questions remain. Which, of a number of prompts, does one use? Does one provide the "who," "what," "where", prompts, or Alison King's question stems, or Val Anderson's general questions? In the single study on this topic (King & Rosenshine, 1996) students who were provided with King's prompts did better on the achievement tests than did students who were provided with the "who", "what" prompt.

Similarly, there are a number of different prompts that have been developed for teaching summarization or writing. I believe it is worthwhile to study which prompts are most effective, for which learners, and why.

Which of the scaffolds and instructional procedures are most important for teaching the cognitive strategy? The concept of scaffolds is a major instructional contribution, and the idea can be studied and expanded. Which scaffolds are most useful, and why? Is the guided practice component best placed within the traditional teacher-led setting or within a reciprocal teaching setting? To date, studies using each format yielded the same effect sizes when the cognitive strategy of question-generation was taught.

How do strategies achieve their effects?

Criticisms of cognitive strategy research

Despite the impressive results, cognitive strategy research and findings has been criticized as being out of step with "new conceptions of the learner." This reminds me of the story where the senior professor says "Your idea may be fine in practice, but it will never work in theory". ?
I have a pragmatic, perhaps Midwestern approach to education. I search for what works, and I believe that results count. And I'm reluctant to discard what works unless, in true American fashion, I'm shown something that is bigger, better, and faster.

New Conceptions of the Learner (Again)

When the results of the cognitive strategy research were reported in the 1980's, the results were frequently given the lofty title of "Thinking and Learning Skills" (Segal, Chapman, & Glaser, 1995), and "The How of Learning (Weinstein & Underwood, 1995). It was said that these approaches stemmed from "a new conception of the learner," one in which learners used these strategies to construct their own knowledge.

In the 1990's, there was an even newer conception of the learner, an even newer conception of construction. This new conception that emphasizes learning by discovery and de-emphasizes teacher-led instruction in cognitive strategies. Strategies, we are told, are better caught than taught.

This focus on discovery learning is reminiscent of William Heard Kilpatrick's project method of 1918, of the discovery learning of the 1950's and of the open classrooms of the 1970's. This shows how ardently we practice recycling in education. But although I place glass bottles and newspaper on the curb each Monday, I am reluctant to discard our tremendous accomplishments in cognitive strategy instruction. Results still count, and cognitive strategy research has produced results and a technology for future research and application.

To those who would discard teacher-led cognitive strategy instruction for discovery learning, I have a simple quote from a recent movie, modified slightly to fit education:

"Show me the data!"

"Show -- me -- the data!"

Table 3
Accomplishments of Cognitive Strategy Research

1. Cognitive strategies represent an approach for teaching those important educational tasks for which each step cannot be specified.
2. The major component is the concrete prompt, prompts that served as a heuristic to guide the learners while they developed appropriate internal structures.
3. Most of these prompts were simply invented by the developers. But we also developed a technology for discovering new prompts by studying the processing of experts.
4. We have developed and identified a series of instructional procedures, called scaffolds that can be used to help students learn these cognitive strategies. These scaffolds include thinking aloud by the teacher and providing the learner with cue cards and checklists.
5. These instructional procedures have been used to develop cognitive strategies in reading, writing, mathematics, science, and study skills.
6. We proved the validity of this approach through a series of experimental studies.

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