Comprehension

Part II

Text
Comprehension
Instruction

COMPREHENSION II

Text Comprehension Instruction

Introduction

An examination of the scientific basis for instruction of text comprehension was undertaken by members of the NRP. The Panel decided to focus on instruction of vocabulary, on instruction of comprehension of text, and on the preparation of teachers to teach comprehension of text. This report presents a review of the scientific evidence on the instruction of comprehension of text in normal readers.

Comprehension has come to be viewed as "the essence of reading" (Durkin, 1993). Although comprehension of text is now regarded as essential to reading and learning, comprehension as a process began to receive scientific attention only in the past 30 years. Beginning in the 1970s, researchers such as Markman (1977, 1981) began to study the awareness that readers had of their comprehension processes during reading. The questions were whether readers knew that they did not understand what they were reading in a text and what they did if they recognized that they had an understanding failure. The initial, surprising finding by Markman was that both young and mature readers failed to detect logical and semantic inconsistencies in the text. This discovery of comprehension failure led to the identification and teaching of strategies that readers could learn to enhance their comprehension (see below).

An important development in theories about reading comprehension occurred in the 1970s. Reading comprehension was seen not as a passive, receptive process but as an active one that engaged the reader. Reading came to be seen as intentional thinking during which meaning is constructed through interactions between text and reader (Durkin, 1993). According to this view, meaning resides in the intentional, problem-solving, thinking processes of the reader that occur during an interchange with a text. The content of meaning is influenced by the text and by the reader's prior knowledge that is brought to bear on it (Anderson & Pearson, 1984). Reading comprehension was seen as the construction of the meaning of a written text through a reciprocal interchange of ideas between the reader and the message in a particular text (see, for example, Harris & Hodges, 1995, definition #2, p. 39). The important theoretical idea here was that readers construct meaning representations of the text as they read and that these representations were essential to memory and use of what was read and understood. This view was furthered by the publication of important papers on dynamic models of the comprehension processes such as that by Kintsch and van Dijk (1978). Here, readers were assumed to construct mental representations of what they read. These representations were stored in memory and contained the semantic interpretations of the text made by the reader during reading. The memory representations provided the basis for subsequent use of what was read and understood.

The bulk of instruction of text comprehension research during the past 3 decades has been guided by this cognitive conceptualization of reading. In the cognitive research of the reading process, reading is purposeful and active (Pressley & Afflerbach, 1995). According to this view, a reader reads a text to understand what is read, to construct memory representations of what is understood, and to put this understanding to use. A reader can read a text to learn, to find out information, or to be entertained. These various purposes of understanding require that the reader use knowledge of the world, including language and print. This knowledge enables the reader to make meaning of the text, to form memory representations of these meanings, and to use them to communicate with others information about what was read.

Although instruction on text comprehension has been a major research topic for more than 20 years, the explicit teaching of text comprehension before the 1970s was done largely in content areas and not in the context of formal reading instruction (Durkin, 1979). The idea behind explicit instruction of text comprehension is that comprehension can be improved by teaching students to use specific cognitive strategies or to reason

strategically when they encounter barriers to comprehension when reading. The goal of such training was the achievement of competent and self-regulated reading.

Readers normally acquire strategies for active comprehension informally. Comprehension strategies are specific procedures that guide students to become aware of how well they are comprehending as they attempt to read and write. Explicit or formal instruction on these strategies is believed to lead to improvement in text understanding and information use. Instruction in comprehension strategies is carried out by a classroom teacher who demonstrates, models, or guides the reader on their acquisition and use. When these procedures have been acquired, the reader becomes independent of the teacher. Using them, the reader can effectively interact with the text without assistance. Readers who are not explicitly taught these procedures are unlikely to learn, develop, or use them spontaneously.

The past 30 years of the scientific study of instruction of text comprehension reveal a distinct trend. The initial investigations focused on the training of particular individual strategies such as comprehension monitoring or identifying main ideas. Here the question was whether readers could learn to use an individual strategy. Then, the focus was on whether particular strategies could be learned and whether they could facilitate comprehension. This was an important advance because it validated the teaching of text comprehension strategies. Next, researchers began to study whether the teaching of combinations of different strategies lead to their acquisition and improvement of text comprehension. The success of these "multiple" strategy teaching methods led to study of the preparation of teachers to teach strategies in natural classroom contexts. This historical development from the instruction of individual strategies to the preparation of teachers to implement them in interaction with readers in the classroom is an important contribution of the scientific approach to the study of reading instruction. The Panel's review covers this history of instruction of text comprehension.

Cognitive Strategies for Improving Reading Comprehension

Comprehension strategies are procedures that guide students as they attempt to read and write. For example, a reader may be taught to generate questions about the text as it is read. These questions are of the why, what, how, when, or where variety; and by generating and trying to answer them, the reader processes the text more actively. The value of cognitive strategies in comprehension instruction is, first, their usefulness in the development of instructional procedures, and second, the learning of these procedures by students as an aid in their reading and learning, independent of the teacher.

Instruction of strategies for comprehending during reading is a way for teachers to break though students' passivity and involve them in their own learning (Mier, 1984). Typically, instruction of cognitive strategies employed during reading consists of:

1. The development of an awareness and understanding of the reader's own cognitive processes that are amenable to instruction and learning
2. A teacher guiding the reader or modeling for the reader the actions that the reader can take to enhance the comprehension processes used during reading
3. The reader practicing those strategies with the teacher assisting until the reader achieves a gradual internalization and independent mastery of those processes (Palinscar & Brown, 1984; Paris & Oka, 1986; Pressley et al., 1994).

The general finding is that when readers are given cognitive strategy instruction, they make significant gains on measures of reading comprehension over students trained with conventional instruction procedures (Pressley et al., 1989; Rosenshine & Meister, 1994; Rosenshine, Meister, & Chapman, 1996).

From a historical perspective, instruction in how to comprehend is not new. Benjamin Franklin invented a "weighted characteristics test" used in a current instruction curriculum for readers to apply for making decisions about ideas in texts while reading (Block, 1993). E. L. Thorndike claimed back in 1917 that "reading is reasoning." Despite Thorndike's arguments,

however, beginning readers were seldom taught cognitive strategies that could assist them in reading. Durkin's (1979) highly cited observational studies of reading instruction in grade 4 showed that teachers, in fact, spent little time on comprehension instruction. Only 20 minutes of comprehension instruction was observed in 4,469 minutes of reading instruction. This lack was echoed by Duffy, Lanier, and Roehler (1980). They described teachers as spending time in assigning activities, supervising and monitoring students as to being on task, directing recitation sessions as a way of assessing what the students were doing, and providing corrective feedback when the students erred. The teachers did not teach or show the students skills, strategies, or processes that they could use in reading to comprehend what they read and to be successful in learning information in the text.

Research on instruction of comprehension strategies that could help students improve their reading comprehension began in the late 1970s and has thrived since. According to Rosenshine, Meister, and Chapman (1996), the earliest uses of the term "comprehension monitoring" is found in Markman (1978, 1979), Gagne (1977), and Weinstein (1978). Researchers and educators have long been interested in what we think about thinking, in how our knowledge develops, and in how what we know about how our own thought processes affect reading comprehension. The focus on what we know about cognition has led to the development of practical strategies for improving students' comprehension. The cumulative result of nearly 3 decades of research is that "there is ample extant research supporting the efficacy of cognitive strategy training during reading as a means to enhance students' comprehension" (Baumann, 1992, p. 162).

Methodology

Database

In order to conduct a scientific review of the research on comprehension instruction during the past 2 decades, the Panel located studies since 1980 by searching the PsycINFO and ERIC databases electronically. The Panel used the terms comprehension, strategy, and instruction. From this search, the Panel identified 453 studies on comprehension. In addition, the Panel added other studies that were from the 1970s or otherwise not revealed in the search. In this regard, reviews or studies on strategy instruction by Duffy and Roehler (1989); Lysynchuk, Pressley, d'Ailly, Smith, and Cake (1989); Pressley, Johnson, Symons, McGoldrick, and Kurita (1989); Pressley (1998); Rosenshine and Meister (1994); and Rosenshine, Meister, and Chapman (1996) proved to be very helpful. As a result, an additional 28 studies not found initially in the electronic search were added to the Panel's review.

Analysis

In order to be included in the NRP's scientific review of the research literature on instruction of text comprehension, a study had to be:

1. Relevant to instruction of reading or comprehension among normal readers. This criterion, in particular, excluded studies on comprehension instruction in reasoning and mathematics problem solving (Schoenfeld, 1985), physics (Larkin & Reif, 1976), and writing (Englert & Raphael, 1989; Scardamalia & Bereiter, 1985).
2. Published in a scientific journal. A few exceptions are dissertations and conference proceedings that were reviewed in two meta-analyses by Rosenshine and his colleagues (Rosenshine & Meister, 1994; Rosenshine, Meister, & Chapman, 1996).
3. Have an experiment that involved at least one treatment and an appropriate control group or have one or more quasi-experimental variables with variations that served as comparisons between treatments. The latter was rare.
4. In so far as could be determined, have the participants or classrooms randomly assigned to the treatment and control groups or matched on initial measures of reading comprehension. This criterion was relaxed in a number of studies where random assignment of classrooms was not carried out.

The application of these criteria reduced the number of studies to be reviewed from 481 to 205. The Panel then coded and entered the coded contents of these studies into a database to identify the types of comprehension instruction that were reported as effective. Because the studies numbered 205, the Panel first analyzed the abstracts of the studies, coding the kind of instruction, experimental treatments and controls (independent

variables), grade and reading level of readers, instructor (teacher or experimenter), assessments (dependent variables), and kind of text. The Panel then classified and grouped studies based upon the kinds of instruction used. The Panel identified 16 distinct categories of instruction. Table 1, on the following page, summarizes the 16 categories of a total of 203 studies that met the NRP criteria for inclusion as scientific studies on comprehension instruction. It shows the type of instruction used, the number of studies using that kind of instruction, a brief rationale as to why instruction was used, and generally whether and how it was effective.

Each category of studies is summarized in Appendix A. The summaries define and describe the rationale for each kind of instructional strategy, the procedures used, and how the instruction is assessed by the researchers. The Panel then evaluated the category of instruction, based on reported results.

In Appendix B, a table summarizes the 16 categories of instruction, describing the effects claimed by the researchers, the grade levels that were studied, and how the method might be taught in a classroom setting.

In order to draw scientific conclusions about a finding, one needs evidence that an experimental effect is reliable, robust, replicable, and general. Reliability of an effect is decided by differences that statistically favor a treatment. Robustness of an effect is determined by the magnitude of effects over replications. Replication is determined by independent validation of significant treatment effects. Generality is determined by the transfer measures. In this review, experimenter tasks reflect near transfer and standardized tests reflect far transfer. The NRP evaluated how well each strategy met these criteria. The main criteria that the NRP used are reliability, replication, and generality. Robustness was not determined in most cases because effect sizes could not be calculated for almost all of the studies. Effect size data, however, were available from two meta-analyses by Rosenshine and his colleagues (Rosenshine & Meister, 1994; Rosenshine et al., 1996).

Consistency With the Methodology of the National Reading Panel

The methods of the NRP were followed in the conduct of the literature searches and the examination and coding of the articles obtained. A formal meta-analysis was not possible because even the studies identified in the same instructional category used widely varying sets of methodologies and implementations. Therefore, the Panel found few research studies that met all the NRP criteria; however, to the extent possible, NRP criteria were employed in the analyses. An examination of the quality of the research studies appears in the Discussion section of this report. NRP criteria for Evaluating Existing Reviews of Research were used in the analyses of the two Rosenshine and colleagues meta-analyses.

Results

Of the 16 categories of instruction, 7 appear to have a firm scientific basis for concluding that they improve comprehension in normal readers. The seven individual strategies that appear to be effective and most promising for classroom instruction are (in alphabetical order) comprehension monitoring, cooperative learning, graphic and semantic organizers including story maps, question answering, question generation, and summarization. In addition, many of these strategies have also been effectively used in the category "multiple strategy," where readers and teachers interact over texts.

Mental Imagery and Mnemonic (Keyword) Strategies have reliable effects on improving memory for text. These procedures may be useful when teachers wish to use an alternative way of having the reader try to understand and represent text. These procedures are useful for recall of individual sentences or paragraphs.

Curriculum-Plus-Strategies, Psycholinguistic, and Listening Actively studies were so few that an assessment of the scientific merit of a particular treatment could not be made. The use of instructional procedures that activate prior knowledge was found to be quite varied. The activation of prior knowledge may be obtained through other means such as question elaboration, question generation, or question answering as well as other forms of content area exposure such as teacher lectures, films, and discussion before reading.

Two categories on which there were few studies have, in the view of the NRP, considerable promise for future study. Only four studies were found on the Preparation of Teachers on comprehension instruction strategies. These studies are important because they represent a culmination in the evolution of text comprehension

TABLE 1
CATEGORIES OF COMPREHENSION INSTRUCTION

TYPE OF INSTRUCTION	# OF STUDIES	WHY INSTRUCT?	HOW EFFECTIVE?
Comprehension Monitoring	22	Readers do not show comprehension strategy awareness.	Readers learn to monitor how well they comprehend.
Cooperative Learning	10	Readers need to learn to work in groups, listen and understand their peers as they read, and help one another use strategies that promote effective reading comprehension.	Readers learn to focus and discuss reading materials. Readers learn reading comprehension strategies and do better on comprehension tests. Teachers provide cognitive structure.
Curriculum	8	Strategies should be integrated into the normal curriculum.	Readers improve reading ability and academic achievement.
Graphic Organizer	11	Readers do not use external organization aids that can benefit their understanding.	Readers improve memory and comprehension for text.
Listening Actively	4	Readers do not listen effectively.	Readers improve memory and comprehension for text.
Mental Imagery	7	Readers do not use imagery.	Readers improve memory and comprehension for text.
Mnemonic	2	Pictorial aids are not usually available; and these, plus keywords, help readers learn and organize information.	Readers improve memory and comprehension for text.
Multiple Strategies	38	Readers need to learn to coordinate several processes in order to construct meaning from texts.	Readers improve reading ability and academic achievement.
Prior Knowledge	14	Readers may not have relevant knowledge during reading.	Readers improve memory and comprehension for text.
Psycholinguistic	1	Reader may lack relevant knowledge about language.	Readers learn to identify antecedents of pronouns.

TABLE 1
CATEGORIES OF COMPREHENSION INSTRUCTION (continued)

TYPE OF INSTRUCTION	# OF STUDIES	WHY INSTRUCT?	HOW EFFECTIVE?
Question Answering	17	Readers do not know how to answer questions, nor do they know how to make inferences.	Readers improve answering questions.
Question Generation	27	Readers do not know how to generate questions or inferences.	Readers learn to generate and answer inferential questions.
Story Structure	17	Poor readers cannot identify structure.	Readers improve memory and identification of story structure.
Summarization	18	Readers do not know how to summarize text.	Readers improve memory and identification of main ideas.
Teacher Preparation	6	Teachers do not ordinarily use effective transactional strategies.	Teachers learn strategies. Readers improve reading comprehension.
Vocabulary-Comprehension Relationship	3	Reading comprehension depends upon word knowledge.	Readers learn word meanings and improve comprehension.

instruction during the past 2 decades. These studies also represent essential investigations because in most of the text comprehension strategy instruction reviewed, strategies were taught by experimenters rather than classroom teachers. It is important to know whether strategies can be learned and used faithfully and effectively by teachers in classroom contexts. These four studies are intensively reviewed as a part of the Comprehension report section on teacher preparation.

Success in instruction on the relation of vocabulary to comprehension has been found in only two studies with 8th graders. This is an important kind of instruction that needs to be investigated on a wider range of grade levels. The Panel would like to know what the relationship is between word learning and comprehension. The review on vocabulary in Comprehension I (Vocabulary Instruction) shows that vocabulary can be successfully taught over a wide range of grades.

Comprehension Monitoring meets criteria of reliability and replication for the *specific* learning of the strategy (100% effectiveness in 14 studies across grades 2 through 6). Although comprehension monitoring is believed to be important as a part of a multiple strategy method, the evidence for it alone having a general effect is less compelling. Reliable effects are reported on only three experimenter tasks (error detection, recall, question answering) with two reported failures on 2nd graders. The number of studies reporting the use of transfer tests is small (four on reliable experimenter effects and five on reliable standardized tests). The method does not seem to generalize for 2nd graders. Nevertheless, it may be a useful addition to a program of instruction that employs flexibility and the teaching of multiple comprehension strategies.

Cooperative Learning showed 10 studies that reported reliable effects of instruction on grade levels 3 through 6 on experimenter tasks. Only three studies used standardized tests. Thus, cooperative learning produces reliable and replicable near transfer. The evidence for generalization is based on a small number of studies. Having peers instruct or interact over the use of reading strategies leads to an increase in the learning of the strategies, promotes intellectual discussion, and increases reading comprehension. This procedure saves on teacher time and gives the students more control over their learning and social interaction with peers.

Graphic Organizers were used in 11 studies on texts used in Social Studies and Science. The most frequent grade levels were 4 to 6. Children who can learn and benefit from this instruction have to have skill in writing and reading. The empirical evidence indicates reliable and replicable effects on near transfer tasks of memory for reading content (six of seven studies). The main effect of graphic organizers appears to be on the improvement of the reader's memory for the content that has been read. General effects are reported in four studies on achievement gains in content areas. Although the number is small, success in increasing achievement in a context subject is promising. Only two studies report the use of standardized tests so that evidence is limited in replication on this kind of general transfer. Teaching students to organize the ideas that they are reading about in a systematic, visual graph benefits the ability of the students to remember what they read and may transfer, in general, to better comprehension and achievement in Social Studies and Science content areas. The success here suggests that the instruction of comprehension could be carried out in content area teaching.

Question Answering was investigated in 17 studies, mainly in grades 3 through 5. The evidence is primarily that the effects are specific to increased success on experimenter tests of question answering. There are no reports of standardized or other general tests. This procedure may be best used as a part of multiple strategy packages where the teacher uses questions to guide and monitor readers' comprehension.

Question Generation. The strongest scientific evidence was found for the effectiveness of asking readers to generate questions during reading. There were 27 studies on this treatment that was used on readers in grades 3 through 9 (mode = 6). The main support comes from the large number of studies that assessed effectiveness by both experimenter and standardized tests as well as a meta-analysis by Rosenshine, Meister, and Chapman (1996). In the latter analysis, the respective effect sizes for multiple choice (n = 6), short-answer (n = 14), and summary (n = 3) measures were 0.95, 0.85, and 0.85, respectively. On standardized tests, the median effect size for 13 studies that used standardized comprehension tests was 0.36. Although there is a positive effect size for standardized tests, only 3 of 13 effects were statistically significant, casting doubt on the generality of this single strategy instruction. In contrast, experimenter tests fared better because 16 of 19 were statistically significant. Thus, there was stronger evidence for near transfer than for generalized effects. There is mixed evidence that general reading comprehension is improved on standardized, comprehension tests. Question generation may also be best used as a part of a multiple strategy instruction program.

Story Structure is a procedure used extensively in reading comprehension of narrative texts. There are 17 studies over grades 3 through 6, about one half of which were focused on poor readers. The success in the treatment is more frequent with poor or below-average readers; good readers do not seem to need this kind of instruction. The treatment successfully transfers to question answering and recall. Only a few (two of three) studies report transfer to standardized comprehension tests. The instruction of the content and organization of stories thus improves comprehension of stories as measured by the ability of the reader to answer questions and recall what was read. This improvement is more marked for less able readers. More able readers may already know what a story is about and therefore do not benefit as much from the training. However, this kind of instruction may aid both kinds of readers in terms of writing as well as reading literary texts. Because stories are used extensively in elementary school, instruction on how to understand a story is warranted by the data, especially for less able readers.

Summarization has a large number of studies (18) that replicate treatment effects, mainly at grades 5 and 6. Summarization presupposes writing as well as reading skill, hence its late study. The effects are largely specific to improving the writing of summaries, but there are 11 studies that show transfer effects on recall of what was summarized and on question answering. Standardized tests as general transfer were used rarely (only two studies). Instruction of summarization succeeds in that readers improve on the quality of their summaries of text, mainly identifying the main idea but also in leaving out detail, including ideas related to the main idea, generalizing, and removing redundancy. This indicates that summarizing is a good method of integrating ideas and generalizing from the text information. Furthermore, the instruction of summarization improves memory for what is read, both in terms of free recall and answering questions. This strategy instruction is used as a part of treatments that teach multiple strategies.

Multiple Strategy Instruction represents an evolution in the field from the study of individual strategies to their flexible and multiple use. This method finds considerable scientific support for its effectiveness as a treatment, and it is the most promising for use in classroom instruction where teachers and readers interact over texts. The NRP reviewed 11 studies not covered by the meta-analysis of Rosenshine and Meister (1994), who reviewed 16 reciprocal teaching studies on readers in grades 3 through 7.

One of the main methods is to have the teacher model an approach by showing how she or he would try to understand the text, using two or more combinations of four strategies: question generation, summarization, clarification, and prediction of what might occur. Rosenshine and Meister found strong evidence that the reciprocal teaching treatment showed near transfer. Experiment tests in ten studies had an average effect size of 0.88. There was also support for general transfer in nine studies where the average effect size was 0.32. All readers show more near transfer benefit in these treatments, whereas only the better readers show significant effect sizes in the 0.32 range. These data suggest that good readers benefit and generalize what they learn as strategies more than poor or below-average readers. Furthermore, the significant effect sizes do not occur for grade 3, are mixed for grades 4 through 6, and do occur for grades 7 and 8.

There were 11 other multiple strategy studies on readers in grades 2 through 11, with grade 4 as the modal grade. The strategies taught varied across these studies. In 6 of the 12 studies, students were taught summarizing or identification of main ideas. Three studies used question answering or generation, two used monitoring, and others used cooperative reading, recall, retelling, hypothesis testing, story structure, and psycholinguistic training (word, phrase, and sentence classification, morphological analysis). There was evidence for specific learning and near transfer. No studies reported the use of standardized tests.

Taken together, the evidence supports the use of combinations of reading strategies in natural learning situations. These findings build on the empirical validation of strategies alone and attest to their use in the classroom context. A common aspect of individual and multiple strategy instruction is the active involvement of motivated readers who read more text as a result of the instruction. These motivational and reading practice effects may be important to the success of multiple strategy instruction. Furthermore, multiple strategy instruction that is flexible as to which strategies are used and when they are taught over the course of a reading session provides a natural basis on which teachers and readers can interact over texts.

Discussion

In the preceding section, the Panel summarized the research claims and implications for instruction of comprehension. In this section, the kinds of claims being made are illustrated by three quotations:

> "The best way to pursue meaning is through conscious, controlled use of strategies" (Duffy, 1993, p. 223).
>
> "Becoming an effective transactional strategies instruction teacher takes several years" (Brown et al., 1996, p. 20).
>
> "The data suggests that students at all skill levels would benefit from being taught these strategies" (Rosenshine, Meister, & Chapman, 1996, p. 201).

The past 2 decades of research appear to support the enthusiastic advocacy of instruction of reading strategies expressed in the above quotations. The Panel's review of the literature indicates that there has been an extensive effort to identify reading

comprehension strategies that can be taught to students to increase their comprehension and memory for text. The instruction of cognitive strategies improves reading comprehension in readers with a range of abilities.

This improvement occurs when teachers demonstrate, explain, model, and implement interaction with students in teaching them how to comprehend a text. In studies involving even a few hours of preparation, instructors taught students who were poor readers but adequate decoders to apply various strategies to expository texts in reading groups, with a teacher demonstrating, guiding, or modeling the strategies, and with teacher scaffolding (e.g., Palinscar & Brown, 1984; see Rosenshine, Meister, & Chapman, 1996 for a review). Such instruction is consistent with socially mediated learning theory (Pressley & McCormick, 1995; Vygotsky, 1978). Students using these strategies, even in limited ways, produced noticeable improvement in the use of the instructed strategies, albeit with only modest improvement on standardized reading tests (Rosenshine & Meister, 1994). More intensive instruction and modeling have been more successful in improving reading and standardized test scores (Bereiter & Bird, 1985; Block, 1993; Brown et al., 1996).

Many of the studies involve teaching one group of students a particular cognitive strategy to use while reading. These studies show that readers can learn a strategy and use it effectively in improving their comprehension. Reading, however, requires the coordinated and flexible use of several different kinds of strategies. Considerable success has been found in improving comprehension by instructing students on the use of more than one strategy during the course of reading. Skilled reading involves an ongoing adaptation of multiple cognitive processes. Becoming an independent, self-regulated, thinking reader is a goal that can be achieved through instruction of text comprehension (Brown et al., 1996).

Rosenshine and Meister (1994) conclude that the main weakness in understanding the practice of instruction is that not enough studies have been devoted to implementation. The NRP concurs with this conclusion.

Implementation of Instruction in Reading Comprehension

The major problem facing the teaching of reading comprehension strategies is that of implementation in the classroom by teachers in a natural reading context with readers of various levels on reading materials in content areas. For teachers, the art of instruction involves a series of "wh" questions: knowing *when* to apply *what* strategy with *which* particular student(s). Having students actually develop independent, integrated strategic reading abilities may require subtle instructional distinctions that go well beyond techniques such as instruction, explanation, or reciprocal teaching (Duffy, 1993). Duffy argues that strategies are not skills that can be taught by drill; they are plans for constructing meaning. Teaching students to acquire and use strategies may require altering traditional approaches to strategy instruction. It may be necessary to free teachers of the expectation that their job is to follow directions narrowly. Being strategic is much more than knowing the individual strategies. When faced with a comprehension problem, a good strategy user will coordinate strategies and shift strategies as it is appropriate to do so. They will constantly alter, adjust, modify, and test until they construct meaning and the problem is solved.

How well has the knowledge gleaned from research filtered into the classroom to impact teachers' actual practice? In spite of apparent effectiveness, teachers may not be using effective comprehension instruction strategies without having themselves had preparation in instruction (Anderson, 1992; Bramlett, 1994; Brown, 1996; Duffy, 1993; Durkin, 1979; Pressley, Johnson, Symons, McGoldrick, & Kurita, 1989; Pressley, 1998; Reutzel and Cooter, 1988). Pressley (1998) reports that a yearlong observation of ten upstate New York grade 4 and 5 classes in the 1995–1996 school year showed that teachers varied in several factors: their class management, their extent of monitoring student progress, their extent of engaging students, how concerned they were with external standards and state tests, and their frequency of assigning homework and skills practices. However, regarding comprehension instruction:

> In some classrooms . . . we observed explicit comprehension instruction only rarely, despite a great deal of research in the past two decades on how to promote children's comprehension of what they read . . . Indeed, the situation seemed to be much as Durkin (1979) described it two decades ago, with a great deal of testing of comprehension but very little teaching of it (Pressley, 1998, p. 198).

Durkin (1981) observed that when comprehension skill instruction is present, in many classrooms teachers appear to be "mentioning" a skill to students and "assigning" it to them rather than employing the effective instruction modeling and transactional practices that research supports (Durkin, 1981; Reutzel & Cotter, 1988). In the United States, reading from basal reading series accounts for 75% to 90% of classroom reading instruction time (Franklin et al., 1992). Although some basal teachers' manuals do provide more evaluative comprehension skill lessons, these lessons are usually not instructional and offer little structure and rationale for helping teachers give effective skill instruction (Reutzel & Cotter, 1988).

In a 5-year study of how teachers help low-achieving students become strategic readers, using monthly inservice strategy preparation sessions, biweekly individual teacher coaching with a strategy expert staff developer, and collaborative discussion of principals' and teachers' experiences in individual schools, Duffy (1993) suggests that effective reading instruction is associated more with independent teacher action than with implementation of basal text prescriptions. He argues that developing metacognitive readers who understand their reasoning requires teachers who themselves understand their reasoning, as well as a supportive environment in the schools for strategy learning. Pressley's (1998) recent observations suggest that too little has changed in the classroom since Durkin's 1978–1979 school year observations:

> A twist on this [1995–1996 school year] situation, however, was that the comprehension tasks now being given to students did seem to be informed by the comprehension process research of the past two decades. It was not uncommon, for example, for students to be asked to respond to short-answer questions requiring them to summarize what they read, identify confusing points in a text, construct questions pertaining to a text, or predict what might be next in a text. That is, they were asked to respond to questions constructed around the cognitive processes involved in skilled comprehension (i.e., summarizing, monitoring confusion, self-questioning, predicting based on prior knowledge). However, there was little evidence that students were being taught to self-regulate comprehension processes as they read, and in some classrooms, there was no evidence that they were being taught the active comprehension process validated in the last two decades. In general, students were provided with opportunities to practice comprehension strategies, but were not actually taught the strategies themselves nor the utility value of applying them. (Pressley, 1998, p. 198).

Deshler and Schumaker (1988) have taught learning disabled students how to comprehend, write, and remember in a learning disabilities curriculum. They emphasize the role of controllable factors, such as the use of strategies. One problem they encountered is that learning disabled students make attributions that render them dysfunctional (e.g., "I am stupid."). These kinds of attributions can defeat what might otherwise be effective comprehension instruction. Alternatively, effective comprehension instruction might lead learning disabled students to make more positive, functional attributions.

When conscientious, diligent, and highly professional teachers apply their strategy instruction in the classroom, even when applied imperfectly, their students do improve in reading comprehension (Bramlett, 1994; Duffy, 1993; Pressley, Johnson, Symons, McGoldrick, & Kurita, 1989). However, close observation of inservice trained strategy teachers suggests that:

> Progress was not easily accomplished. It was a struggle. For much of the academic year, the four [strategic] teachers [in the study] required from their students counterproductive 'answers' and 'routes'—that is, answers and thinking that led students to construct inaccurate conceptions [of strategies].

> Although by May it appeared that [their grade 2 poor reading] students were developing an integrated concept of what it means to be strategic, students' responses to interview probes during fall and winter suggested incomplete conceptions or *mis*conceptions about what it means to be strategic (Duffy, 1993, p. 237).

In spite of heavy emphasis on modeling and metacognitive instruction, even very good teachers may have trouble implementing, and may even omit, crucial aspects of strategic reasoning. The research suggests that, when partially implemented, students of strategy teachers will still improve. But it is not easy for teachers or readers to develop readers' conceptions about what it means to be strategic. It takes time and ongoing monitoring of success to evolve readers into becoming good strategy users.

> Helping teachers [become good strategy teachers] will require a significant change in how teacher educators and staff developers work with teachers and what they count as important about learning to be a teacher. Current practices that require teachers to successfully complete university course work, to attend mandated half-day in-service programs, or to be 'trained' in the 'right way' to teach and then [be] held accountable for that encourage teachers, like the children . . . to learn only the labels of professional knowledge without learning how to be strategic themselves. Such practices must be replaced by teacher education/staff development experiences that account for (1) the complexity involved in teaching [students] to be strategic and for (2) the creative adaptations teachers must make as they deal with that complexity (Duffy, 1993, p. 244-245).

Strategic reading requires strategic teaching, which involves putting teachers in positions where their minds are the most valued educational resource (Duffy, 1993). Skilled reading is constructive reading, and the activities of the reader matter (Pressley, Harris, & Marks, 1992; Pressley & Afflerbach, 1995).

What is the scientific basis for claims made about instruction of comprehension?

The Panel now begins a more critical analysis of the literature on instruction of comprehension. First, the quality of the studies is discussed. Second, scientific criteria are applied and the Panel's prior evaluations to arrive at an overall set of conclusions are discussed.

Quality of Studies: An Overlooked Issue

In half the studies reviewed by Rosenshine and Meister (1994), experimenters failed to address the quality of instruction in the intervention study. There are several papers, however, that have raised questions about the quality issues of reading research: Almasi, Palmer, Gambrell, and Pressley (1994); Lysynchuk, Pressley, d'Ailly, Smith, and Cake (1989); Pressley et al. (1989); Rosenshine et al. (1996); Rosenshine and Meister (1994); and Troia (1999). Of these, Lysynchuk et al. (1989) evaluated the methodological adequacy of 37 studies of reading comprehension instruction. Several problems were identified. Of particular importance were (1) failure to randomly assign students to treatments and control conditions, (2) failure to expose experimental and control participants to the same training materials, (3) failure to provide information about the amount of time spent on dependent variable tasks, (4) failure to study fidelity of treatment by not including analysis of teacher and reader performance during instruction, (5) use of inappropriate units (individual, group, classroom) in analyses, and (6) failure to assess either long-term effects or generalization of the strategies to other tasks and materials.

Lysynchuk et al. (1989) applied 24 criteria of internal validity (classified in four categories as to general design, possible confounds, measurement, and statistics) and five criteria of external validity (theory, sample, reading ability, text properties, measures of transfer). The range of percentages of studies that met internal validity criteria was from 17 to 100, median = 78%. For external validity, the range was from 8% to 100%, median = 82.5 percent. Although most studies specified the experimental and control groups and the independent and dependent variables in their general design presentations, only 64% randomly assigned participants or classes to the experimental and control conditions, compromising cause-and-effect conclusions.

With respect to confounds, in 75% of the studies, control subjects were lead to believe that they were in an experimental condition; therefore, 25% were not, allowing for possible Hawthorne effects. In nearly one-third of the studies, there were possible confounds of differences in training materials between the experimental and control groups with the experimental groups given more materials to read. However, in these studies they were, with one exception, exposed to materials for the same amount of time.

In other studies, time on task was confounded with condition. Experimental groups may have been allowed more time to read than control groups. Only 10 of 37 studies reported the amount of time, and 8 of 10 of these were the same. However, these studies did not analyze what students did during the time assigned; therefore, it is unknown whether they used the time to read. In addition, there were possible experimenter-by-condition or teacher-by-condition confounds in some studies because neither the experimenters nor the teachers were randomly assigned to groups. Measurement problems involved not measuring reliability (37% of the studies), floor and ceiling effects (33% of the studies), and failure to assess fidelity of treatment through checks on manipulation (only 37% did so for teachers, and 27% measured ongoing processes). On statistical practices, the most serious flaw was in the use of appropriate units—if one assigns groups to conditions and then conducts analyses on individuals, the unit of analysis differs from the unit of treatment. Errors then cannot be assumed to be independent. With respect to external validity, most studies met theory and reporting of sample criteria. Other problems involved omission of data on reading level (16%), failures to measure transfer or delayed effects (76%), and failures to measure transfer to school subjects (92%).

Future studies would benefit from attention to quality criteria for internal and external validity. In particular, researchers should conduct reliability assessments of their scoring of data when raters are used; should use random assignment of experimenters, teachers, classrooms, or students where possible; or should at least collect data on comparability of instructors and on participant characteristics in the treatment and control conditions. Researchers should try to meet quasi-experimental criteria if random assignment is not possible (Cook & Cambell, 1979). Hawthorne effects can be reduced by motivating controls to believe that they are receiving the same benefits and treatment as experimental participants. Often the tasks themselves motivate experimental and controls differently, confounding motivation with the variable of study. Similarly, Hawthorne effects on teachers can occur if they believe that the experimental group will benefit more than controls. One way to deal with this problem is to assign the teacher to both groups but with the belief that either treatment would benefit the participants.

Future studies should include fidelity to treatment measures of the preparation of teachers, of the teachers' teaching the strategies as intended, and of the students' performance during training. There is a need to observe, document, and analyze all components of the experiment, from training to implementation to learning to assessment. The amount of time on each task should be recorded and reported as well as examined in relation to outcome measures. Floor and ceiling effects on measures should be avoided. The unit of analysis should be the same as the unit of treatment. All these steps would improve the design and internal validity of studies on reading strategy instruction. External validity could be improved by the inclusion and measurement of training and transfer of training to other measures, particularly performance in content areas. Text, as a variable, has been sorely neglected. The external validity of a study could also be improved by the kind of texts used (both expository and narrative and sampled from content areas), an analysis of text difficulty, the content and structure of the text, the vocabulary and sentence complexity of the text, appropriateness of the level of text difficulty to the ability of readers, and possible interactions between difficulty of the text and ability of reader. Long-term benefits could be assessed through followup studies later so that the effects are not just short term.

In the section of this Text Comprehension report on quality of studies, the Panel describes a set of criteria for internal and external validity that should be used to plan, conduct, and report research in individual studies but also that can be applied in evaluation of single and multiple studies and reviews of studies. That section includes several criteria for internal and external validity. These criteria incorporate, elaborate, extend, and adapt to the reading situation the 24 categories of the Lysynchuk et al. (1989) review.

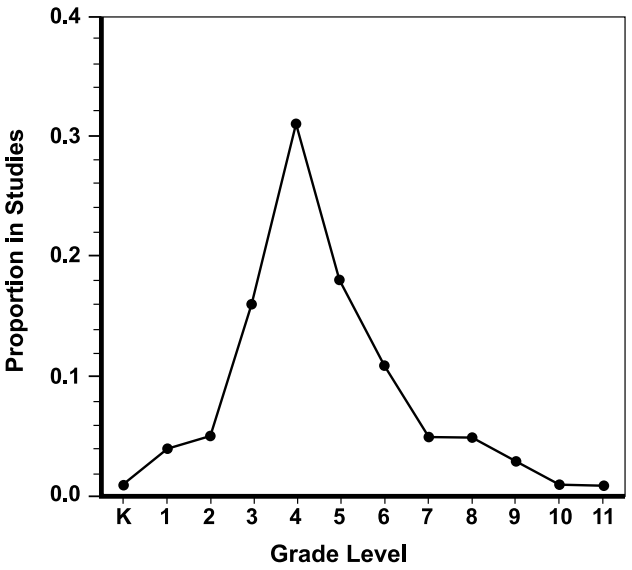
Scientific Evaluation of the Claims Made in the Literature

The empirical evidence reviewed favors the conclusion that teaching of a variety of reading comprehension strategies leads to increased learning of the strategies, to specific transfer of learning, to increased memory and understanding of new passages, and, in some cases, to general improvements in comprehension. In particular, individual strategies that can be used in natural reading or content area instruction and through interaction with the teacher over a text appear to have a strong scientific support for their effectiveness and for their inclusion in classroom programs on comprehension instruction.

The NRP now integrates its evaluations of the instruction strategies that have the best scientific basis for effectiveness and use by teachers in the classroom. The Panel first considers the grade level appropriateness and general effectiveness, then the evidence of reliability, robustness, replication, and transfer for a set of particular strategies in support of the general conclusion above.

On what grade levels has text comprehension instruction been effectively studied? Figure 1 shows the distribution of the grade levels at which investigations of instruction in comprehension have been successfully carried out.

Figure 1. Distribution of Grade Levels Across All Studies of Direction



In Figure 1, grades 3 through 6 constitute 76% of the grade levels studied. The modal grade is 4 with the next highest percentages occurring with grades 3 and 5. Thus, instruction of comprehension begins mainly at the 3rd grade and continues through the 6th grade. In examining the studies, the Panel found that the lower three grades (K through 2) were studied primarily as a part of an experimental curriculum. The higher grades (above grade level 6) tend to focus on less able readers. The increase in percentage at grade level 3 suggests that researchers taught readers who had achieved decoding and other basic reading skills before they were taught strategies.

To determine the effectiveness of instruction and whether it was related to grade level, the Panel found the percentage of reported significant findings where the experimental treatment was favored over the control group. The overall average percentages of success, as measured by experimenter tasks or by standardized tests, were 97 and 93%, respectively. The high overall rates of success are not surprising because these data are based upon published studies. For grades K through 1 and 7 through 11, the reported percentage of success was 100 on experimenter tasks and standardized tests; for grades 2 through 6, the average was 92%. For standardized tests, the average success was 89% for grades 2 through 6. There was no relationship between grade level and the respective percentages of success in treatment.

These data indicate that instruction is likely to be more successful when measured on experimenter designed tasks than on standardized tests of comprehension. The instruction of comprehension appears to be effective on grades 3 through 6.

With respect to the scientific basis of the instruction of text comprehension, the NRP concludes that comprehension instruction can effectively motivate and teach normal readers to learn and to use comprehension strategies that benefit them.

These comprehension strategies yield increases in measures of near transfer such as recall, question answering and generation, and summarization of texts. Furthermore, when used in combination, these

comprehension strategies produce general gains on standardized comprehension tests. Teachers can learn to teach students to use comprehension strategies in natural learning situations. In addition, when teachers teach these strategies, their students learn them and improve their reading comprehension.

A common aspect of individual and multiple strategy instruction is the active involvement of motivated readers who read more text as a result of the instruction. These motivational and reading practice effects may be important to the success of multiple strategy instruction.

Multiple strategy instruction that is flexible as to which strategies are used and when they are taught over the course of a reading session provides a natural basis on which teachers and readers can interact over texts. The research literature developed from early studies of isolated strategies then moved to the use of strategies in combination, and finally to the preparation of teachers to teach strategies in interactions about texts with readers in naturalistic settings. The Panel regards this development as the most important finding of its review because it moves from the laboratory to the classroom and prepares teachers to teach strategies in ways that are effective and natural.

The empirical evidence reviewed favors the conclusion that teaching of a variety of reading comprehension strategies leads to increased learning of the strategies, to specific transfer of learning, to increased memory and understanding of new passages, and, in some cases, to general improvements in comprehension.

The important development of instruction of comprehension research is the study of teacher preparation for instruction of multiple, flexible strategies with readers in natural settings and content areas and the assessment of the effectiveness of this instruction by prepared teachers on comprehension.

Directions for Further Research

The Panel's analysis of the research on instruction of text comprehension left a number of questions unanswered:

1. More information is needed on the effective ways to teach teachers how to use proven strategies for instruction in text comprehension. This information is crucial to situations where teachers and readers interact over texts in real classroom contexts.
2. The Panel reviewed some evidence that instruction in comprehension in content areas benefit readers in terms of achievement in social studies. There is a need to know whether instruction of comprehension strategies leads to learning skills that improve performance in content areas of instruction. If so, it might be efficient to teach reading comprehension as a learning skill in content areas.
3. It is already known that instruction of comprehension has been successful over the grade 3 through 6 range. Further evidence is needed on whether certain strategies are more appropriate for certain ages and abilities, what the important reader characteristics are that influence successful instruction of reading comprehension, and which strategies, in combination, are best for younger readers, poor or below-average readers, and for learning disabled and dyslexic readers.
4. It is also important to know whether successful instruction generalizes across different text genres (e.g., narrative and expository) and across texts from different subject content areas. The NRP's review of the research indicated that little or no attention has been given to the kinds of text used. The review also indicated that there was little available information on the difficulty level of texts.
5. Information is needed on the important teacher characteristics that influence successful instruction of reading comprehension, as well as the effective ways to prepare teachers, both preservice and inservice.

6. Prior studies suffer when the quality of the studies is assessed (Lysynchuk et al., 1989) according to criteria of internal and external validity. These issues need to be considered when designing future research. The main problems were:

   (a) Failure to randomly assign students to treatments and control conditions and failure to expose experimental and control participants to the same training materials

   (b) Failure to provide information about the amount of time spent on dependent variable tasks

   (c) Failure to study fidelity of treatment, by failing to analyze teacher and reader performance during instruction

   (d) Use of inappropriate units (individual, group, classroom) in analyses

   (e) Failure to assess either long-term effects or generalization of the strategies to other tasks and materials.

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Appendix A

A total of 203 studies met the Panel's criteria for inclusion as scientific studies on comprehension instruction. These studies were grouped into 16 different categories, each representing a particular instructional strategy or collection of strategies. In the following pages, each category of studies is summarized. The Panel defines and describes the rationale for each kind of instructional strategy, the procedures used, and how the instruction was assessed by the researchers. The Panel then evaluates the category of instruction, based on reported results.

Comprehension Monitoring (Also Known as Metacognitive Awareness)

"Comprehension monitoring in the act of reading is the noting of one's successes and failures in developing or attaining meaning, usually with reference to an emerging conception of the meaning of the text as a whole, and adjusting one's reading processes according" (Harris & Hodges, 1995, p. 39). A related concept is "metacognitive awareness," which is "knowing when what one is reading makes sense by monitoring and controlling one's own comprehension" (Harris & Hodges, 1995, p. 153).

Comprehension monitoring, first studied by Markman (1978), involves the readers becoming aware of when they understand what they are reading. Instruction of comprehension monitoring involves teaching readers to become aware of when they do understand, to identify where they do not understand, and to use appropriate fix-up strategies to improve comprehension when it is blocked (Taylor et al., 1992). For reading, comprehension monitoring is "thinking about thinking," an awareness by readers of their ongoing comprehension process while reading. Typically, readers do not spontaneously select comprehension strategy awareness. This instruction strategy involves self-listening (monitoring) or listening to others (Elliott-Faust & Pressley, 1986) and thinking that is designed to help the reader or listener identify when there are problems understanding particular content, such as noticing the comprehension blocks. Comprehension monitoring training is intended to provide readers with steps that they can take to resolve reading problems as they arise. Steps may include formulating what the difficulty is, restating what was read, looking back through the text, and looking forward in the text for information that might help to resolve a problem (Bereiter & Bird, 1985).

The Panel found 20 studies on comprehension monitoring. Table 2, on the following page, summarizes the rationale, procedures, and assessment of research studies on the instruction of comprehension monitoring strategies.

Evaluation

Grade Level

In this search, the Panel found 20 studies on comprehension monitoring instruction. The 20 studies are listed in the bibliography under the rubric Comprehension Monitoring. The distribution of grade levels studied in research on comprehension monitoring ranged from grades 2 to 6: grade level 2, n = 3; level 3, n = 6; level 4, n = 8; level 5, n = 5; level 6, n = 6. Hence, the mode was at grade 4.

Texts

Comprehension monitoring has been studied mainly with expository texts that are used in the elementary grades, particularly social studies and science texts. These present problems with novel concepts and vocabulary as well as novel facts and relationships.

Experimenter Tests

Awareness During Reading

The vast majority of studies on comprehension monitoring investigated whether children could learn to become aware of their comprehension difficulties and verbally report them to the teacher. In terms of success, 16 of 16 studies (100%) measured and obtained more

TABLE 2
COMPREHENSION MONITORING INSTRUCTION

DEFINITION AND RATIONALE OF INSTRUCTION	PROCEDURES TAUGHT OR PRACTICED	ASSESSMENT
The goal of comprehension monitoring is to develop awareness by readers of the cognitive processes involved during reading. Readers learn to become aware of whether they are understanding a text and what steps they should take to correct comprehension difficulties.	The teacher demonstrates awareness of difficulties in understanding words, phrases, clauses, or sentences. Students are taught to: 1. Formulate what it is that is causing them difficulty in understanding. 2. Use think-aloud procedures that show the readers and the teacher where and when understanding difficulties occur. 3. Look back in the text to try to solve a problem. 4. Restate or paraphrase a text in terms more familiar to readers. 5. Look forward ("watch" for information) in a text to solve a problem.	Learning of comprehension monitoring itself. Experimenter tests 1. Detection of inconsistencies in logic of an argument or meaning of a passage. 2. Recall. 3. Long-term maintenance of comprehension monitoring. 4. Self-esteem. 5. Creative thinking. Standard comprehension tests.

success in awareness of comprehension during reading (or listening) for the treatment as compared to the control groups. This success occurs at about the same rate across grades 2 through 6.

Detection of Inconsistencies in Text

Asking the reader to detect inconsistencies in the text is one of the primary means that researchers have used to evaluate success of training and its transfer. Although this is difficult to do, even for adults (Markman, 1983), five studies report significant improvement in error detection for comprehension monitoring conditions.

Other Experimenter Measures

Recall, question answering, and course achievement gains were used once, twice, and once, respectively. The recall and question-answering effects were null for 2nd graders, suggesting that this method does not generalize, at least for the youngest readers. However, one study that measured improvement in science course achievement found that 2nd graders benefited from the training.

Standard Comprehension Tests

Seven studies used standardized comprehension tests to assess general transfer effects of learning comprehension monitoring. Of these, five reported significant effects (grades 3 through 6), and two had no significant effects (grades 3 and 4).

Summary Evaluation of Comprehension Monitoring

Children in grades 2 through 6 can be taught to monitor their comprehension, become aware of when and where they are having difficulty, and learn procedures to assist them in overcoming the problem. There is evidence that this training has specific and general transfer benefits. The main transfer is to improved detection of text inconsistencies and memory for the text and on standardized reading comprehension test performance.

Cooperative Learning

> Cooperative learning is defined as any pattern of classroom organization that allows students to work together to achieve their individual goals (Harris & Hodges, 1995, p. 45).

A related approach is called "collaborative learning," which is defined as "learning by working together in small groups, so as to understand new information or to create a common product" (Harris & Hodges, 1995, p. 35).

As indicated above, cooperative learning involves students working together as partners or in small groups on clearly defined tasks. The tasks require the participation of each student. Mixed ability groups may work together. Readers teach each other. The readers are encouraged to break down the content area material from "teacher-talk" to "kid-talk" to facilitate learning (Klinger, Vaughn, & Schumm, 1998).

Cooperative learning instruction has been successfully used to teach reading comprehension strategies in content subject areas and for teaching across the curriculum. Cooperative learning classes lead to improved academic performance, greater motivation toward learning, and increased time on task (Bramlett, 1994). Students of all abilities benefit from cooperative learning. Furthermore, it has been found to be effective for integrating academically and physically handicapped students into regular classrooms (Klinger et al., 1998).

The majority of teaching, reciprocal teaching, and transactional strategy instruction programs have taken place in small groups rather than large classrooms (Klinger et al., 1998). Cooperative learning is a means for teaching a variety of comprehension strategies in small groups.

The Panel found 10 studies on cooperative learning. Table 3 summarizes the rationale, procedures, and assessment of research studies on cooperative learning and strategy instruction.

Evaluation

Grade Level

The grade levels for cooperative learning were evenly distributed at two each over grades 3 to 6.

Experimenter Tests

The reading strategies that were instructed were successfully learned in the ten studies that measured them. Two studies evaluated the success of the instructional arrangement by analyses of the talk of the children. These analyses showed increased focus on intellectual content and what was being read.

Standardized Tests

Three studies found significant improvement in reading comprehension as measured by standardized tests.

Summary Evaluation of Cooperative Learning

Having peers instruct or interact over the use of reading strategies leads to an increase in the learning of the strategies, promotes intellectual discussion, and increases reading comprehension. This procedure saves on teacher time and gives the students more control over their learning and social interaction with peers.

Curriculum Plus Strategies

Curriculum plus strategy instruction integrates strategy skill training across content areas. A curriculum plus strategy instruction provides the students with cognitive strategy instruction in the context of ongoing academic activities, across school subjects, and throughout the school year. In this approach, each strategy may be taught individually, allowing students to practice a strategy to attain skill. Then students learn to apply the strategies as they need them while reading in each subject area. Individual strategies such as question generation and asking, prediction, clarification, and summarization are taught in conjunction with metacognitive support and flexible use of the strategies (Pressley, Gaskins, Wile, Cunicelli, & Sheridan, 1991).

TABLE 3
COOPERATIVE LEARNING INSTRUCTION

DEFINITION AND RATIONALE OF INSTRUCTION	PROCEDURES TAUGHT OR PRACTICED	ASSESSMENT
The aim of cooperative learning is to teach children to read together with a partner. Readers learn to read aloud with a partner and to listen to the partner's reading. Readers are given activities that teach them strategies for effective reading comprehension. The readers become independent of the teacher and learn to tutor each other. This reduces the amount of time that the teacher spends with a student.	Students are taught and allowed to participate in partner reading, summarization of paragraphs, and turn-taking in making predictions. Oral reading and listening is done by reader and peers. Training is given, and children learn to carry out activities that follow the self or partner reading, including word recognition (decoding), story structure, prediction, and story summary activities related to texts.	Experimenter tests Analyses of peer talk during cooperative learning Summarization Prediction Standardized tests

TABLE 4
CURRICULUM PLUS STRATEGY INSTRUCTION

DEFINITION AND RATIONALE OF INSTRUCTION	PROCEDURES TAUGHT OR PRACTICED	ASSESSMENT
The goal of a curriculum strategy is to provide students with multiple opportunities, in an ongoing school context, to become aware of and develop their cognitive processes across school subjects and throughout the school year. A curriculum strategy provides students with opportunities to adapt and practice various cognitive strategies in different subjects: reading, writing, social studies, science, and mathematics. Experiences that integrate listening, speaking, reading, and writing promote growth in reading and written composition. Motivates students who are at potentially high risk for educational failure.	The focus of these studies is the interaction between teachers and students. The idea behind adding strategic teaching is to attain consistency in this interaction despite variation in content. In reading instruction, students are given opportunities to identify text structure. In writing instruction, the students are given opportunities to apply structures. In social studies instruction, students attempt a structural analysis of the texts. Cooperation is encouraged among students working in small groups practicing and applying strategies.	Experimenter tests - Comprehension - Monitoring Standardized tests Achievement grades

The Panel found eight studies on curriculum plus strategies instruction. Table 4, on the following page, summarizes the rationale, procedures, and assessment of research studies on curriculum plus strategies instruction.

Evaluation

The Panel found eight studies that investigated the effects of curriculum experimentally. As noted in Table 4, these studies added strategic instruction to the program of instruction, notably comprehension monitoring, which often differed from standard reading instruction that used basal or directed reading.

Grade Level

The grade levels studied were K through 8 for two of the curriculum investigations. These were literary in nature and focused on real literature rather than basal readers. The remainder of grade levels studies were level 2, n = 1; level 3, n = 2; and level 4, n = 1. These studies used curricula that focused on content areas, literary content, and writing as part of literacy instruction.

Experimenter Tests

General comprehension improvement was reported in seven out of eight studies; four studies reported significant gains in standardized tests. Because instruction in strategy comprehension is a part of the curriculum, it is difficult to assess how the strategies and their learning benefited the readers. Our analysis of multiple strategies and transactional instruction below, however, is consistent with the idea that teaching comprehension strategies as part of the content areas or reading curriculum is an effective procedure.

Summary Evaluation Curriculum Plus Strategies

The variation and complexity of curricula across these studies do not permit one to argue for the scientific support of a particular curriculum or for the particular strategies added to the instruction. However, the success of these individual studies indicates that there may be merit in adding comprehension instruction of reading strategies to a given curriculum and evaluating the results scientifically against those of control groups.

Graphic Organizer

A graph is a "diagram or pictorial device that displays relationships" (Harris & Hodges, 1995, p. 101). In teaching readers to use external means of representing the meaning of relationships in a text, teachers instruct students to organize their ideas through the construction of graphs of ideas based upon what they read, hence the term "graphic organizer."

To help readers construct meanings and organize the ideas presented in a text, the use of graphs or the construction of graphs focuses the readers on concepts and their relations to other concepts. Graphic organizers are methods used to teach the reader to use diagrams of the concepts and their relationships. They are particularly appropriate for expository texts used in content areas such as science or social studies, but they have also been applied to stories as "story maps." The external graphic aids (1) help students focus on text structure while reading, (2) provide tools to examine and visually represent textual relationships, and (3) assist in writing well-organized summaries.

The Panel found 11 studies on graphic organizer instruction. Table 5, on the following page, summarizes the rationale, procedures, and assessment of research studies on graphic organizer instruction.

Evaluation

The Panel found 11 studies that used graphic organizers to assist students in framing and identifying the main ideas in social studies and science texts.

Grade Level

The grade level distribution for the use of graphic organizers is level 2, n = 1; level 3, n = 1; level 4, n = 5; level 5, n = 4; level 6, n = 6; level 7, n = 2; level 8, n = 2. Hence, the modal level is grade 6 with the technique becoming more frequent at grade level 4. Graphic organizing is an activity that is taught to readers in the higher elementary and middle school grades, 4 through 8, with the mode occurring at grade 6. This suggests that children who can learn and benefit from this instruction have to have skill in writing and reading.

TABLE 5
GRAPHIC ORGANIZER INSTRUCTION

DEFINITION AND RATIONALE OF INSTRUCTION	PROCEDURES TAUGHT OR PRACTICED	ASSESSMENT
Readers are instructed to make graphic representations of text material. Graphic organizers include semantic maps, expository maps, story maps, story schema, and graphic metaphors. Graphic organizers visually (spatially) represent super-ordinate and more important subordinate ideas of a passage, story, or exposition. Spatial (graphic) metaphors are assumed to facilitate learning and memory of text and the making of well-organized summaries.	Teachers show readers how to create graphic organization of ideas. Teachers may provide graphic metaphors such as making an umbrella for main ideas and putting details below the topic. or Teachers show readers how to construct maps of expository passages by locating the title or main concept in the center of a circle and then writing in the related ideas from a survey of the text for main ideas. or Teachers show readers how to make box diagrams of a story, for example, problem box-action box-results box and filling in the content of the boxes.	Experimenter tests - Summaries - Text recall Standardized tests - Comprehension subtest of - Gates-MacGinitie Reading Test

Experimenter Tests

Seven studies used recall of the text content to evaluate the effect of training on the use of a graphic organizer. Six of the seven report significant benefits to the experimental groups; one reported a null finding. Four studies (three other than those using recall) report significant achievement gains in the content area. Thus, the main effect of graphic organizers is on improving the reader's memory for the content that is read.

Standardized Tests

Two studies reported positive findings on grades 6 through 8 for standardized tests to evaluate transfer from learning to organize content graphically.

Summary Evaluation of Graphic Organizer Instruction

Teaching students to use a systematic, visual graph to organize the ideas that they are reading about develops the ability of the students to remember what they read and may transfer in general to better comprehension and achievement in social studies and science content areas.

Listening Actively

Listening is the "act of understanding speech." A child's "listening comprehension level" is the "highest grade level of material that can be comprehended well when it is read aloud to the student," also known as "auding, the processes of perceiving, recognizing, interpreting, and responding to oral language" (Harris & Hodges, 1995, p. 140 and p. 14, respectively).

Listening to another person read and following what is being read by reading the text is a method used to teach students how to listen while reading. In the 1970s, efforts were made to train listening skills in general. Dickson (1981) summarizes the relevant work on this kind of training.

Active listening by the student can promote reading comprehension. Students have been taught more effective listening by applying Palinscar's and Brown's (1984) reciprocal teaching (see below) strategies to listening (Grant, 1989). For students in a remedial reading class, listening lessons improved their critical listening, critical reading, and general reading comprehension.

The Panel found four studies on listening instruction and comprehension of text. Table 6, on the following page, summarizes the rationale, procedures, and assessment of research studies on listening instruction.

Evaluation

The Panel found four studies that investigated how listening during reading affects comprehension

Grade Level

Listening studies were carried out on students in grade level 1, n = 1; level 4, n = 1; level 5, n = 1; and level 6, n = 1.

Experimenter Tests

Questions answering showing improvement in two studies.

Standardized Tests

Improvement is reported in two studies on standardized tests.

Summary Evaluation of Listening Instruction

Direct instruction on learning to listen to others (teachers or peers) who read while following in the text what is read may benefit students' comprehension in specific and in more general ways.

Mental Imagery

A mental image is "a perceptual representation or ideational picture of a perceptual experience, remembered or imagined" (Harris & Hodges, 1995, p. 152).

In imagery training, students are instructed to construct visual images to represent a text as they read it. The text is often a short passage or a sentence. Imagery training improves students' memory (Levin & Divine-Hawkins, 1974) and inferential reasoning about written text (Borduin, 1994).

The Panel found seven studies on mental imagery instruction. Table 7, on the following page, summarizes the rationale, procedures, and assessment of research studies on mental imagery instruction.

TABLE 6
LISTENING ACTIVELY INSTRUCTION

DEFINITION AND RATIONALE OF INSTRUCTION	PROCEDURES TAUGHT OR PRACTICED	ASSESSMENT
Instruction is aimed at achieving active listening for meaning by the reader. Emphasis on listening for meaning produces better sentence recall than emphasis on accurate oral reading. Students who take "active listening turns" are assumed to remember more sentences from a lesson than those who follow along. Listening instruction focuses interest in material. Subject interest is a major factor in sentence recall that is more important than readability. Listening instruction supposedly improves critical listening, reading, and general reading comprehension. It increases participation in group discussions and leads to more thoughtful responses to questions.	The teacher guides the students in critical listening instruction. The teacher poses questions for the students to answer while they listen to the teacher read the text.	Experimental tests - Pretest and posttest on reading and listening Standardized tests - Subtests of Sequential Test of Educational Progress

TABLE 7
MENTAL IMAGERY STRATEGY INSTRUCTION

DEFINITION AND RATIONALE OF INSTRUCTION	PROCEDURES TAUGHT OR PRACTICED	ASSESSMENT
Readers are instructed to make an image to represent the text content. Generating an image requires an interpretation of the text as to its referent(s). When the reader can construct an image of what is read, the reader is assumed to have understood the referent of the text. The constructed image serves as a memory representation of the reader's interpretation of the text.	Teachers ask readers to construct an image(s) that represents the content. This is most often done at the sentence level.	Experimenter Tests - Recall - Short-answer questions

Evaluation

The Panel located seven studies that used mental imagery training and examined its effects experimentally.

Grade Level

Imagery has been used in studies at all grade levels higher than the 2nd grade. The distribution of grades studied was grade level 2, n = 1; level 3, n = 2; level 4, n = 2; level 5, n = 1; level 7, n = 1; and level 8, n = 1. Mental imagery instruction while reading sentences appears to be applicable to grades 2 through 8.

Experimenter Tests

The main effect of imagery is to increase memory for the sentence imaged. The main memory tests used were recall (3 studies) and question answering (6 studies). Keyword cues were used as prompts in five of these studies. In addition, detection of inconsistency showed improvement in two studies.

Summary Evaluation of Mental Imagery Instruction

Instructing readers to imagine what they are reading and coding what they imagine with a keyword cue facilitates readers' memory of what they have read.

Mnemonic Instruction

"Mnemonic procedures include devices or techniques that are aimed at improving memory" (Harris & Hodges, 1995, p. 156).

Mnemonic instruction is a procedure that uses external memory aids. It is a procedure that trains students to use a picture or a concept as a proxy for a person, concept, sentence, or passage. Students are taught to generate an interactive image between the proxy (a word or a picture) and the information covered in the text. This procedure increases learned associations between the proxy and other information in text. The method has been used successfully to teach unfamiliar concepts (e.g., biographies of unfamiliar people, information about unfamiliar places). Although both good and poor readers benefit from this procedure, good readers seem to benefit more (Peters & Levin, 1986). A "keyword" can serve as a proxy.

The Panel's search yielded only two studies on mnemonic instruction and comprehension instruction. Both these studies used keyword methods. Table 8, shown on the following page, summarizes the rationale, procedures, and assessment of research of these studies.

Evaluation

The two studies that used keywords as mnemonics were done on 8th graders. Both found improved recall for passages that had keywords.

Summary Evaluation for Mnemonics

Mnemonic methods using keywords as organizers increase memory and recall. The relationship to other measures of comprehension is not known.

Multiple Strategy Instruction

A "strategy" is "in education, a systematic plan, consciously adapted and monitored, to improve one's performance in learning" (Harris & Hodges, 1995. p. 244). Strategies can be taught and reading requires the flexible use of several different kinds of strategies.

Skilled reading involves the coordinated use of several cognitive strategies. Readers can learn and flexibly coordinate these strategies to construct meaning from texts. Several individual strategies are reviewed in this report. In this section, we examine studies that teach readers to use more than one strategy in the context of reading and in interaction with a teacher over the text. Hence, multiple strategy instruction occurs in a dialog between the teacher and the student. Students are taught individual strategies when and where they are appropriate, usually through modeled use by the teacher. Over the course of reading a passage, several strategies may be taught in conjunction with one another. For example, the reader may predict along with clarification of a word's meaning, activation of knowledge about a story schema, and summarization of the main idea, and all with awareness of problems that are encountered during the reading. In multiple strategy instruction, students are taught how to adapt the strategies and use them flexibly, according to their situation (Pressley, 1991). The teacher models and assists in the learning and flexible use of the strategies by the student. Cooperative learning or peer tutoring may be used as a part of multiple-strategies instruction.

TABLE 8
MNEMONIC INSTRUCTION

DEFINITION AND RATIONALE OF INSTRUCTION	PROCEDURES TAUGHT OR PRACTICED	ASSESSMENT
The reader is taught to use a keyword to substitute (serve as a proxy) for a person or some aspect of text (person, concept, sentence, passage). The keyword is associated with an interactive image of the referent of a sentence or paragraph. This method is useful when the reader is trying to learn information about totally unfamiliar concepts (e.g., people or countries). The method is assumed to increase the reader's memory through association of the keyword element and other information in the text.	Teacher instructs students to form a keyword substitute for some aspect of prose (person, concept, place, situation, sentence), for example, "tailor" for "Taylor". Pictures are used to help students understand the text. The picture is organized around the keyword.	Experimenter tests - Recall

One variant of multiple-strategy instruction is called "reciprocal teaching." The teacher first models (demonstrates through personal use) and then explains what a strategy is and when to use it (Palinscar & Brown, 1984; Lysynchuk et al., 1990). At first, the teacher guides the reader in applying and practicing strategies while reading a passage. Modeling includes not only examples but the teacher "thinking aloud" to demonstrate the coordinated use of strategies. Gradually, the student begins to practice and implement each strategy independently. In explicit transactional approaches that use multiple strategies, the teacher will explain a strategy before modeling it in a passage (Rosenshine & Meister, 1994).

The Panel found 38 studies on multiple-strategies instruction. Of these, 27 studies were on "reciprocal teaching." The definitions, rationales, procedures, and assessments for "reciprocal teaching" are described in Table 9, on the following page. The 11 studies on other treatments of multiple strategies are summarized in Table 12.

Evaluation of Reciprocal Teaching

Meta-analysis

In "reciprocal teaching," the teacher models by showing how she or he would try to understand the text, using two or more combinations of four strategies: question generation, summarization, clarification, and prediction of what might occur. Rosenshine and Meister (1994) conducted a meta-analysis on 16 reciprocal training studies. Rosenshine and Meister used the criteria of selection that was adopted by us: a study had to be an experimental study with controls and use random assignment or matching of conditions. The grade levels studied were 1 through 8, distributed as level 1, n = 1; level 2, n = 1; level 3, n = 4; level 4, n = 6; level 5, n = 3; level 6, n = 4; level 7, n = 4; and level 8, n = 1. The modal grade for reciprocal teaching was grade 4, but high numbers occur for grades 3 through 7 in these studies (4 on average). Reciprocal teaching using multiple strategies presumes basic reading (decoding) skills, even on those two or more grades below level.

The kinds of strategies included varied from one to four components of summarization, question generation, clarifying, and predicting. Question generation was most frequent (nine studies), followed by summarizing (six studies).

The effect sizes (Rosenshine & Meister, 1994, Table 5, page 194) for experimenter tests (10) studies averaged 0.88; for standardized tests (9 studies), the average effect size was 0.32. These values were about the same for high- and low-quality studies (0.88 and 0.86, respectively, for experimenter tests; 0.31 and 0.36, respectively, for standardized tests). The low-quality studies showed the same effect (0.87) for experimenter tests but a small negative effect (-0.12) for standardized tests. Excluding the low-quality studies, the effect size for standardized tests was raised to 0.36 (seven studies).

Effect size varied as a function of reader ability. Table 11 summarizes these data.

In Table 10, it can be seen that the magnitude of the effect size for experimenter tests was larger for below-average or poor readers. Despite greater efficacy of specific training, scores of standardized tests declined as did the ability of the reader. These data suggest that good readers benefit and generalize what they learn as strategies more than do poor or below-average readers.

Rosenshine and Meister (1994) tested for the significance of effect sizes and examined their results as a function of grade level, excluding below-average readers. These data are summarized in Table 12. Their results show that reciprocal teaching of strategies is not significant for grade 3, is mixed for grades 4, 5, and 6, and is significant for grades 7 and 8. Thus, as measured by significant effect sizes, the older readers benefit most from reciprocal teaching.

Reciprocal Teaching Studies Not Reviewed by Rosenshine & Meister, 1994

The Panel located 11 studies on reciprocal teaching that were not covered in the meta-analysis of Rosenshine and Meister (1994). These studies covered grade levels from 1 to 6 (level 1, n = 1; level 2, n = 1; level 3, n = 3; level 4, n = 3; level 5, n = 3; and level 6, n = 1). These studies tended to use more strategies (seven had combinations of summarization, question generation, clarification, and prediction) and added, in one case each, either monitoring or collaborative learning. Four studies reported improvement on experimenter tests, and three reported significant improvement on standardized tests. These data are consistent with those of Rosenshine and Meister (1994).

TABLE 9
MULTIPLE STRATEGIES: RECIPROCAL TEACHING

TABLE 9
MULTIPLE STRATEGIES: RECIPROCAL TEACHING

DEFINITION AND RATIONALE OF INSTRUCTION	PROCEDURES TAUGHT OR PRACTICED	ASSESSMENT
Multiple-strategies instruction is designed to take place in the context of a dialog between the teacher and the students--each of whom reads text passages. In some cases, the teacher also explains a strategy.	The teacher guides the reader in applying and practicing strategies while reading a passage. The teacher models each strategy in the context of reading a passage. The student then applies the strategy to his or her own reading of a passage. There are four main strategies (varies from two to four): 1. Generation of questions during reading 2. Summarization of main ideas of the passage 3. Clarification of word meanings or confusing text 4. Prediction of what might occur later in the text. Optional additions include question answering, making inferences or drawing conclusions, listening, monitoring, thinking aloud,and elaborating.	Experimenter tests - Learning and use of strategies is assessed by analyses of: · Recall · Generating · Answering questions · Summarizing (main idea) · Predicting (what will happen in new passage) Content area achievement Standardized tests

TABLE 10
EFFECT SIZE AS FUNCTION OF READER ABILITY

TYPE OF STUDENT	TYPE OF TEST (number of studies)	
	Standard	Experimenter
All	0.32 (4)	0.85 (5)
Good-Poor	0.19 (2)	0.88 (3)
Below Average	0.08 (4)	1.15 (2)

TABLE 11
EFFECT SIZE SIGNIFICANCE AND GRADE LEVEL

STUDENTS	EFFECT OF GRADE LEVEL		
	Significant	Mixed	Not Significant
Good-poor/All			
3			X
3			X
4		X	
4 & 6	X		
4 & 7		X	
5 & 6		X	
6, 7, 8	X		
7	X		

TABLE 12
MULTIPLE STRATEGIES: OTHER TREATMENT COMBINATIONS

DEFINITION AND RATIONALE OF INSTRUCTION	PROCEDURES TAUGHT OR PRACTICED	ASSESSMENT
The instruction takes place primarily through the student practicing a given strategy, with feedback from the teacher. The teacher may initially model the strategy.	There are several skills that are practiced here. Packages of skills vary in number from 2 to 5: Self study of the passage. Oral reading Rereading Retelling Review Summarization of main ideas Generation of questions Testing hypotheses Deriving word meaning from morphemes Word recognition training Vocabulary instruction Drawing conclusions Filling in blanks in the passage (Cloze procedure) Monitoring of comprehension Story structure Collaborative learning with partner, including listening to partner reading. Debating or arguing with the author of the text or with the teacher or partner Classification of words, phrases, and sentences	Same as reciprocal teaching

Summary of Reciprocal Teaching of Multiple Strategies

There is strong empirical evidence that the instruction of more than one strategy in a natural context leads to the acquisition and use of these reading strategies and transfers to standard comprehension tests.

Evaluation

Grades

The 12 studies involved readers from grades 2 through 11. The grades were distributed: level 2 = 1, level 3 = 2, level 4 = 6, level 5 = 1, level 6 = 2, and levels 7 through 11, 1 each. Thus, the modal grade is grade 4. Again, basic decoding skill is assumed in teaching reading strategies.

Strategy Instruction

The strategies taught varied across these studies. Six out of the twelve taught summarizing or identifying main ideas. Three had question answering or generation. Monitoring was trained in two studies. Others used cooperative reading, recall, retelling, hypothesis testing, story structure, and psycholinguistic training (word, phrase, and sentence classification, morphological analysis).

Experimenter Tests

Seven studies report specific learning of the strategies taught; two studies report mixed results; and two studies report negative findings. The mixed results and negative findings occurred over grades 4 through 6.

Standardized Tests

No data on standardized tests were reported.

Summary of Other Multiple Strategy Treatment Studies

One or more strategies taught in the context of an interaction facilitates comprehension as evidenced by memory, summarizing, and identifying main ideas.

Overall Summary of Instruction of Multiple Strategies

Taken together, the evidence supports the use of combinations of reading strategies in natural learning situations. These findings build on the empirical validation of strategies alone and attest to their use in the classroom context.

Prior Knowledge

By prior knowledge, the Panel means knowledge that stems from previous experience. This knowledge is a key component of schema theories of reading comprehension (Anderson & Pearson, 1984). Schema theory holds that comprehension depends upon the integration of new knowledge with a network of prior knowledge. Harris and Hodges (1995) offer that within a schema theory, reading is an active process of meaning construction in which the reader connects old knowledge with the new information that is encountered in the text.

To read with understanding, the reader has to have a considerable amount of knowledge. In learning about a content area subject, children acquire knowledge that they can use to understand a text on that content area. In effect, children need prior experience and acquired knowledge to be able to read (Athey, 1983). A reader must activate what he or she knows to use it during reading to comprehend a text. Without activation of what is known that is pertinent to the text, relevant knowledge may not be available during reading, and comprehension may fail; this is analogous to listening to someone speak an unknown foreign language. Teachers can develop relevant knowledge through instruction in content areas prior to reading. One method of reading about other people, in fiction or social studies, asks students to think of their own experiences and how their lives compare with the life situation of someone that is described in a text. This procedure activates relevant prior knowledge and recalls experience that aids understanding (e.g., a trip to the dentist).

A body of work related to prior knowledge activation is called “elaboration interrogation.” This procedure encourages students to ask themselves why facts in a text make sense; prior knowledge is stimulated by this

TABLE 13
PRIOR KNOWLEDGE ELICITATION

DEFINITION AND RATIONALE OF INSTRUCTION	PROCEDURES TAUGHT OR PRACTICED	ASSESSMENT
Students possess considerable knowledge of the world that they can use to comprehend what they are being taught and what they read. Prior knowledge affects comprehension by creating expectations about the content, thus directing attention to relevant parts, enabling the reader to infer and elaborate what is being read, to fill in missing or incomplete information in the text, and to use existing mental structures to construct memory representations that facilitate later use, recall, and reconstruction of text.	Teachers encourage children to compare their lives with situations in the text, either prior or during the reading. Teachers ask students to make predictions about content based on their prior knowledge, often in response to pre-reading questions about the text. Teachers have students practice answering inferential, postreading questions by drawing on text information and prior knowledge. Teachers ask students to search the text and to use what they know to answer inferential questions about the text. Teachers ask students to monitor adequacy of answers to questions on the text.	Recall Short-answer questions (cued recall)

procedure (Martin & Pressley, 1991). This suggests that question elaboration, generation (see below), and answering (see below) are related in that they all necessarily activate and use prior knowledge.

The Panel found 14 studies on prior knowledge instruction. Table 13, on the previous page, summarizes the rationale, procedures, and assessment of research studies on prior knowledge instruction.

Evaluation

Grade Level

The activation and use of what the reader knows that is relevant to what is being read has been studied experimentally for students in grades 1 through 9. The distribution of these grade levels is level 1, n = 1; level 2, n = 2; level 3, n = 1; level 4, n = 6; level 5, n = 2; level 6, n = 2; and level 9, n = 1.

Methods

Most of the studies activated knowledge prior to reading by asking the students to think about topics relevant to the passage to be read (five studies). The remaining studies varied in how prior knowledge was made available: teaching the relevant knowledge (two studies), pre-reading (one study), predicting based on one's own experience (one study), making associations during reading (one study), and previewing the story or text (two studies). Two studies did not specify their methods in the abstracts.

Experimenter Tests

Memory measures were the favored method of assessing comprehension. Recall was used in nine studies, question answering was used in three studies, and achievement in content area was used in two studies. All reported significant effects of prior knowledge on these assessments except for one grade 4 study that previewed the text (Spires, 1992).

Summary Evaluation of Prior Knowledge

The activation of relevant world knowledge helps children understand and remember what they read. The activation of prior knowledge occurs naturally in contexts in which subject content is taught by the teacher, and readers then read text that relates to what has been learned. Prior knowledge activation occurs with several strategies, notably question elaboration, generation, and answering.

Psycholinguistic Instruction

Psycholinguistics is "the interdisciplinary field of psychology and linguistics in which language behavior is examined. Psycholinguistics includes such areas of inquiry as language acquisition, conversational analysis, and the sequencing of themes and topics in discourse" (Harris & Hodges, 1995, p. 197).

The Panel found only one study that trained readers on a psycholinguistic skill, for example, understanding the referents of pronouns. This kind of instruction helps young and developing readers recognize "words that stand for other words" in "anaphoric" relationships, that is, personal pronouns or repeated nouns such as when the word "it" refers to a preceding noun, noun phrase, or clause (Baumann, 1986). Baumann's study on teaching 3rd graders anaphoric reference found that the experimental treatment group increased in accuracy in identifying referents. No transfer or standardized tests were used.

Table 14, on the following page, summarizes the rationale, procedures, and assessment of research studies on psycholinguistic instruction.

Evaluation

Grades

The one study involved readers from grade 3.

Summary Evaluation of Psycholinguistic Training

Children may need some instruction in reading contexts to aid them in establishing who is being referred to by personal pronouns. Instruction apparently does work. The lack of studies in this area suggests that much more training on syntactic and semantic relationships could be developed and researched for its effectiveness.

TABLE 14 PSYCHOLINGUISTIC STRATEGY

DEFINITION AND RATIONALE OF INSTRUCTION	PROCEDURES TAUGHT OR PRACTICED	ASSESSMENT
Readers need to learn that words that stand for or refer to other words, e.g., "she" stands for a female referent introduced earlier in the text. This strategy is used to communicate the use of a word or phrase that stands for a preceding word or phase, like a pronoun. Readers come to understand the semantic relationship between a pronoun and the word or phrase to which it refers.	Teachers model or show readers how to identify the antecedents of pronouns and to answer questions based on identified antecedents. Readers learn to identify noun substitutes, verb substitutes, and clause substitutes.	Experimenter Tests Students answer pronoun-specific questions after reading expository or narrative texts. Students write down the antecedents for underlined anaphoric terms in expository text.

Question Answering

When queried by teachers, themselves, or others, young readers experience difficulty in answering questions well. Question-answering instruction is intended to aid students in learning to answer questions while reading and thus learn more from a text. Students can also learn procedures for answering questions or what to do when they cannot answer a question. If students can develop these strategies, their learning from text is facilitated when the answers are available in the text.

There were 17 studies on question answering instruction. Table 15, on the following page, summarizes the rationale, procedures, and assessment of research studies on question-answering instruction.

Evaluation

Grade Level

Question answering begins with students in grade 3 and has been studied up to grade 8. The distribution of reported grade levels is level 3, n = 2; level 4, n = 3; level 5, n = 3; level 6, n = 1; and level 8, n = 1. The preponderance of studies, then, has been on grades 3 through 5.

Experimenter Tests

Improvement in performance by treatment vs. control groups is reported on question answering (nine studies), looking back in text (three studies), question generation (one study), and recall (one study).

Standardized Tests

There are no reports on the use of standardized tests in abstracts of the question answering studies surveyed.

Summary of Evaluation of Question Answering

Instruction of question answering leads to an improvement in answering questions after reading passages and in strategies of finding answers. This improvement occurs in grades 3 through 8. The effects of this method, however, are small.

Question Generation

The goal of reading strategy instruction, in general, is to teach readers to become independent, active readers who use strategies that enhance their comprehension. One strategy that achieves this goal is question generation in which the reader learns to pose and answer questions about what is being read. Without

TABLE 15
QUESTION ANSWERING

DEFINITION AND RATIONALE OF INSTRUCTION	PROCEDURES TAUGHT OR PRACTICED	ASSESSMENT
Question-answering strategy instruction assists students learning from a text. A question focuses the student on particular content and can facilitate reasoning (e.g., answering why or how). In content questions, the information available in the text determines, in great part, the student's ability to answer the questions. Teaching students to look back in the text when they cannot answer a question facilitates their learning. Students can learn to discriminate questions that can be answered based on the text vs. those that are based on their own knowledge and require the generation of inferences or conclusions. Questions after the reading of a passage can lead to reprocessing of relevant text after the reader fails to answer the question.	Teachers ask students questions during or after reading passages of text. Teachers ask students to look back to find answers to questions that they cannot answer after one reading. Teachers ask students to analyze questions with respect to whether the question is tapping literal information covered in the text, information that can be inferred by combining information in the text, or information in the reader's prior knowledge base. Questions often come at the end of science and social studies or in workbooks to accompany texts. These may be used in question answering.	Experimenter Tests - Recall - Short answer questions - Look back in text to answer question

training, young readers are not likely to question themselves. Nor are they likely to use questions spontaneously to make inferences. The assumption of question generation instruction is that readers will learn to engage text by making queries that lead to the construction of better memory representations. The goal is to teach students to make these self-questions while reading. If one asks why, how, when, where, which, and who kinds of questions, it is possible to integrate segments of text, to thereby improve reading comprehension and memory for what is read, and to gain a deeper understanding of the text. Question generation should also increase the reader's awareness of whether the text is being understood. When the teacher is present, the reader's creation of questions may signal success or failure in comprehension and prompt the teacher or the reader to attempt to compensate for comprehension failure. Finally, question generation has been studied in isolation or as a multiple-strategy instruction program such as reciprocal teaching.

In the Panel's search, it located a recent literature review on question generation by Rosenshine, Meister, and Chapman (1996). Rosenshine and his colleagues conducted a meta-analysis of 30 studies that instructed

students how to generate questions during reading, either as a single strategy or in combination with other reading strategies. Of these, 11 studies used the "reciprocal teaching" method, and question generation was part of a set of two or more strategies that were taught. These studies were described in Table 10 above. Nineteen additional studies reviewed by Rosenshine et al. (1996) investigated instruction of question generation alone or in combination with strategies not taught by reciprocal teaching methods.

The Panel found 27 studies on question generation instruction. Table 16, on the following page, summarizes the rationale, procedures, and assessment of research studies on question generation instruction.

Evaluation

The main evaluation of question generation is based on the meta-analysis of Rosenshine, Meister, and Chapman (1996) who employed the same criteria as Rosenshine and Meister (1994) for selection of studies.

Grade Level

The study of question generation instruction begins with grade 3 and has been carried out up to grade 9. The distribution of grade levels in this study of this kind of instruction is level 3, n = 3; level 4, n = 6; level 5, n = 4; level 6, n = 9; level 7, n = 4; level 8, n = 3; level 9, n = 2. The modal level is grade 6.

Experimenter Tests

The respective effect sizes for multiple choice (n = 6), short-answer (n = 14), and summary (n = 3) measures were 0.95, 0.85, and 0.85.

Standardized Tests

The median effect size for 13 studies that used standardized comprehension tests was 0.36. The median effect sizes for standardized vs. experimenter tests are reported in Table 17 (following Table 16), broken down by reciprocal teaching and other treatments. The magnitude of the median effect sizes in Table 17 is approximately the same as that found for reciprocal teaching of multiple strategies. There is an overlap of studies here so that the similarity is likely a result of common studies. It is of interest that although there is a positive effect size for standardized tests, only 3 out of 13 are statistically significant. Experimenter tests fare better here because 16 out of 19 are statistically significant. Thus the effects of instruction of question generation are specific to learning the particular strategy and may not generalize to standardized tests.

Summary Evaluation of Question Generation

There is strong empirical and scientific evidence that instruction of question generation during reading benefits reading comprehension in terms of memory and answering questions based on text as well as integrating and identifying main ideas through summarization. There is mixed evidence that general reading comprehension improved on standardized comprehension tests. Question generation may be best used as a part of a multiple-strategy instruction program.

Story Structure

A story is "an imaginative tale shorter than a novel but with a plot, characters, and setting, as a short story." A "story map" is "a time line showing the ordered sequence of events in a text" or "a semantic map showing the meaning of relationships between events or concepts in the text, regardless of their order." (Harris & Hodges, 1995, pp. 243-244). Story structure refers to the finding in discourse analysis that the content of stories is systematically organized into episodes and that the plot of a story is a set of episodes. Knowledge of episodic content (setting, initiating events, internal reactions, goals, attempts, and outcomes) helps the reader understand the who, what, where, when, and why of stories as well as what happened and what was done.

Story structure instruction is a method by which the teacher teaches the reader knowledge and procedures for identifying the content of the story and the way it is organized into a plot structure. In addition to learning the episodic content, the reader can learn to infer causal and other relationships between sentences that contain the content. This learning gives the reader knowledge and procedures for deeper understanding of stories and allows the reader to construct more coherent memory representations of what occurred in the story.

TABLE 16
QUESTION GENERATION INSTRUCTION

DEFINITION AND RATIONALE OF INSTRUCTION	PROCEDURES TAUGHT OR PRACTICED	ASSESSMENT
The goal of question generation is to teach readers to become independent, active, self-questioners. The assumption is that readers will learn more and construct better memory representation when self-questions are asked while reading. Integrative questions that capture large units of meaning should improve reading comprehension and memory of text by making readers more active while reading. Question generation is often a part of a multiple-strategy program such as reciprocal teaching. Question generation should increase students' awareness of whether they are comprehending text.	Teachers ask children to generate questions during the reading of a passage. The questions should integrate information across different parts of the passage. Teachers ask children to evaluate their questions about whether the questions covered important material, were integrative and could be answered based on what is in the text. Teachers provide feedback on the quality of the questions asked or assist students in answering the questions generated. Teachers teach the students to evaluate whether their questions covered important information, whether the questions were integrative, and whether they themselves could answer the questions.	Experimenter tests - Quality of questions generated - Question answering Standardized comprehension tests

TABLE 17 MEDIAN EFFECT SIZES FOR QUESTION GENERATION
(DATA FROM ROSENSHINE, MEISTER, & CHAPMAN, 1996, APPENDIX D)

RECIPROCAL TEACHING N = 11 STUDIES	STANDARDIZED TESTS	EXPERIMENTER TESTS
Median Effect Size	0.34 (n = 6)	0.88 (n = 7)
Number Significant	0 out of 6	7 of 7
OTHER TREATMENTS		
Median Effect Size	0.35 (n = 7)	0.82 (n = 12)
Number Significant	3 of 7	9 of 12

TABLE 18
STORY STRUCTURE INSTRUCTION

DEFINITION AND RATIONALE OF INSTRUCTION	PROCEDURES TAUGHT OR PRACTICED	ASSESSMENT
Instruction is aimed at teaching the student how stories and their plots are organized into episodes. Readers know a great deal about the content and structure of stories as a genre. However, training in how stories and their plots are organized into episodes can aid a reader in understanding the who, what, where, when, and why of narratives. Stories often entail problems that are faced by people, and they provide a context in which students can learn about problemsolving by experiencing the lives of others. Asking and answering the questions of who, what, when, where, and why, as well as learning about problems and their solutions, are useful procedures that are trans-situational and apply to stories as well as to real life. Knowing the structure of the story and its time, place, characters, problems, goals, solutions, and resolution facilitates comprehension and memory for stories. Stories constitute the bulk of the texts used in elementary school reading.	Teachers teach students to ask and answer five questions: 1. Who is the main character? 2. Where and when did the story occur? 3. What did the main characters do? 4. How did the story end? 5. How did the main character feel? Students learn to identify the main characters of the story, where and when the story took place, what the main characters did, how the story ended, and how the main characters felt. Students learn to construct a story map recording the setting, problem, goal, action, and outcome over time. Students construct a story map while reading stories. Some mapping procedures require recording the setting, problem, goal, action, and outcome information.	Experimenter tests - Retell the story (recall) - Short-answer questions

The Panel found 17 studies on story structure instruction. Table 18, which follows Table 17, summarizes the rationale, procedures, and assessment of research studies on story structure instruction.

Evaluation

Grade Level

Research on story structure instruction begins in grade 3, n = 2, but increases in grade 4, n = 8 (four studies on poor readers). This trend continues into grade 5, n = 7 (on poor readers), and grade 6, n = 2 (on poor readers).

Experimenter Tests

The main kinds of tests used to evaluate experimental training on story structure are recall (n = 10 successes and 1 failure in grade 5 among normal readers), question answering on the stories (n = 8 successes, and 1 failure in grade 5 among normal readers), and identifying the elements of a story structure (n = 5 successes and 2 failures: 1 in grade 3 and 1 in grade 5, both with normal readers). All studies on poor readers report improvement on experimenter tests.

Standardized Tests

Three studies report the use of standardized tests following training in story structure. There were two successes and one failure (grade 5, normal readers).

Summary Evaluation of Story Structure Instruction

Instruction in the content and organization of stories improves comprehension of stories as measured by the ability of the reader to answer questions and recall what was read. This improvement is more marked for less able readers. More able readers may already know what a story is about and therefore do not benefit as much from the training. However, this kind of instruction aids both kinds of readers.

Summarization

A summary is "a brief statement that contains the essential ideas of a longer passage or selection" (Harris & Hodges, 1995, p. 247). To be able to create a summary of what one has just read, one must discern the most central and important ideas in the text. One also must be able to generalize from examples or from things that are repeated. In addition, one has to ignore irrelevant details.

The assumption in teaching students how to summarize what they read is that most students do not summarize well. The central aim of most summarization instruction is to teach the reader how to identify the main or central ideas of a paragraph or a series of paragraphs.

Summarization training is effective. It can be transferred to situations requiring general reading comprehension, and it leads to improved written summaries. Summarization training can make students more aware of the way a text is structured and how ideas are related. If asked to summarize, students have to pay closer attention to the text while they read. They also learn to spend more time on reading and trying to understand what they read. In some instances, training increases the quality of students' note taking and recall of major information (Rinehart, 1986).

The Panel found 18 studies on summarization instruction. Table 19, on the following page, summarizes the rationale, procedures, and assessment of research studies on summarization instruction.

Evaluation

Grade Level

Summarization instruction studies are rare below grades 5 and 6. Of those reporting information on grades studied, we found one level 3 and one level 4. There were four and nine studies on grades 5 and 6, respectively. There was one study at the high school level. Summarization often presupposes writing as well as reading skill. This may be one reason for its use for upper elementary school grades.

Experimenter Tests

The majority of the studies reported improvement of the quality of summaries (n = 11). Other studies reported improved recall of what was summarized (n = 7) and improved question answering (n = 4). No negative findings were reported.

Standardized Tests

Standardized tests were rarely used. Only two studies reported using them on 6th graders; one succeeded and the other failed in increasing comprehension.

TABLE 19
SUMMARIZATION INSTRUCTION

DEFINITION AND RATIONALE OF INSTRUCTION	PROCEDURES TAUGHT OR PRACTICED	ASSESSMENT
The aim of summarization instruction is to teach the reader to identify the main or central ideas of a paragraph or a series of paragraphs. To do so, the reader needs to use prior knowledge of the content of the text as well as knowledge of grammar. Furthermore, the reader has to make inferences that go across sentences and beyond the text. The reader must learn to generalize. Integrating text through main ideas leads to a more organized, succinct, and coherent memory representation of what was read.	Readers are taught to summarize paragraphs by rule application, mainly to delete trivial and redundant information; to use superordinates; and to identify or generate a main idea. The reader is taught through example and feedback to apply any of five rules: 1. Deletion of trivia 2. Deletion of redundancy 3. Superordination, which replaces a list of exemplars with a superordinate term 4. Selection of a topic sentence to serve as a scaffold of the summary 5. Invention of a topic sentence for a paragraph where one was not explicitly stated. Readers gain experience in summarizing single- or multiple-paragraph passages. With multiple paragraphs, readers first summarize individual paragraphs and then construct a summary of summaries or a spatial organization of the paragraph summaries.	Recall of expository or narrative text Question answering with open or multiple-choice answers

Summary Evaluation of Summarization

The instruction of summarization succeeds in that readers improve the quality of their summaries of text, mainly in identifying the main idea but also in leaving out detail, including ideas related to the main idea, generalizing, and removing redundancy. This result indicates that summarizing is a good method of integrating ideas and generalizing from the text information. Furthermore, instruction in summarization improves memory of what is read, both in free recall and in answering questions. This strategy of instruction is used as part of reciprocal teaching and other treatments that teach multiple strategies. It is an important component.

Teacher Preparation for Text Comprehension Instruction

Teachers have to learn how to teach reading comprehension strategies and procedures. Teachers can do this by becoming more aware of, and being prepared on, the procedures and processes of good comprehension of text. Teachers need to learn how to interact with students during the reading of a text to teach them reading comprehension strategies at the right time and right place. The goal of teacher preparation for text comprehension instruction is to provide teachers with opportunities to learn about the cognitive processes that occur in reading, how to instruct in comprehension strategies that can be utilized by the reader, how to teach strategies through demonstration and other techniques, how to explain them, how to allow the student to learn and use them in the context of reading a text, and how to use individual strategies in conjunction with several other reading comprehension strategies.

Teacher preparation on strategy instruction is recent and rare. When teachers receive and implement training on strategy instruction, reading comprehension improves. The idea of the teacher as a modeler of thinking strategies and as a coach facilitating them is new. As a result, few teachers have received practical preparation in the teaching of cognitive strategy instruction (Anderson & Roit, 1993; Duffy, 1993).

Four studies were found on teacher preparation instruction. Table 20, on the following page, summarizes the rationale, procedures, and assessment of these research studies. The next section of this report conveys a more detailed analysis of preparation of teachers in strategies, focusing on recent, successful programs that occur in natural reading contexts involving transactions among the reader, teacher, and text.

Evaluation

Grade Levels

Teachers were prepared to teach students multiple strategies for text comprehension from grades 2 through 11. The distribution is fairly uniform over this range of grades. Of interest is the fact that all the studies, save one (Franklin, 1993), were carried out on "poor readers," "disabled students," or "low achievers."

Experimenter Tests

With respect to the teachers' learning and faithfulness to the treatment, all six studies claim success. With respect to student benefits from the teachers who were prepared in instructing multiple reading strategies, two studies report improvement in the subject matter of the instruction.

Standardized Tests

Two studies report success in improving performance on standardized comprehension tests.

Summary Evaluation of Teacher Preparation to Teach Text Comprehension

This is a very important area for study. To implement the teaching of reading strategies in naturalistic classroom environments, it is important to know how and whether teachers can be effectively prepared in instructional procedures. Furthermore, it is important to learn about time and other costs that are associated with such instruction. Finally, it is important to determine whether students as well as teachers learn and benefit from the teacher preparation. This small set of studies indicates that teachers can learn to implement comprehension strategy instruction in the classroom under natural teaching circumstances. It also suggests that students benefit from such instruction by prepared teachers. There is a need to carry out additional preparation studies of this kind with a wider range of readers. Normal readers, as well as others who are less skilled in reading, could benefit from implementation of the teaching of multiple reading comprehension strategies, not only in reading instruction but in content areas as well.

TABLE 20
TEACHER PREPARATION ON COMPREHENSION INSTRUCTION

DEFINITION AND RATIONALE OF INSTRUCTION	PROCEDURES TAUGHT OR PRACTICED	ASSESSMENT
The aim of teacher preparation is to instruct teachers in teaching reading comprehension strategies in the classroom context and in natural interaction with students.	Teachers undergo preparation in multiple strategies and explanation of strategies. Teachers are instructed in strategic reading techniques and a collaborative transactional approach to reading informational texts. Teachers are prepared to make decisions and explain mental processing associated with reading skills as strategies. Self-evaluative workshops are often used for learning and feedback. Teachers also learn from the use of transcripts of lessons, videos, and post-lesson interviews.	Experimenter tests Fidelity to treatment by teachers: - Do teachers learn and teach the strategies in which they were trained? - Videotape pre- and posttests - Reading sessions Comprehension by students: - Do students learn and practice the strategies taught? - Do students show gains in reading comprehension? Awareness of lesson content Achievement in content learning Standardized reading tests

TABLE 21
VOCABULARY INSTRUCTION AND RELATION TO COMPREHENSION

DEFINITION AND RATIONALE OF INSTRUCTION	PROCEDURES TAUGHT OR PRACTICED	ASSESSMENT
The aim of vocabulary instruction is to use instruction and reciprocal teaching methods to teach strategies for discovering the meanings of unfamiliar words. Intensive vocabulary instruction is designed to promote word knowledge that will enhance text comprehension.	Teacher models being a "word detective," looking for contextual clues to find word meaning, a synonym, or an antonym by analyzing words and word parts and by looking at surrounding text description for clues to meaning. Teachers elaborate on word meanings and use them in diverse contexts, adding activities to extend use of learned words beyond the classroom. The learning tasks provide definitions, knowledge, fluent access to word meanings, context interpretation, and story comprehension. Students encounter words multiple times (16 to 20), highlight and use vocabulary terms to generate inferences, complete sentence stems, generate contents or situations appropriate to target words, and fill in words that are missing in a Cloze procedure.	Experimenter Tests - Word meanings - Cloze tests Standardized tests

Vocabulary Instruction and Relation to Comprehension

Vocabulary knowledge is correlated with reading comprehension (see the Comprehension I report). The rationale and procedures for teaching vocabulary are found in Beck, Perfetti, and McKeown (1982).

The instruction of vocabulary and assessment of learning vocabulary with respect to comprehension can show whether this correlation is, in fact, causal. Although the first section of the subcommittee report shows that vocabulary can be acquired through instruction, few of those studies examined whether successful instruction of vocabulary leads to increased comprehension. Four studies were found on vocabulary-comprehension instruction. Table 21, which follows Table 20, summarizes the rationale, procedures, and assessment of research studies on vocabulary and its relation to comprehension instruction.

Evaluation

The Panel found two studies by McKeown (1983, 1984) on teaching vocabulary that also assessed students on comprehension. These 4th grade students were tested on word meanings, Cloze procedures, and story comprehension. The author reports success in learning of the words and use of word meanings and in increased story comprehension. In addition, there is a study by Tomeson and Aarnouste (1998), who applied reciprocal teaching methods to teach vocabulary to 4th grade students. Students learned to derive word meanings from text, but transfer to more general reading comprehension as assessed by a Dutch standardized test was not successful.

Summary Evaluation of Vocabulary Instruction and Relation to Comprehension

More experimental studies on the relationship between learning vocabulary and reading comprehension are needed. There is a high correlation between vocabulary knowledge and comprehension. Is there a causal direction between learning vocabulary and improving reading comprehension? Furthermore, vocabulary learning is a part of normal content area learning. Instruction in vocabulary in content areas may lead to better reading and listening comprehension and to improvement in course achievement. This is a promising area of research because it bridges early reading skill development and later comprehension training.

Appendix B

This Appendix summarizes information on three questions:

- What are the claims in the literature about the effectiveness of instruction on comprehension?
- What grades have been studied?
- What are some of the implications for instruction in the classroom?

Table 22, on the following page, provides information on the 16 categories of instruction to answer these questions. For each category, there are sections that describe the effects claimed by the researchers, the grade levels that were studied, and ways in which the method might be taught in a classroom setting.

TABLE 22
RELEVANCE OF INSTRUCTION

TYPE OF INSTRUCTION	HOW EFFECTIVE?	GRADE LEVELS STUDIED	HOW TAUGHT?
Comprehension Monitoring	Children can be taught to monitor their comprehension and become aware of when and where they are having difficulty during reading. They can learn procedures to assist them in overcoming the problem that they are having withunderstanding what they are reading. This training has specific and general transfer benefits. The main transfer is to improved detection of text inconsistencies and memory for the text and improved performance on standardized reading comprehension tests.	2 to 6	Comprehension monitoring can be taught through teacher modeling of the process and practice by children in doing it during reading. Comprehension monitoring can be taught in natural reading contexts where children read aloud and have difficulty with word recognition or word and sentence meaning. Teachers can be trained on how to teach comprehension modeling either preservice or inservice. They can be taught how to think aloud and to communicate their own understanding processes to the students. The students can learn with feedback to look back or forward in the text and to use the text to find clues as to the meaning of words and sentences. Comprehension monitoring can be taught as a part of a larger program of reading strategies in interaction with the teacher in natural reading or content areas.

TABLE 22
RELEVANCE OF INSTRUCTION (CONTINUED)

TYPE OF INSTRUCTION	HOW EFFECTIVE?	GRADE LEVELS STUDIED	HOW TAUGHT?
Cooperative Learning	When students as peers tutor or instruct one another or interact over the use of reading strategies, the evidence is that they learn reading strategies. They engage in intellectual discussion, and they increase their reading comprehension. This procedure develops independent learning by children and frees the teacher for other activities and students. The students gain more control over their learning and social interaction with peers. The study of cooperative learning in natural reading contexts and as a part of a program of instruction that uses multiple strategies needs to be done. Teacher training studies on how to teach cooperative learning in natural reading contexts need to be done.	3 to 6	Cooperative learning or peer tutoring can be developed in group reading situations where students work together to learn and use reading comprehension strategies. Cooperative learning can be a part of a natural reading program where peers as well as the teacher engage in a transaction over the meaning of a text in a content area or in reading instruction. Teachers can be trained on how to develop cooperative learning, either in experimental investigations, or in preservice or inservice development.

TABLE 22
RELEVANCE OF INSTRUCTION (CONTINUED)

TYPE OF INSTRUCTION	HOW EFFECTIVE?	GRADE LEVELS STUDIED	HOW TAUGHT?
Curriculum	The variation and complexity of curricula across these studies does not permit one to argue for the scientific support of a particular curriculum nor for the particular strategies added to the instruction Because the kinds of strategies added to a given curriculum works when studied in isolation or as a part of a set of multiple strategies, adding them to an existing reading curriculum or to content area curricula should enhance learning, comprehension, and course achievement.	2 to 4	Teachers can be trained in instruction of a variety of strategies. They can learn to teach these strategies in reading or content area instruction. Teacher preparation studies are needed to assess their fidelity to treatment and the effectiveness of the strategies as part of a curriculum. Fidelity of the students' learning of the strategies needs to be assessed in natural reading or content area instruction The relationships of teacher preparation and student learning of strategies needs to be assessed in terms of general transfer to comprehension tests, but, more importantly, to improved content area achievement.

TABLE 22
RELEVANCE OF INSTRUCTION (CONTINUED)

TYPE OF INSTRUCTION	HOW EFFECTIVE?	GRADE LEVELS STUDIED	HOW TAUGHT?
Graphic Organizer	Teaching students to use external aids and writing to organize their ideas about what they are reading is a proven procedure that enhances comprehension for text. The use of systematic, visual or semantic graphs on the content of a passage benefits the student in terms of better memory for what was read. Furthermore, this preparation, when done in Social Studies and Science content areas, facilitates memory and content area achievement. Teaching teachers to use graphic organizers has not been studied. The use of graphic organizers as a part of a reading instruction program has not been studied.	2 to 8	Teachers could be trained to teach students how to graphically represent ideas and relations for either narrative or expository text while reading in either a natural reading or content area instructional context. Studies on teacher preparation and student learning, fidelity to treatment, and general comprehension effects of this procedure in natural contexts and as a part of a package of strategies needs to be studied. Teacher preparation on the use of this strategy could be done preservice or inservice.

TABLE 22
RELEVANCE OF INSTRUCTION (CONTINUED)

TYPE OF INSTRUCTION	HOW EFFECTIVE?	GRADE LEVELS STUDIED	HOW TAUGHT?
Listening	Instruction on learning to listen to others (teachers or peers) while reading may benefit readers' comprehension in specific and in more general ways. The number of studies on listening is small, and listening's effectiveness lacks a strong scientific base. Teaching teachers to teach students how to listen to the teacher and to peers who read orally needs to be studied further. It is likely that listening occurs informally as part of reading and content area instruction.	1 to 6	Teachers can be trained to teach students listening skills when the teacher or peers read. The teacher assesses comprehension through questioning. Fidelity to treatment of teachers and students needs to be assessed in studies of the effectiveness of instruction on listening during reading. Instruction on listening during reading could be added to instruction of a package of reading comprehension strategies in the teaching of reading or content area

TABLE 22
RELEVANCE OF INSTRUCTION (CONTINUED)

TYPE OF INSTRUCTION	HOW EFFECTIVE?	GRADE LEVELS STUDIED	HOW TAUGHT?
Mental Imagery	Instructing readers to imagine what they are reading and coding what they imagine with a keyword cue facilitates readers' memory what they have read. This method is useful for imagining the referents of individual sentences. This method seems to be limited to memory for particular sentences No studies on preparation of teachers or students on the use of imagery in reading or content areas have been done.	2 to 8	The use of imagery is an easy strategy to teach. Teachers could be trained to use it appropriately at sentences during the reading of text in natural reading or content areas. This method would actively engage the reader to use mental processes that lead to good recall. Furthermore, it could be used during oral reading and listening because imagery is easier when listening than when reading. This strategy could be added to a repertoire of strategies.

TABLE 22
RELEVANCE OF INSTRUCTION (CONTINUED)

TYPE OF INSTRUCTION	HOW EFFECTIVE?	GRADE LEVELS STUDIED	HOW TAUGHT?
Mnemonic	This method is similar to graphic organizers (Pressley et al., 1989). The use by students or teachers of keywords or concepts to organize main ideas and relationships or to generalize from instances can lead to better specific memory. The use of an external referent such as a picture has limited utility.	8 Its use in other grades has not been studied. It is similar to graphic organizers that have proven use in grades 2 to 8.	Teachers could be taught to use words as concepts or classes to help students organize ideas that are subordinate or related to main ideas. This teaching could be part of an instruction program in reading or in a content area.

TABLE 22
RELEVANCE OF INSTRUCTION (CONTINUED)

TYPE OF INSTRUCTION	HOW EFFECTIVE?	GRADE LEVELS STUDIED	HOW TAUGHT?
Multiple Strategies	There is very strong empirical, scientific evidence that the instruction of more than one strategies in a natural context leads to the acquisition and use of these reading strategies and transfers to standard comprehension tests. Preparation of teachers in the use of multiple strategies in interactive instruction has been successful (see Teacher Preparation below).	3 to 8	Teachers can be trained in the use of multiple strategy instruction in natural reading or content areas. Current programs of transactional research are promising examples of this. Fidelity to treatment by both teachers and students is desired and should be studied. Studies need to be done on when, where, and how to implement strategy instruction in natural instructional contexts. Teachers could be trained on multiple reading strategy instruction in-service or pre-service. The instruction of multiple reading strategies should not be restricted to poor reader.

TABLE 22
RELEVANCE OF INSTRUCTION (CONTINUED)

TYPE OF INSTRUCTION	HOW EFFECTIVE?	GRADE LEVELS STUDIED	HOW TAUGHT?
Prior Knowledge	The activation of relevant world knowledge helps children understand and remember what they read. The activation of prior knowledge occurs naturally in contexts where subject content is taught by the teacher and readers then read text that relates to what has been learned. It is not clear that this procedure has to be explicitly taught, especially in content areas.	2 to 6	Teacher teach content areas in a variety of ways which provide the kind of knowledge that readers can later activate to understand the current text. Prior knowledge studies indicate that prior learning or learning that precedes reading enhances comprehension of what is read. In this sense, reading about a subject after learning about it in other ways would be a part of a program of instruction in a content area. Research on how learning content prior to reading about it and its benefits needs to be studied.

TABLE 22
RELEVANCE OF INSTRUCTION (CONTINUED)

TYPE OF INSTRUCTION	HOW EFFECTIVE?	GRADE LEVELS STUDIED	HOW TAUGHT?
Psycholinguistic	Children may need some instruction in reading contexts to aid them in establishing who is being referred to by personal pronouns. Instruction apparently does work here. The lack of studies here suggests that much more training on syntactic and semantic relationships could be developed and researched for its effectiveness.	4 Its use in other grades has not been studied. Instruction on how to use knowledge of syntax, semantics, text properties, and text genre has not been done.	Teachers might benefit from preparation in linguistic and discourse analyses and how to teach children how to deal with complexity of sentences and genres. This has been successfully done with stories as a genre (see Story Structure below). Children need more experience in early exposure to expository (non-narrative texts) so that they can learn properties and strategies of coping with this kind of text. This is best done by earlier introduction to texts on Science and Social Studies. Teachers could teach children about understanding complexities of sentences and different genres by their adoption earlier in the reading and content area curricula. The teaching of understanding of these kinds of texts would involve the use of modeling of as well as sue of procedures for teaching other reading comprehension strategies.

TABLE 22
RELEVANCE OF INSTRUCTION (CONTINUED)

TYPE OF INSTRUCTION	HOW EFFECTIVE?	GRADE LEVELS STUDIED	HOW TAUGHT?
Question Generation	There is strong empirical and scientific evidence that instruction of question generation during reading benefits reading comprehension in terms of memory and answering questions based upon text as well as integrating and identifying main ideas through summarization. There is mixed evidence that general reading comprehension is improved on standardized comprehension tests. Question Generation may be best used as a part of a multiple strategy instruction program. Question Generation enables the student to be actively involved in reading and to be motivated by his own queries rather than those of the teacher in question answering.	3 to 9	Question generation should be part of a program of instruction of reading comprehension strategies in a natural reading or content area context. Teachers can be taught to ask readers to generate questions and to provide feedback in these contexts. Students can learn to generate and find answers to their own questions. Fidelity to treatment by teachers and students needs to be assessed. The relation of successful learning needs to be related to content area achievement as well as standardized tests.

TABLE 22
RELEVANCE OF INSTRUCTION (CONTINUED)

TYPE OF INSTRUCTION	HOW EFFECTIVE?	GRADE LEVELS STUDIED	HOW TAUGHT?
Question Answering	Instruction of Question Answering leads to an improvement in answering questions after reading passages and in strategies of finding answers.	3 to 8	Question asking by teachers and question answering by students is a part of natural reading and content area instruction. It should be explicitly taught to teachers with the addition that they give feedback on answers and elaborate the feedback in the context of the text or content area being taught. Question asking and feedback on the content of the answer should be made a part of programs that give instruction of multiple reading comprehension strategies. Teacher and student preparation on question answering, feedback, and ways to find information that answer questions should be studied in natural instructional contexts on reading and content areas. Teachers could be trained inservice or preservice.

TABLE 22
RELEVANCE OF INSTRUCTION (CONTINUED)

TYPE OF INSTRUCTION	HOW EFFECTIVE?	GRADE LEVELS STUDIED	HOW TAUGHT?
Story Structure	The instruction of the content and organization of stories improves comprehension as measured by the ability of the reader to answer questions and recall what was read. This improvement is more marked for less able readers. More able readers may already know what a story is about and therefore do not benefit as much from the preparation. However, this kind of instruction aids both kinds of readers.	3 to 6	Teachers can be prepared to teach story structure through the use of questions and graphic organizers (story maps). They should not teach story grammar categories per se but rather should focus on the characters, the settings, what happened, how characters felt, what they thought, what they wanted to do, what they did, and how things turned out. When the reading material is narrative, question answering and generation strategies can be used by teachers to draw out the content and organization of stories crucial to the student building a representation of the episodic structure and causal relationships. The use of questions to learn story structure can be a part of a program of instruction of comprehension strategies in natural reading or content areas.

TABLE 22
RELEVANCE OF INSTRUCTION (CONTINUED)

TYPE OF INSTRUCTION	HOW EFFECTIVE?	GRADE LEVELS STUDIED	HOW TAUGHT?
Summarization	The instruction of summarization succeeds in that readers improve on the quality of their summaries of text, mainly identifying the main idea but also in leaving out detail, including ideas related to the main idea, generalizing, and removing redundancy. Summarizing is a good method of integrating ideas and generalizing from the text information. Instruction of summarization improves memory for what is read, both in terms of free recall and answering questions. This strategy instruction has been used as a part of reciprocal teaching and other treatments that teach multiple strategies. It is an important component.	3 to 6	Rules and procedures for the summarization of single and multiple passages can be taught to teachers either inservice or preservice. It is an important strategy for integration and generalization of information found in a text. It is an integral part of multiple strategy instruction and has been widely implemented and studied.

TABLE 22
RELEVANCE OF INSTRUCTION (CONTINUED)

TYPE OF INSTRUCTION	HOW EFFECTIVE?	GRADE LEVELS STUDIED	HOW TAUGHT?
Teacher Preparation	This is a very important area for study. In order to implement the teaching of reading strategies in naturalistic classroom environments, it is important to know how and whether teachers can be effectively prepared in the instructional procedures. Further, it is important to learn about the time and other costs that are associated with such instruction. Finally, it is important to determine whether the students as well as the teachers learn and benefit from the teacher preparation. The small set of studies on teacher preparation indicate that teachers can learn to implement multiple comprehension strategy instruction in the classroom under natural teaching circumstances. The research also suggests that students benefit from such instruction by prepared teachers.	2 to 11 Mostly on poor readers. There is a need for studies on normal and above average readers.	There is a need to carry out further preparation studies of this kind and on a wider range of readers in natural reading and content area instruction. These preparation studies should focus on the implementation of the teaching of several kinds of reading comprehension strategies that have been proven singly or multiply in scientific studies. This implementation should be done in natural occurring contexts, especially in content areas. Normal readers as well as others who are less skilled in reading could benefit from implementation of the teaching of multiple reading comprehension strategies, not only in reading instruction, but in content areas as well. Fidelity to treatment by teachers and students needs to be assessed. The relation of successful learning and teaching by teachers and of successful learning and use of strategies to content area achievement needs to be assessed rather than transfer to general reading comprehension tests.

TABLE 22
RELEVANCE OF INSTRUCTION (CONTINUED)

TYPE OF INSTRUCTION	HOW EFFECTIVE?	GRADE LEVELS STUDIED	HOW TAUGHT?
Vocabulary-Comprehension	Three studies on instruction report increased word meaning and improvements on experimenter tests of story comprehension or standardized comprehension tests.	4 (see initial section of report on Vocabulary Instruction for a wider range of grades)	Teachers can be prepared to teach word meanings and strategies to create them while reading. Students can learn vocabulary through instruction of word meanings in the context of reading instruction or content area instruction. Basic and classroom research on vocabulary instruction, its effectiveness and its relationship to reading comprehension is needed.