DOCUMENT RESUME

ED 328 904 CS 010 433

AUTHOR	Burdick, Patricia M.; Denner, Peter R.
TITLE	Effects of Training Ninth-Grade Students in the Two Methods of Self-Questioning: Why Train Students to Self-Question When They Can Simply Reread?
PUB DATE	Mar 91
NOTE	38p.; Paper presented at the Annual Reading Research Conference of the Washington Organization for Reading Development (16th, Bellevue, WA, March 14-16, 1991).
PUB TYPE	Speeches/Conference Papers (150) -- Reports - Research/Technical (143)
EDRS PRICE	MF01/PC02 Plus Postage.
DESCRIPTORS	Grade 9; Junior High Schools; Learning Strategies; Metacognition; *Reading Comprehension; Reading Research; *Reading Strategies; Recall (Psychology)
IDENTIFIERS	Comprehension Monitoring; Idaho; *Self Questioning Techniques

ABSTRACT

A study examined the effects of training students in two kinds of self-questioning strategies, critical self-questioning and interpretive self-testing, on their acquisition of information from a science text. Subjects, 175 ninth-grade students from a junior high school in southeastern Idaho, were blocked according to their reading ability and then randomly assigned to one of three experimental conditions (critical self-questioning, interpretive self-testing, or read/reread control). The expository text passages used for training were adapted form a ninth- to twelfth-grade life-science textbook. The dependent measure consisted of 36 fill-in-the-blank items that assessed recall of six types of information directly stated in the final experimental passage about spiders. Results indicated that the two self-questioning strategies did not enhance students' overall knowledge acquisition when compared to rereading. The same pattern of results was found across five of the six kinds of information tested with the exception of classification items, where the students in the self-questioning groups significantly outperformed students in the control group without differing significantly from each other. Findings do not support the idea that content area teachers take class time to train students to self-question. (Eight tables of data are included; 32 references are attached.) (RS)

Effects of training ninth-grade students in two methods of self-questioning: Why train students to self-question when they can simply reread?

Patricia M. Burdick

Peter R. Denner

Department of Education

Idaho State University

Paper presented at the 16th annual Reading Research Conference of the Washington Organization for Reading Development, Bellevue, Washington, March 14-16, 1991.

ABSTRACT

This study examined the effects of training ninth-grade students in two kinds of self-questioning strategies, critical self-questioning and interpretive self-testing, on their acquisition of information from a science text. Contrary to our expectations the two self-questioning strategies did not enhance students' overall knowledge acquisition when compared to rereading. The same pattern of results was found across five of six kinds of information tested with the exception of classification items, where the students in the two self-questioning groups significantly outperformed the students in the read/reread control without differing significantly from each other. In general, the results do not support the idea that content-area teachers take class time to train students to self-question. Comparable information was acquired when students were simply instructed to reread the material.

Effects of training ninth-grade students
in two methods of self-questioning: Why train students
to self-question when they can simply reread?

In recent years, some educators have advocated direct instruction in comprehension processes, a **"process-into-content"** approach to content-area instruction (Roehler, Duffy & Meloth, 1984), as opposed to direct instruction in content only (the traditional approach). They contend that content-area teachers should train students in the processes required for understanding content and in the processes necessary to monitor their own comprehension (Nessel, 1987; Roehler, Duffy & Meloth, 1984; Seretny & Dean, 1986). According to this view, training students to use comprehension strategies and to monitor their application should lead to more effective comprehension and, in turn, facilitate the acquisition of content knowledge.

The research conducted to date has supported the idea that explicit instruction in comprehension and knowledge acquisition strategies improves students' active participation in the monitoring of their own learning (Cross & Paris, 1988). Among the strategies which have been investigated are (a) critical self-questioning (Miller, 1987; Nolte & Singer, 1985), and (b) self-testing (Andre & Anderson, 1978-79; Davey & McBride, 1986a, 1986b; King, 1989; King, Biggs, & Lipsky, 1984). To distinguish these two strategies for the purpose of this investigation, critical self-questioning is defined as a monitoring process by which the reader determines the extent to which he or she is understanding the intended message of the author; while self-testing is defined as the self-assessment of the mastery level which one has achieved in preparation for a test.

Critical Self-Questioning

A direct approach to comprehension monitoring instruction comes in the form of critical self-questioning or self-talk (Miller, 1987; Miller, Giovenco, & Rentiers, 1987). Critical self-questions are self-reflective in that they require students to become more aware of their own processing during the reading of text. They are critical in the sense that they require students to analyze how the processing is going. As an illustration, a critical self-question that a student might ask during reading is "How well do I understand this material so far?" From the studies conducted to date (Miller, 1985; Miller, 1987; Miller, Giovenco, & Rentiers, 1987, Nolte & Singer, 1985), it can be concluded that instruction in critical self-questioning is successful in producing positive effects on comprehension and in assisting students toward active participation in the direction of their own learning.

Self-testing

An alternative approach to self-questioning and the development of metacognitive awareness is to focus on self-testing. This strategy encourages students to be more aware of task demands and the kinds of questions teachers might ask so they can learn to test themselves. A key element of the self-testing approach is training students to monitor how the comprehension process is going and whether their learning goals are being met.

The first study to focus on training students in self-questioning was conducted by Andre and Anderson (1978-1979). The study of seniors in high school found that those trained in a self-testing study strategy generated more "good questions" (questions that targeted main ideas) compared to an untrained read/reread control group. Self-testing was also shown to improve retention of the main ideas targeted by the questions. Similar findings were obtained by Drener & Gambrell (1985) immediately following self-questioning training for sixth grade boys. However, a follow-up assessment of the transfer value of the training suggested that the boys did not independently maintain the self-testing stragegy beyond the initial training sessions.

Using narrative text instead of expository text, Singer and Donlan (1982) trained a group of eleventh grade students to formulate and to answer self-posed questions. Students in the experimental group were taught five story elements; the leading character, the character's goal, obstacles, outcomes of the struggle to achieve goals and the theme. Students listened to the recording of six different passages over a three week period. At specific intervals the recording was paused, students in the experimental group were instructed to generate three questions that they wanted to answer as the story progressed while students in the control group were asked story-specific or "teacher-provided" questions. The final quiz was made up of questions dealing with the previously mentioned characteristic elements of a short story. The results revealed superior performance on the part of the experimental group suggesting that instruction in self-testing can help students improve processing of narrative text.

In a more recent investigation using expository text, Davey and McBride (1986a) investigated the effects of training a group of sixth-graders in the use of two types of questions (those linking information across sentences and those tapping the most important information). There were a total of five experimental groups: (1) question training, (2) no-question control, (3) question-generation practice, (4) inference question practice, and (5) literal-question practice. Although groups three, four, and five were each directed to engage in self-testing, they did not receive any training in how to go about generating self-test questions. Group two, the no-question control merely read thepassage once. Results of the study favored the trained group compared to the four other groups on several comprehension and metacomprehension measures.

The purpose of the present study was to determine which of the two comprehension monitoring training approaches, critical self-questioning or interpretive self-testing, is most effective in improving ninth grade students' acquisition of information contained in an expository text. These two methods were not compared in any of the previous investigations of self-questioning. Given that content-area teachers can be expected to train students to use only one strategy at a time, it important to determine which of these strategies is most useful for increasing content knowledge and therefor 'crth the effort.

Reading Ability

Reading ability was also included as a factor in the present investigation because of its potential to moderate the effect of any reading or study method. We predicted that below average readers should benefit most from strategy instruction, because they typically assume a more passive role during the reading process (Ryan, Ledger, Short, & Weed, 1982), and they often operate on minimal awareness of how to monitor and regulate their own learning (Owings, Peterson, Bransford, Morris & Stein, 1980). Training in self-questioning ought to help them to overcome these deficiencies. However, above-average readers have also been demonstrated to benefit from self-questioning training (reference). Therefore, a second major purpose of the present investigation was to determine whether reading ability interacted with the type of trained self-questioning for junior high school readers. It was further predicted that below average readers would benefit most from training in critical self-questioning, while above-average readers would benefit most from self-testing.

Components of Strategy Instruction

The process-into-content approach to strategy instruction suggests that the best way to assure student control over a specific strategy is to guide them there (Anthony & Raphael, 1989; Roehler, Duffy & Meloth, 1984). In addition, research has determined that successful guidance involves several key factors. First, students must be aware of why the strategy is appropriate and the benefits to be gained from its use (Brown, 1982; Cross & Paris, 1988; Roehler et al., 1984; Pressley, Johnson, Symons, McGoldrick, & Kurita, 1989). Second, students must understand the thinking processes necessary to make sense out of text (Cross & Paris, 1988; Roehler et al., 1984); that is, the steps one should take to achieve an answer must be specified instead of merely emphasizing the correct answer. Third, a think-out-loud modeling of the strategy by the instructor must take place so students can internalize the mental processes involved in effective strategy use (Cross & Paris, 1988; Pressley et al., 1989; Roehler et al.. 1984). Fourth, strategy instruction must involve real content materials rather than isolated exercises (Roehler et al., 1984). Fifth, students must be given an opportunity to apply the strategy with guided practice using real content materials (Cross & Paris, 1988; Pressley et al., 1989; Roehler, Duffy, & Meloth, 1984). A corollary of this component is to promote collaboration among students as they apply the strategy (Roehler et al., 1984). Finally, the focus throughout training must be on strategy use (process) rather than primarily on the content to be learned (Roehler et al., 1984).

Under investigation in this study is the use of direct instruction in training students to engage in two self-questioning strategies; critical self-questioning, and interpretive self-testing. The training sessions instantiated all elements of a process-into-content approach to strategy training as described above.

METHODS

Subjects

The 180 ninth-grade students from a junior high school in southeastern Idaho volunteered to participate in this study. The students were first blocked according to their reading ability based upon a median split (Md = 64.00; Q= 17.00) of their current standardized reading achievement test scores and then randomly assigned to one of three experimental conditions (critical self-questioning, interpretive self-testing or read/reread control). Due to absence because of illness, or to an inability to obtain achievement test scores, five of the students who initially volunteered were eliminated from the final analyses. Therefore, the number of subjects completing the experiment was n = 175.

Materials

The expository text passages used for the training and testing phases of this study were selected from a 9-12 grade life-science textbook (Teter, Edwards, Fitzpatrick & Bain, 1985) and were adapted (with permission) to meet the needs of this research. The adaptations consisted first of reorganizing the passages into a common format, so that the same categories of information were addressed in the same order with similar side headings. A second kind of adaptation consisted of the addition of information from other sources, along with some rewriting of paragraphs to integrate the additional information with the already present passage information. This was done to make all the passages similar in length and in the amount of information presented per major side heading.

Each of the fcur expository text passages presented descriptive information about a common life-science topic: sponges, worms, mollusks, or spiders. Each passage conveyed information about the scientific classification of the organism, general physical description, major body systems, habitat, food sources, reproductive process, and some affects the organism has for humans (either harmful, beneficial or both). The results of the Dale-Chall (1954) readability test revealed an 8th - 9th grade reading range for each of the adapted text passages.

Instruments

The dependent measure consisted 36 fill-in-the-blank items that assessed recall of six types of information directly stated in the final experimental passage about spiders. The test items were developed using sentences extracted directly from the spider passage from which an important word or phrase was omitted. Six test items targeted each of the six kinds of passage information: (1) general classifications, conveying information about immediate superordinate and subordinate relations, (2) general characteristics, conveying information about descriptive properties and traits generic to all spiders, (3) characteristics of specific parts, conveying information about the attributes of prototypic parts of spiders, (4) vocabulary terms, covering the scientific names of key parts of spiders or their actions (these terms appeared in bold print in both the original text and in the experimental passage), (5) general actions, conveying information about the prototypic actions and activities of spiders, and (6) actions of specific parts, conveying information about the typical actions or purposes of specific prototypic parts of a spider. The above categories covered the main types of information cognitive psychologists have identified as typical of a state schemata (Anderson & Pearson, 1984; Just & Carpenter, 1987; Rumelhart & Ortony, 1977).

Procedures

All teachers (trainers) were college graduates with prior experience teaching at the secondary level. To equate teacher effects across treatment conditions, each of the teachers was randomly assigned to one treatment for the first class period of the school day and then a rotation system was followed for the remaining 6 class periods. Overall, each teacher instructed an approximately equal number of students under each of the experimental conditions.

The teachers and the principal investigator met together on three separate occasions for a total of six hours. An identical training packet was received by each teacher. Each packet contained a day by day lesson plan for each treatment group. Together the teachers reviewed and revised each lesson until there was agreement about the clarity and the appropriateness of the language utilized for ninth graders. While instructing the other teachers, the principal investigator stressed the fact that the expected procedures must be followed exactly. Concerns and questions posed by the teachers were addressed. until each teacher was confident she could follow the procedures and teach the strategy lessons.

Instructional sessions (training students to use either a critical self-questioning strategy or interpretive self-testing strategy) took place during regularly scheduled reading classes. Students were sent to separate classrooms and teachers according to their randomly assigned treatment conditions. All students received strategy instruction for three days. The participants were also informed of the purpose of their assigned study strategy for enhancing learning from text and that they would be required to apply their assigned study method following strategy training.

Students in the self-questioning groups received training in either critical self-questioning or interpretive self-testing. In each case, appropriate use of the self-questioning technique was initially modeled by the teacher. Practice was then carried out in a group setting or independently in a planned sequence. Subjects in the read/reread control group, were taught the overall value of rereading as a strategy for learning. Key ideas related to the value of rereading were summarized by the teachers. The students were then instructed to read the passage and then to re-read it. This procedure was repeated for each instructional phase to equate the groups in time on task and also to familiarize all students with the common structure of the passages.

On the fourth day, all students performed independently on the final passage using the strategy they had been trained to use. On the final day all students were given the same 36 item completion test assessing their acquisition of the six categories of information contained in the final passage (spiders).

Design

This study used a 2 (below-median readers versus above-median readers) by 3 (critical self-questioning, interpretive self-questioning, and read/re-read control) factorial design with reading ability and type of trained study method as the between subjects factors. The separately analyzed dependent measures incluc i total cued-recall and recall by type of information acquired. The alpha level was set at .05 for all tests of significance.

Power estimates were made of the above described design prior to conducting the experiment using procedures outlined by Stevens (1990). An evaluation of power was made to determine whether the sample size (n = 175) was sufficient to afford a reasonable chance of rejecting the hypothesis of no difference among the treatment means (null hypothesis), if the treatments did make a difference. In general, power estimates of .80 or greater are considered adequate for most experimental purposes (Kirk, 1982, p. 38). The preliminary power estimates using Cohen's (1977) description of the magnitude of effect sizes indicated that the above design had power equal to .83 to detect a medium effect size (.25), and .99 to detect large effect sizes (.35 or more) for both the test of the main effect of the study methods and the test of the study methods by reading ability interaction. Based on these estimates the design was judged to have sufficient power to detect practical differences (effect sizes of .25 or greater) among the treatments, and therefore, was judged to have adequate power for the purposes of this investigation.

Scoring

The students' responses to the items on the final test were accepted as correct if they contained the deleted word or phrase or its semantic equivalent. Variations in phrasing were counted as correct only when they did not alter the meaning of the original text sentence. The interrater reliability of the scoring procedure was assessed by having two independent raters, both of whom were blind to the design of the experiment and the treatment conditions, score all the students' test performances. The two sets of ratings were then correlated using the Pearson product-moment correlation procedure. The analysis revealed an $r = .97$, $p < .01$ ($n = 175$), indicating high interrater reliability. One set of scores was then chosen at random to serve as the basis for all further analyses.

RESULTS

Trainers

Before attempting to answer the research questions, two preliminary methodology questions were examined. First, was there an overall difference in the effectiveness of the trainers? Second, did differences among trainers interact with the effectiveness of the study methods? A unique sums of squares regression approach to ANOVA indicated that the overall means of the three trainers did not differ significantly across the three study-method training conditions, $F(2,166) = .76$, $p = .47$. Furthermore, there was also no significant interaction between trainers and the three study methods, $F(4,166) = 1.65$, $p = .16$. Table 1 presents the means and standard deviations of the trainers by study method. These preliminary analyses indicate any differences in effectiveness or lack of differences among the three study methods (critical self-questioning, interpretive self-testing and rereading) cannot be attributed to the differential effectiveness of the trainers who taught the students to use those methods. As a result, teacher effects were not examined in any of the following analyses.

Total Cued-Recall

The influence of training in interpretive self-questioning and critical self-questioning compared to rereading on the total cued-recall of passage information was assessed using the regression approach to ANOVA for unbalanced designs (Glass & Hopkins, 1984, p. 444; Stevens, 1990, p. 115). Table 2 presents the means and standard deviations of the three trained study methods by reading ability for total cued recall performance. The ANOVA revealed a significant main effect for reading ability, $F(1,169) = 26.80$, $p < .05$, $MSe = 28.11$, but no significant main effect for trained study method, $F(2,169) = 1.62$, $p = .20$. The interaction was also not significant, $F(2,169) = .22$, $p = .81$. The results indicate that above average readers ($M = 25.16$, $SD = 5.5$, $n = 88$) outperformed the below average readers ($M = 20.95$, $SD = 5.1$, $n = 87$), while the means of the study methods did not differ significantly. This means the extensive strategy training devoted to the two self-questioning study methods did not enhance students' overall knowledge acquisition when compared with instructing students to reread the passage. The following sections present separate analyses for each of the six kinds of text information tested.

Vocabulary

Table 3 presents the means and standard deviations for cued recall of key vocabulary terms (unique names of parts or actions of spiders presented in bold print in the chapter) by trained study method and by reading ability level. The ANOVA revealed no significant main effect for study method, $F(2,169) = .31$, $p = .73$ and no study method by reading ability interaction, $F(2,169) = .24$, $p = .79$. The main effect of reading ability was significant, $F(1,169) = 14.35$, $MSe = 2.27$, $p < .05$. The results indicated that the three study methods did not differ with respect to recall of new vocabulary terms.

Classification

Table 4 presents the means and standard deviations for cued-recall of superordinate/subordinate classification information by reading ability and trained study method. Results of the ANOVA indicated that both the main effect of reading ability, $F(1,169) = 38.50$, $MSe = 1.91$, $p < .05$ and the main effect of trained study method, $F(2,169) = 3.42$, $p < .05$, were statistically significant. However, the interaction between trained study method and reading ability, $F(2,169) = 2.23$, $p = .11$, was not statistically significant. Post hoc mean comparisons using the Newman-Keuls Procedure revealed that the mean of the critical self-questioning group ($M = 3.58$) and the mean of the interpretive self-testing group ($M = 3.65$) both exceeded ($p < .05$) the mean of the rereading control group ($M = 3.00$) without differing significantly from each other.

General Characteristics

The ANOVA did not yield a statistically significant main effect for trained study method, $F(2,169) = .15$, $p = .86$, or a significant interaction effect between trained study method and reading ability, $F(2,169) = .07$, $p = .93$. The main effect for reading ability was statistically significant, $F(1,169) = 6.14$, $p < .05$. Means and standard ·iations are shown in table 5. The results indicate that the three treatment groups did not differ with respect to performance on items assessing their knowledge of the general characteristics of spiders stated in the experimental passage.

General Action

Table 6 presents the means and standard deviations for recall of the general (typical) action information (of spiders) by trained study method and reading ability. The ANOVA did not yield a statistically significant main effect for trained study method, $F(2,169) = .73$, $p = .49$, or a significant interaction effect between trained study method and reading ability, $F(2,169) = 2.43$, $p = .09$. The main effect for reading ability was significant, $F(1,169) = 5.00$, $MSe = 1.10$, $p < .05$. These results indicate the two self-questioning groups and the rereading group did not differ in their recall of the general action information stated in the experimental passage about spiders.

Part Characteristics

The ANOVA for recall of the characteristics of the main parts of spiders revealed no significant main effect for study method, $F(2,169) = 2.63$, $p = .075$ and no study method by reading ability interaction, $F(2,169) = .15$, $p = .86$. The main effect of reading ability was significant, $F(1,169) = 10.70$, $MSe = 1.71$, $p < .05$. Table 7 presents the means and standard deviations for the self-questioning groups and the reread control group by reading ability. The results demonstrate that the study methods did not differ with respect to their impact on the recall of the characteristics of major parts of spiders.

Actions of Parts

Means and standard deviations for the cued recall of information related to the typical actions of parts of spiders by trained study method and reading ability level is presented in table 8. Results of the ANOVA did not yield a statistically significant main effect for trained study method, $F(2,169) = 1.72$, $p = .18$, or a significant interaction effect between trained study method and reading ability, $F(2,169) = .35$, $p = .70$. The main effect for reading ability was once again significant, $F(1,169) = 10.76$, $MSe = 1.97$, $p < .05$. In concert with the above analyses, this finding demonstrates that trained study method did not differentially influence the cued-recall of information related to the actions of the parts of spiders that were explicitly stated in the experimental passage.

DISCUSSION

Contrary to the findings of past research (Andre & Anderson, 1978-1979; Davey & McBride, 1986a; King, Biggs & Lipsky, 1984; Nolte & Singer, 1985), training students to self-question did not enhance overall final test performance. The performance of the students in the control group was found to be comparable to those in either of the self-questioning conditions in overall knowledge acquisition. Hence, in concert with Dreyer and Gambrell (1985), this study revealed no overall difference between groups trained in self-questioning and a read-reread control group.

A small difference favoring the self-questioning groups was found for classification items, but there was no significant difference among the treatment conditions across the other five types of information tested. However, the significant finding for classification items should be viewed with some caution. The use of multiple separate ANOVAs increased the probability of falsely rejecting the hypothesis of no difference (null hypothesis) somewhere in the overall set of tests. Using the more stringent alpha = .01 level of significance, the difference in favor of the self-questioning groups on the classification items would not have been judged statistically significant. As a result, we interpret the finding as providing little support for the beneficial effects of either self-questioning method. Indeed, a slight difference favoring students in the self-questioning groups for classification items only, constitutes very weak support for the argument that training students to self-question during reading enhances comprehension-monitoring and knowledge acquisition. Such training does not appear to supersede rereading enough to warrant recommendation as an instructional strategy.

In addition, contrary to Andre & Anderson (1978-1979), but in concert with Miller (1987) and Davey and McBride (1986b), no differential effect was found for reading ability. The three study methods were similarly effective across the two reading ability levels. The paucity of findings in the literature demonstrating differential improvement for below average readers is somewhat surprising, since below-average readers have been demonstrated to lack metacognitive awareness (Owings, Peterson, Bransford, Morris & Stein, 1980), one would, therefore, anticipate differential benefits to accrue to such students from attempts to train them in self-questioning. The present study suggests that the actual benefits of self-questioning training are not significantly greater than instructing students to reread, and that the pattern is the same for both above and below average readers.

Nonsignificant Differences

Problems arise, of course, in the interpretation of nonsignificant results. Before concluding that training in either self-questioning method did not have an overall beneficial effect when compared to rereading, several factors must be considered as rival hypotheses to this conclusion. First, did the study have enough statistical power to detect differences among the treatment groups? In other words, was the sample size adequate? Preliminary analyses indicated power to detect an average effect size (.25) to be at least .83 for all tests. This means that there was sufficient power to reject an hypothesis of no difference (null hypothesis) at least 83% of the time, if the hypothesis was false. Power equal to .80 is considered as both satisfactory and sufficient for most experimental purposes (Kirk, 1982). Moreover, even if an alpha level of .10 had been chosen for the test of significant differences among the treatment means, the main effect for the treatments on total cued-recall would not have proved statistically significant, even though at that point the power to detect a moderate effect size (.25) would have been increased to .90. Hence, power to detect differences was adequate in this experiment, and therefore, was not the likely reason for the outcome of no significant differences among the three study methods.

A related second factor is concerned with whether the dependent variable was measured adequately. Measurement flaws can affect a dependent measure's ability to detect differences. An examination of the individual scores of students in each of the treatment conditions on the dependent variable did not reveal a ceiling effect; above average readers answered only 70% of the completion items correctly on the average. Students in all treatment conditions had plenty of room to show improvement. This was particularly true for below-average readers who ought to have benefitted most from the self-questioning treatments, but who averaged only 58% of the items correct on the dependent measure.

Additionally, the reading ability demands of the material may also affect the outcome of an investigation. If the material is too difficult or too easy, the results may be reflecting that aspect as opposed to the effects of training. The present investigation sought to identify the effectiveness of self-questioning strategies on knowledge acquisition of expository text at the students' actual reading grade level (instructional reading level). As a result, training materials included expository passages that according to the Dale-Chall (1954) formula for computing readability was at the 9th grade reading level.

Moreover, the passages were adapted from a commercial textbook aimed directly at junior high school students. Therefore, the passages the students were asked to read and study were comparable to what they would encounter normally in their regular science classes.

For it to be worth devoting instructional time to a study method like self-questioning, it would need to be demonstrated to be of value to students when completing regular textbook reading assignments. In fact, the "process-into-content" approach to strategy instruction used to train students in this investigation, specifies that training must be conducted using regular textbook passages to avoid the problem of transfer of the strategies to actual learning situations (Roehler, Duffy, Meloth, 1984, p. 88). Hence, the difficulty level of the passages used in the present investigation can be ruled out as a factor militating against the conclusion of no differences among the experimental treatments.

A fourth factor concerns the issue of treatment fidelity. This study combined aspects of direct instruction, components of self-control training (students were taught to use monitoring checklists) and elements of informed training (students were taught how the questioning strategy could help them in future learning) for the instructional portion of the investigation in a manner very similar to Davey and McBride (1986a). The instructional design was based on a "process-into-content approach" to strategy instruction as prescribed by numerous researchers, and the actual training implemented all essential components for effective strategy instruction as defined by past research (Anthony & Raphael, 1989;

Cross, & Paris, 1988; Roehler, Duffy, & Meloth, 1984; Pressley, Goodchild, Fleet, Zajchowski, Evans, 1989; Pressley, Johnson, Symons, McGoldrick, & Kurita, 1989) In addition, all teachers were carefully trained to deliver highly comparable instruction, and statistical evaluation showed no significant differences among the teachers overall in impact on students' cued-recall and no teacher by treatment interaction. Thus, the teachers implemented the training procedures in the same fashion and the training procedures reflected all the elements of strategy training intended by the process-into-content approach to strategy instruction. Hence, it is very unlikely that the failure to find significant treatment effects was due to poor treatment fidelity.

A final factor concerns whether the training was long enough or intense enough. It seems to us that 1 school week (1 class period each day) dedicated to instruction and practice is about as long and as intense a period of training as any content-area teacher will ever be likely to devote to training students in a single study strategy. In addition, the amount of time spent in the present investigation was comparative to previous investigations reporting positive effects (King, 1989; Singer & Donlan, 1982; Davey & McBride, 1986a) and in some cases exceeded the amount of time devoted to strategy training in previous investigations (Miller, 1987; Andre & Anderson, 1978-1979). Therefore, the implementation of strategy-training instruction in this experiment fulfilled both theoretical expectations and practical considerations with respect to both time and intensity of training.

Further support for the latter conclusion comes from the careful inspection of the self-questions generated by the students trained in the two self-questioning methods. The students in these two groups were instructed to write down their self-questions in accordance with the training they had received, and then to respond to them carefully as they studied the experimental passage. Analysis of their written self-questions revealed that virtually all students in each of the experimental conditions fully employed their trained self-questioning strategy (This judgement was confirmed by two independent raters). In other words, the process-into-content approach to strategy instruction worked, but the self-questioning strategies did not work.

From the above discussion, it may be judged that the major rival hypotheses to a conclusion of negligible difference can be ruled out or viewed as unlikely in the case of the present investigation. Therefore, the results of the present study warrant the conclusion that training ninth-grade students in either of the two self-questioning methods did not make a meaningful difference to their acquisition of content information from science text when compared to rereading.

Conclusions

Upon reevaluation of the available literature an interesting pattern emerged, most of the previous studies that found differences favoring self-questioning (of any kind) compared it to a **single reading of the text** as the control condition (Davey & McBride, 1986a; King, et al., 1984; Nolte & Singer, 1985); hence, the amount of time spent processing the text may have been the critical factor leading to the apparent effectiveness of the self-questioning training (and not the process per se). Moreover, across studies there has been a frequent failure on the part of self-questioning training to enhance students' acquisition of **passage content** (although not necessarily other types of learning outcomes) when compared to rereading (Davey & McBride; 1986a; Dreher & Gambrell, 1985; Miller, Giovenco, & Rentiers, 1987).

Some might argue that an emphasis on the acquisition of conceptual and factual information is misplaced--that the focus should be on the effects of self-questioning on "higher order" learning or improved comprehension-monitoring per se, such as error detection (Miller et al., 1987). We argue, however, that the whole purpose of the shift toward a "process-into-content" approach to instruction is to empower students to gain more content or at least to empower them to gain it on their own. There is no reason for content-area teachers to train students to engage in a process that has minimal or no pay off in terms of increased knowledge acquisition. Indeed, as we see it, it will be hard to convince content-area teachers to shift from a content focus to a process focus during instruction if the students they train do not learn more of the content as a result. Hence, it is our conclusion that our findings do not support the recommendations of other researchers (e.g., Davey & McBride, 1986b; King, Biggs & Lipsky, 1984) that content-area teachers spend time training students in self-questioning. Comparable content knowledge may be acquired by simply encouraging students to reread the material.

REFERENCES

Anderson, R. C., & Pearson, P. D. (1982). A schema-theoretic view of basic processes in reading. In P. D. Pearson (Ed.), Handbook of reading research. New York: Longman.

Andre, M. F. D. A., & Anderson, T. H. (1978-1979). The development and evaluation of a self-questioning study technique. Reading Research Quarterly, 14(4), 605-623.

Anthony, H., & Raphael, T. (1989). Using questioning strategies to promote students' active comprehension of content area material. In D. Lapp, J. Flood, & N. Farnan (Eds.), Content area reading and learning: Instructional strategies (pp. 244-257). Englewood Cliffs, NJ: Prentice Hall.

Brown, A. L. (1982). Learning how to learn from reading. In J. A. Langer, & T. S. Burke (Eds.), Reader meets author/bridging the gap (pp 26-54). Newark, DE: International Reading Association.

Cross, D. R., & Paris, S. G. (1988). Developmental and instructional analyses of children's metacognition and reading comprehension. Journal of Educational Psychology, 40, 131-142.

Cohen, J. (1977). Statistical power analysis for the behavioral sciences. New York: Academic Press.

Dale, E., & Chall, J. S. (1954). A formula for predicting readability. Educational Research Bulletin, 37, 11-28.

Davey, B., & McBride, S. (1986a). Effects of question-generation training on reading comprehension. Journal of Educational Psychology, 78, 256-262.

Davey, B., & McBride, S. (1986b). Generating self-questions after reading: A comprehension assist for elementary students. Journal of Educational Research, 80(1), 43-46.

Dreher, M. J., Gambrell, L.B. (1985). Teaching children to use a self-questioning strategy for studying ϵ pository prose. Journal of Reading Improvement, 22, 2-7.

Glass, G. V., & Hopkins, K. D. (1984). Statistical methods in education and psychology (2nd ed.). Englewood Cliffs, NJ: Prentice-Hall.

Just, M. A., & Carpenter, P. A. (1987). The psychology of reading and language comprehension. Boston: Allyn & Bacon.

King, A. (1989). Effects of self-questioning training on college students' comprehension of lectures. Contemporary Educational Psychology, 14, 366-381.

King, J. R., Biggs, S., & Lipsky, S. (1984). Student's self-questioning and summarizing as reading study strategies. Journal of Reading Behavior, 15, 205-218.

Kirk, R. E. (1982). Experimental design: Procedures for the behavioral sciences (2nd ed.). Monterey, CA: Brooks/Cole.

Miller, G. E. (1985). The effects of general and specific self-instruction training on children's comprehension monitoring performances during reading. Reading Research Quaterly, 20, 616-628.

Miller, G. E. (1987). The influence of self-instruction on the comprehension monitoring performance of average and above average readers. Journal of Reading Behavior, 19(3), 303-317.

Miller, G. E., Giovenco, A., & Rentiers, K. A. (1987). Fostering comprehension monitoring in below average readers through self-instruction training. Journal of Reading Behavior, 19(4), 379-393.

Nessel, D. (1987, March). The new face of comprehension instruction: A closer look at questions. The Reading Teacher, pp. 604-606.

Nolte, R. Y., & Singer, H. (1985). Active comprehension: Teaching a process of reading comprehension and its affects on reading achievement. The Reading Teacher, 39, 24-31.

Owings, R. A., Peterson, G. A., Bransford, J. D., Morris, C. D., & Stein, B. S. (1980). Spontaneous monitoring and regulation of learning: A comparison of successful and less successful fifth graders. Journal of Educational Psychology, 72(2), 250-256.

Paris, S. G., Cross, D. R., & Lipson, M. Y. (1984). Informed strategies for learning: A program to improve children's reading awareness and comprehension. Journal of Educational Psychology, 76, 1239-1252.

Pressley, M., Goodchild, F., Fleet, J., Zajchowski, R. (1989). The challenges of classroom instruction. The Elementary School Journal, 89, 301-342.

Pressley, M., Johnson, C. J., Symons, S., McGoldrick, J. A., & Kurita, J. A. (1989). Strategies that improve children's memory and comprehension of text. The Elementary School Journal, 90, 3-32.

Roehler, L. A., Duffy, G. G., & Meloth, M. B. (1984). What to be direct about in direct instruction in reading: Content-only versus process-into-content. In T. E. Raphael (Ed.), The contexts of school-based literacy (pp. 79-95). New York: Random House.

Rumelhart, D. E., & Ortony, A. (1977). The representation of knowledge in memory. In R. C. Anderson, R. J. Spiro, & Montague, W. E. (Eds.), Schooling and the acquisition of knowledge. Hillsdale, NJ: Earlbaum.

Ryan, E. B., Ledger, G. W., Short, E. J., & Weed, K. A. (1982). Promoting the use of active comprehension strategies by poor readers. Topics in Learning and Learning Disabilities, 2 (2), 53-60.

Seretny, M. L., & Dean, R. S. (1986). Interspersed postpassage questions and reading comprehension achievement. Journal of Educational Psychology, 78(3), 228-229.

Singer, H., & Donlan, D. (1982). Active comprehension: Problem-solving schema with question generation for comprehension of complex short stories. Reading Research Quarterly, 17(2), 166-185.

Stevens, J. P. (1990). Intermediate statistics: A modern approach. Hillsdale, NJ: Earlbaum.

Teter, H. E., Edwards, G. I., Fitzpatrick, F. L., & Bain, T. D. (185). Living Things. New York: Holt, Rinehart, & Winston.

Table 1

Mean student recall by trainer by study method.

Group	n	M	SD
Trainer #1	58	22.36	5.84
Critical Self-Questioning	20	23.10	6.70
Interpretive Self-Testing	20	23.80	6.00
Rereading	18	19.94	3.86
Trainer #2	59	23.59	5.71
Critical Self-Questioning	19	24.10	5.90
Interpretive Self-Testing	21	24.90	5.46
Rereading	19	21.63	5.54
Trainer #3	58	23.24	5.54
Critical Self-Questioning	21	23.57	4.88
Interpretive Self-Testing	16	21.81	5.14
Rereading	21	24.00	6.43

Table 2

Mean total recall by study method and reading ability.

Group	n	M	SD
Critical Self-Questioning	60	23.58	5.77
Below Average Readers	30	21.17	5.52
Above Average Readers	30	26.00	5.02
Interpretive Self-Testing	57	23.65	5.61
Below Average Readers	27	21.78	4.79
Above Average Readers	30	25.33	5.83
Rereading	58	21.97	5.61
Below Average Readers	30	20.00	4.89
Above Average Readers	28	24.07	5.64

Table 3

Mean recall of key vocabulary terms by study method and reading ability.

Group	*n*	*M*	*SD*
Critical Self-Questioning	60	3.02	1.56
Below Average Readers	30	2.57	1.55
Above Average Readers	30	3.47	1.46
Interpretive Self-Testing	57	2.84	1.66
Below Average Readers	27	2.30	1.56
Above Average Readers	30	3.33	1.60
Rereading	58	2.98	1.46
Below Average Readers	30	2.67	1.30
Above Average Readers	28	3.32	1.56

Table 4

Mean recall of classification information by study method and reading ability.

Group	n	M	SD
Critical Self-Questioning	60	3.58	1.62
Below Average Readers	30	2.77	1.59
Above Average Readers	30	4.40	1.19
Interpretive Self-Testing	57	3.65	1.42
Below Average Readers	27	3.30	1.27
Above Average Readers	30	3.97	1.50
Rereading	58	3.00	1.56
Below Average Readers	30	2.23	1.43
Above Average Readers	28	3.82	1.25

Table 5

Means recall of the general characteristics of spiders by study method and reading ability.

Group	n	M	SD
Critical Self-Questioning	60	5.03	.96
Below Average Readers	30	4.83	1.08
Above Average Readers	30	5.23	.77
Interpretive Self-Testing	57	5.10	.96
Below Average Readers	27	4.93	.92
Above Average Readers	30	5.27	.98
Rereading	58	5.00	.82
Below Average Readers	30	4.87	.97
Above Average Readers	28	5.14	.59

Table 6

Mean recall of the general actions of spiders by study method and reading ability.

Group	n	M	SD
Critical Self-Questioning	60	4.97	1.10
Below Average Readers	30	4.57	1.28
Above Average Readers	30	5.37	.72
Interpretive Self-Testing	57	5.09	1.12
Below Average Readers	27	4.93	1.33
Above Average Readers	30	5.23	.90
Rereading	58	4.84	.97
Below Average Readers	30	4.87	1.01
Above Average Readers	28	4.82	.94

Table 7

Mean recall of the characteristics of parts of spiders by study method and reading ability.

Group	*n*	*M*	*SD*
Critical Self-Questioning	60	3.32	1.30
Below Average Readers	30	3.07	1.11
Above Average Readers	30	3.57	1.43
Interpretive Self-Testing	57	3.51	1.32
Below Average Readers	27	3.15	1.29
Above Average Readers	30	3.83	1.29
Rereading	58	2.93	1.39
Below Average Readers	30	2.57	1.10
Above Average Readers	28	3.32	1.56

Table 8

Mean recall of actions of the generic parts of spiders by study method and reading ability.

Group	*n*	*M*	*SD*
Critical Self-Questioning	60	3.65	1.29
Below Average Readers	30	3.33	1.24
Above Average Readers	30	3.97	1.27
Interpretive Self-Testing	57	3.46	1.43
Below Average Readers	27	3.18	1.33
Above Average Readers	30	3.70	1.49
Rereading	58	3.15	1.59
Below Average Readers	30	2.70	1.49
Above Average Readers	28	3.64	1.57