DOCUMENT RESUME

ED 306 547 CS 009 644

AUTHOR	Stevens, Robert J.
TITLE	A Cooperative Learning Approach to Studying Expository Text. Report No. 31.
INSTITUTION	Center for Research on Elementary and Middle Schools, Baltimore, MD.
SPONS AGENCY	Office of Educational Research and Improvement (ED), Washington, DC.
PUB DATE	Mar 89
GRANT	OERI-G-90006
NOTE	22p.
PUB TYPE	Reports - Evaluative/Feasibility (142)
EDRS PRICE	MF01/PC01 Plus Postage.
DESCRIPTORS	Analysis of Variance; *Content Area Reading; Cooperative Learning; Critical Reading; Grade 5; Grade 6; Intermediate Grades; *Learning Strategies; Program Descriptions; *Program Evaluation; Reading Research; Science Instruction; *Study Skills
IDENTIFIERS	Expository Text

ABSTRACT

A study evaluated the effects of a 5-week study strategies program called RAVES (Read, Answer, Vocabulary, Examples, Share) designed to help intermediate students understand and recall information presented in expository text. Subjects, 156 fifth and sixth grade students enrolled in suburban Maryland science classes, read a section of expository text, answered self-generated questions, defined vocabulary, generated examples of concepts, and shared their vocabulary and examples with partners in a cooperative learning situation. Results indicated that students in the RAVES program scored significantly higher on a comprehension test given after the third week of the program than did the control group of students. (One table of data is included, and 30 references are attached.) (RS)

Center for Research On Elementary & Middle Schools

Report No. 31

March, 1989

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Robert J. Stevens

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Published by the Center for Research on Elementary and Middle Schools, supported as a national research and development center by funds from the Office of Educational Research and Improvement, U.S. Department of Education. The opinions expressed in this publication do not necessarily reflect the position or policy of the OERI, and no official endorsement should be inferred.

Center for Research on Elementary and Middle Schools
The Johns Hopkins University
3505 North Charles Street
Baltimore, Maryland 21218

Printed and assembled by:
VSP Industries
2440 West Belvedere Avenue
Baltimore, Maryland 21215

The Center

The mission of the Center for Research on Elementary and Middle Schools is to produce useful knowledge about how elementary and middle schools can foster growth in students' learning and development, to develop and evaluate practical methods for improving the effectiveness of elementary and middle schools based on existing and new research findings, and to develop and evaluate specific strategies to help schools implement effective research-based school and classroom practices.

The Center conducts its research in three program areas: (1) Elementary Schools; (2) Middle Schools, and (3) School Improvement.

The Elementary School Program

This program works from a strong existing research base to develop, evaluate, and disseminate effective elementary school and classroom practices; synthesizes current knowledge; and analyzes survey and descriptive data to expand the knowledge base in effective elementary education.

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This program's research links current knowledge about early adolescence as a stage of human development to school organization and classroom policies and practices for effective middle schools. The major task is to establish a research base to identify specific problem areas and promising practices in middle schools that will contribute to effective policy decisions and the development of effective school and classroom practices.

School Improvement Program

This program focuses on improving the organizational performance of schools in adopting and adapting innovations and developing school capacity for change.

This report, prepared by the Elementary School Program, presents an evaluation of a cooperative-learning study strategies program designed to help intermediate grade students understand and recall information presented in expository text.

Abstract

This study evaluated the effects of a study strategies program over five weeks for 156 intermediate students in seven science classes in a suburban Maryland school district. In the program, called RAVES, the students read a section of expository text, answered self-generated questions, defined vocabulary, generated examples of concepts, and shared their vocabulary and examples with partners in a cooperative learning situation. Compared to control students, the RAVES students scored significantly higher on a comprehension test given after the third week of the program (Effect Size = .39).

A Cooperative Learning Approach to Studying Expository Text

During the upper elementary and middle school grades, student reading activities change from learning to read to reading to learn. Because students spend most of their academic careers reading and learning textual material, this is a vital transition. Student competence in independent learning and overall success in school largely depend on the ability to extract and understand main concepts presented in expository text, and to organize the information for later recall and use. Despite the importance of this activity, we have only begun to understand the processes involved in understanding expository text and effective processes for studying the information presented in it.

Learning information presented in expository text is a complex cognitive activity, in part due to the interaction of three levels of variables: state, processing, and motivational variables. State variables are related to the nature of the material to be read, the tasks to be performed or how the information is to be used, and the amount of time available (Anderson & Armbruster, 1984; Reynolds, Shirey, Wade, Trathen, & Shepard, 1986). For example, text organization and clarity are important state variables that affect students' ability to extract important information. Processing variables are related to reading and comprehending the text, and organizational strategies for storing and retrieving information (Anderson & Armbruster, 1984; Reynolds et al., 1986). Motivational variables are related to the purpose of reading and learning information from expository text -- why the student is engaging in this goal-directed activity (McKeachie, Pintrich, & Lin, 1985).

Although some research has examined state variables and their impact on student learning from text (see Anderson & Armbruster, 1984), most classroom research has focused on processing variables. Studying techniques that have been used to improve student processing of expository text include notetaking, underlining, outlining, diagramming, self-questioning, summarizing, and elaboration strategies. Yet, when compared to read-reread or read-and-study control treatments, the effectiveness of these techniques is limited (see Anderson & Armbruster, 1984; Weinstein & Mayer, 1986). The strategies that show the most consistent effects are those which engage the students in deeper processing of the material. self-questioning, summarizing, and elaboration strategies.

Studies of Elaboration Strategies

Study strategies referred to as self-questioning and summarizing typically involve the same cognitive activities as elaboration strategies. The goal of elaboration strategies is to engage students in actively processing new information presented in text and to build connections between the new information and students' prior knowledge. Wittrock (1978, 1986) has described these integrative activities as critical generative processes for comprehending what has been read and for learning new information presented in text. Building connections between new and known information is central to schema theoretic descriptions of knowledge acquisition processes (Schallert, 1982; Spiro, 1977).

Researchers have used self-questioning, summarization, and summarization with other elaboration as study strategies in a number of training studies. In self-questioning studies in which students were trained to ask and answer summary (or main idea) questions about the text, Andre & Anderson (1979) and Frase & Schwartz (1975) both found that students who generated and answered summary questions outperformed students who were instructed to simply read and reread the text. This suggests that summarization activity facilitates students' comprehension of new information presented in text. However, Andre & Anderson (1979) also found that low- and average-ability students in high school performed better when they received training in how to write summary questions. Thus summarization may be an activity in which students need some training if effective use is to occur.

In a number of other studies, researchers have instructed students to write summaries of each paragraph or passage they've read (Bretzing & Kulhavy, 1979; Dansereau, 1978; Doctorow, Wittrock & Marks, 1978; Howe & Singer, 1975; Stordahl & Christensen, 1956; Taylor, 1982). The results of these studies are inconsistent. Bretzing and Kulhavy (1979), Dansereau (1978), Doctorow, et al. (1978), and Taylor (1982) found that students who wrote summaries performed better on comprehension and recall measures than did students who were told either to read and reread the passage or to read and study the passage, but Howe and Singer (1975) and Stordahl and Christensen (1956) found no significant differences between similar treatments.

Two of the studies which found summarization to be an effective study strategy used elementary grade students (Doctorow, et al. 1978; Taylor, 1983), rather than college students or college-aged trainees. Also, Dansereau (1978) and Taylor (1982) provided relatively extensive training to students on how to write good summaries about what they read. Thus summarization may be most effective when taught to younger students, and students may need training on how to write summaries in order to effectively use them as a study strategy (Dansereau, 1978; Stordahl & Christensen, 1956; Taylor, 1982).

Researchers have developed study strategy programs that use writing summaries along with other elaboration techniques, including generating examples, defining concepts, and making analogies. These elaborative study strategies were more effective than reading and rereading, or reading and studying expository text with ninth grade (Weinstein, 1982) and college students (Diekhoff, Brown, & Dansereau, 1982). In both of these studies, the experimenters trained students for at least three hours on the procedures involved in the study strategies.

Weinstein (1982) provided students with five one-hour training sessions. Initial sessions involved direct instruction on five elaboration strategies: using verbal elaborations, using imaginal elaborations, drawing conclusions about the content, creating analogies between new content and prior knowledge, and using elaborative summaries that relate the new content to prior knowledge. The students learned to apply these strategies to a variety of content areas, including social studies, science, and English. They practiced the strategies on a number of activities and the trainer provided guidance and feedback regarding the appropriateness of their use of the strategies. Students who received this strategy training outperformed untrained students who were told to read and study textual material. The positive results were found on both an immediate posttest and a delayed posttest administered a month later.

These studies suggest that elaboration strategies improve student comprehension and recall of information presented in expository text. In effective study strategy procedures, students summarize the information they've read and build connections between new information and known information through other elaboration techniques. Further, these programs are more effective when students are younger and when they are well-trained in the skills involved in the strategies.

Motivational Component

Research suggests that it may not be sufficient for students to simply master study strategies in a specific training context. If a student is to be able to use strategies as an independent learner in a variety of contexts, it is important that students are motivated to use them and understand how to apply them in a flexible way depending on the conditions (McKeachie, Pintrich, & Lin, 1985; Paris, Lipson, & Wixson, 1983; Pintrich, 1987). In particular, Paris, et al. (1983) suggest that simply teaching students how to engage in strategies is insufficient. Students need to be taught *conditional knowledge* -- knowledge of why a strategy works, when it is appropriate to use a strategy, and how a strategy can be varied to fit the requirements of a new situation. This kind of knowledge may be critical to instruction in strategies (such as study strategies) which are intended to be generalizable to reading and learning from text in a variety of content areas and for a variety of purposes (Pintrich, 1987).

Cooperative Learning and Study Strategies

Cooperative learning is an effective instructional strategy in a wide range of grades and in a variety of subject areas (Sharan, 1980, Slavin, 1983a, b). Cooperative learning provides a strong motivational component as students work together to master material and encourage each other to stay on task. Cooperative learning also uses students as an instructional resource. As students help each other with new skills, they typically re-explain what the teacher has previously presented -- often in language more easily understood by their peers (Webb, 1985). Also, students provide models for one another and give each other feedback as they practice newly acquired skills (Slavin, 1983a; McDonald, Larso.., Dansereau, & Spurlin, 1985).

Dansereau and his associates (Dansereau, 1985, Larson, et al., 1984; McDonald, et al., 1985; O'Donnell, et al., 1986) have developed a study strategy program that integrates effective elaboration strategies with cooperative learning processes. This program, called MURDER, has students work together to study expository text using six steps. establish the mood for studying, read for understanding, recall or summarize what was in the text, digest the material by correcting and elaborating on the recall, expand knowledge through self-questioning, and review portions of the material where mistakes were made. Students typically work in pairs in which one student constructs a summary and the other listens, corrects and elaborates on it. The students alternate roles as they read and study the text.

The researchers have found this study strategy program to be an effective way for college students to learn from expository text, superior to read-and-study or read-reread controls (Dansereau, 1985; Larson, et al., 1984; O'Donnell, et al., 1985; O'Donnell, et al., 1986). Furthermore, the use of cooperative learning processes with the MURDER strategies has been found to be superior to the use of the same procedure independently (O'Donnell, et al., 1985, O'Donnell, 1986).

The research suggests that, given appropriate training, there are effective strategies students can use to improve their understanding and recall of information presented in expository text. Furthermore, cooperative learning provides effective instructional processes for teaching and engaging students in the use of these strategies. However, most of the study strategies research was done with college level students -- only Doctorow, et al. (1978, 6th grade), Taylor (1982, 5th grade), and Weinstein (1982, 9th grade) have evaluated the effectiveness of their study strategy process with middle school or elementary school children. Because there is a significant transition during the late elementary and middle school grades into reading more expository text, it seems particularly pertinent to further investigate the effectiveness of providing instruction on study strategies to students in these grades.

A Study Strategies Program for Intermediate Grades

The goal of this project was to develop and evaluate a study strategies program designed to help intermediate grade students understand and recall information presented in expository text. The program combines strategies found to be effective for studying text with cooperative learning classroom processes. The program, called RAVES, consists of five steps:

1) R - *Read* the section of expository text carefully.
2) A - *Answer* self-generated questions based on the section and paragraph headings.
3) V - Define *vocabulary* presented in text.
4) E - Generate *examples* of concepts presented.
5) S - *Share* answers, vocabulary, and examples with partners.

The students begin the studying process by reading the section of the text. As they read, they write down any new vocabulary words or vocabulary that has specific meaning for the content being read. The students are taught that new vocabulary or terms present new concepts that are important for understanding the information. They also are taught that either italics or bold print often signal new terms to the reader. Although students will find other new words, they are taught to be sure to write all the words highlighted in the text.

After reading, the students work cooperatively with their partners to further process the information. First, they generate questions based upon section headings or paragraph headings. Because the headings usually focus attention on the main idea, the questions generated are usually main idea or summary questions. Students have been explicitly taught how to construct a good summary question, one that focuses on the information presented in the entire section of the text. After generating the question, the partners answer the question. During both question-generation and question-answering, partners give each other feedback on the quality of the question and the answer. They also work together to define the new vocabulary by locating the definition of the word in the glossary or determining the meaning from the context in which the word was presented. Partners also compare vocabulary lists and meanings to check that both have identified and defined all the new terms. Finally, students work with their partners to generate examples of the concepts presented in the text.

Method

Subjects and Design

The subjects in this study were 156 fifth- and sixth-grade students in seven science classes taught by five different teachers in a suburban Maryland school district. In each class students were identified as high-, average , or low-achieving based upon their previous marking period grades in science, and students from each ability group were randomly assigned to either the experimental or control treatment, in a way to maintain a balance of students' initial ability between the two treatments. Each classroom contained an equal number of students from each treatment, and the teachers acted as their own control.

Materials

Students used their regular general science survey texts. Within each class, students read the same material, but different units were covered across classes. Fifth-grade students studied units on simple machines and earth science; sixth-grade students studied units on weather and earth science. For the purposes of the study, students spent four of the five days of the week reading and studying the text. Class periods were fifty-five minutes long. Most days this was followed by teacher-led whole class discussion of the content. Twice during the three-week intervention, and once two weeks after the intervention, students were given a brief comprehension test instead of engaging in class discussion. On the fifth day each week, students engaged in simple experiments and hands-on activities related to the unit.

Measures

The students were given three experimenter-constructed comprehension tests during the study. An intermediate test was given after the experimental students had practiced the study strategies for five days, a posttest was given at the end of the third week of intervention, and a delayed posttest was given two weeks after the intervention concluded.

During the testing, students were asked to read and study a section in their science text. Within each class both experimental and control students read the same selection and received the same test. The experimental students used the RAVES strategies to study for the test, whereas the control students were told to read and study the selection. After reading and studying for 30 minutes, students were given a 10-item comprehension measure. The measure included short-answer and multiple-choice questions about the content presented in the selection. For example, in a test on earth science, students were asked to define erosion, and were asked to tell the benefits of and problems of erosion.

Reliability of the measures. The three tests were found to be internally consistent, with alpha reliabilities that ranged from .66 to .85. The intercorrelation of the tests ranged from .49 to .83, with the posttest and the delayed posttest being highly intercorrelated ($r = .83$).

Treatments

The students in each science class were split into two groups, as described above. The experimenter met with each RAVES group in part of the classroom, or in the library. On the first day, the experimenter explained the RAVES studying procedure, as described above. During the training, the experimenter emphasized that RAVES would help students in three ways: 1) help them identify what is important in the text; 2) improve their understanding of what is described in the text; and 3) give them a way to relate the science they learn to things they see and that are around them every day. The goal was not only to describe the importance and usefulness of the study strategies, but also to emphasize that the science information in the book really is related to their life and experiences.

After explaining each step in RAVES, the experimenter led the students through an initial practice of the process with the first section in the text. The partners worked together to generate and answer questions, define new vocabulary, and give examples of what they had read. Then the experimenter led the group in discussing their activities at each step, with both the students and experimenter giving feedback on the questions, answers, definitions, and examples.

Each of the next four days of intervention started with a brief review of the RAVES procedures. Then the students read a section of their science text and studied it with their partner. After the students spent 25 to 30 minutes reading and studying the material, the experimenter led them in a discussion of the material. Earlier in the intervention, the discussion included using the components of the RAVES strategy; as the students became more proficient with the strategies, the discussions became more focused on covering the content presented.

Control. In a separate corner of the room, the teacher provided the control group with a brief introduction to the selection to be read in the text, described some new concepts and how they related to what was previously learned, and then gave the students 25 to 30 minutes to read and study the material. The teacher told them it was important to read carefully, so they could engage in a good discussion of the material. After students had read and studied the text, the teacher led them in a group discussion of the material.

Procedure. The students were divided into two treatment groups within each classroom. The intervention was conducted four of the five school days each week, on the fifth day all students engaged in simple experiments and hands-on activities. During the intervention, the two groups met in separate corners of the room, and were far enough apart so that the instruction and activity in one group did not interfere with the activity in the other group.

For the first five days of the intervention, the experimenter met with each experimental group. During this time the experimenter provided instruction and guided practice on the RAVES process. On the sixth day of the intervention all of the students were given the intermediate test described above. For the next five days (days 6 through 10 of the intervention), the students of the two groups were rejoined under the direction of the teacher. On each day, the teacher presented the new unit and told the students to read and study the passage in the text. The two treatment groups separated into opposite corners of the room during the read-and-study time. The teacher also instructed the experimental students to use the RAVES process during the read-and-study activity. After 25 to 30 minutes, the teacher called the whole class together to discuss the main points presented in the text, and application and examples of the information. On the eleventh day, all students were given the posttest, described above. Two weeks after the conclusion of the intervention, the students were given a delayed posttest, also described above.

Results

The results were analyzed using an analyses of variance (ANOVA) design. Because students were randomly assigned to treatments within each class, teachers acted as their own control, thus allowing student-level analyses of the data. As noted earlier, previous grades in science were used as a measure of students' entering ability. The random assignment counter-balanced students' previous achievement level across the two treatments. An analysis of variance on the premeasure indicated no significant difference between the treatment groups (F<1.0).

Means for the analyses of the intermediate test, posttest, and delayed posttest are shown in Table 1.

Table 1

Postest Means and Standard Deviations

Test*	RAVES M	RAVES (SD)	Control M	Control (SD)
Intermediate Test	6.26	(2.05)	6.33	(2.12)
Posttest	7.63	(2.38)	6.62	(2.61)
Delayed Posttest	7.31	(1.80)	6.87	(1.86)
N	80		76	

* The range of possible scores on all tests was zero to ten.

Intermediate test. Analyses of the intermediate test, given after the initial week of training and practice, indicated no significant difference between the treatment groups, F(1,154) = .06.

Posttest. Analyses of the posttest indicated a significant difference between the treatment groups, F(1,154) = 5.18, p=.024. The posttest effect size (difference in means divided by the control group standard deviation) was .388 standard deviations.

Delayed posttest. Analyses of the delayed posttest, given two weeks after the end of the intervention, indicated no significant difference between the treatment groups ($F(1,154) = 2.43$, $p=.121$. However, the effect size did favor the experimental group, ES=.239 standard deviations.

Discussion

The results of this study support the hypothesis that teaching intermediate grade students a cooperative learning approach to elaborative study strategies can facilitate their learning of information presented in expository text. The magnitude of the difference between the experimental and control group's posttest scores, an effect size of .39 standard deviations, indicates both a significant and large effect in favor of the study strategies intervention. Students who read text and actively engage in summarizing, generating examples, and reviewing with partners have better comprehension of the information that has been presented.

However, the results also suggest that students do not automatically apply a learning strategy, but need systematic instruction and practice on strategies in order to use them effectively. The nonsignificant effect on the intermediate test indicates that students needed more than a week of instruction and practice in order to benefit from study strategies training. An additional week of practice with those strategies was useful in producing positive effects on comprehension, as evidenced by the posttest results. This conclusion is supported by a number of studies where training was necessary for accurate and effective use of study strategies (cf. Brown & Smiley, 1977; Larkin & Reif, 1976; Stordahl & Christensen, 1956), and was an important component in effective programmatic studies (cf. Dansereau, 1985; Taylor, 1982; Weinstein, 1982). Although it seems sensible that younger or less proficient readers would benefit most from systematic training and practice, these studies cover a range of student ages and ability levels.

The delayed posttest was used to measure the degree to which experimental group students continued to outperform control group students, which would indicate their continued effective use of the RAVES study strategies after the conclusion of the intervention. There was no statistically significant difference between the treatment groups on the delayed posttest, but the experimental group did outperform the control group by nearly a quarter standard deviation (ES=.24). This suggests that the effects of the study strategy training were maintained to some degree without explicit application of the strategies, such as there was during the treatment, but not fully.

The teacher did encourage students to use their study strategies on the delayed posttest, but the RAVES strategies had not been explicitly used in the classes as a component of the instruction since the conclusion of the intervention two weeks previously. One might speculate that students in the experimental group had not fully integrated the study strategy into the repertoire of activities in which they automatically engaged. Or perhaps over time students engaged in the activity in a more haphazard fashion. In either case, the decline in performance may be due to the brevity of the intervention. For students to fully integrate study strategies into their repertoire so they are automatically applied would seem to require continued follow-up beyond two weeks to encourage their use, or to require that teachers organize their classroom so that the process would be a component of their instruction.

Overall this study supports the usefulness of a cooperative learning approach to elaborative study strategies with fifth- and sixth-grade students in general science classes. As noted, this is particularly important because students at this age are in transition from learning how to read to learning how to learn through reading. Students need to learn how to extract main points and supporting information from text and to organize them cognitively to facilitate future recall and use.

Although the strategies used in this study were effective in improving student performance, further research is needed to determine the degree to which they may generalize to other content areas and to other types of science text. Text structure, content, and task demands are variables that have a strong impact on text comprehension (cf. Anderson & Armbruster, 1984). These cooperative study strategies, as well as any other effective study strategies, need to be evaluated under different conditions to ascertain their generalizability to other contexts.

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