Visual Imagery and Self–Questioning: Strategies to Improve Comprehension of Written Material

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Two learning strategies, visual imagery and self–questioning, designed to increase reading comprehension, were taught to six learning disabled students using a multiple baseline across strategies design. The visual imagery strategy requires the student to read a passage and to create visual images representative of the content of the passage. The self-questioning strategy teaches the student to form questions about the content of a passage as he or she reads to maintain interest and to enhance recall. Specific instructional procedures were followed that included: (a) testing the student's current level of functioning, (b) describing the strategy, (c) modeling the strategy, (d) verbal rehearsal of strategy steps, (e) practice in reading ability level material, and (f) practice in grade level material.

Results of the study indicate that LD students can learn the two strategies and can apply them in both reading ability level and grade level materials. The students' use of the strategies resulted in greater comprehension scores from the pretest in baseline to the posttest after training. Instructional time for each strategy ranged from five to seven hours.

As learning disabled (LD) adolescents attempt to cope with the complex demands of the secondary school setting, their knowledge of *how* to learn is as important as their knowledge of specific facts. One approach to meeting the needs of many LD adolescents is a learning strategies model (Alley & Deshler 1979). Learning strategies are "techniques, principles, or rules that will facilitate the acquisition, manipulation, integration, storage, and retrieval of information across situations and settings" (p. 13). Learning strategies are important not only in helping LD students cope with the demands of the secondary school setting, but also in preparing them for the demands of a rapidly changing and highly technical society. In a learning strategies intervention program, rather than teaching specific content, teachers teach students *how* to learn that content. Two major advantages of strategy learning are that it allows students to use a strategy to attack situations not previously encountered (Becker, Engelmann, & Thomas 1971, Engelmann 1969, Rowher 1971), and it also places students in interactive roles with the content to be learned. Students maintain active involvement with the content as they manipulate and integrate information through use of a learning strategy.

The purpose of this study was to apply a specific instructional methodology to teach two learning strategies: visual imagery and self-questioning. Both visual imagery (Kerst & Levin 1973, Lesgold, McCormick, & Golinkoff 1975, Paivio 1969) and questioning (Manzo 1969, Robinson 1946) have been advocated as techniques to improve reading comprehension. In this study, a visual imagery strategy and a self–questioning strategy were taught to LD adolescents to increase interaction with the content and to facilitate reading comprehension. The effectiveness of these strategies in helping students meet the demands of the regular secondary school curriculum was measured by assessing the students' application of the strategies in class materials.

METHOD

Subjects

Six secondary students (three males, three females), who were being served in programs for LD students, participated. Only students having IQ's in the normal range (i.e., above 80), exhibiting deficits in one or more achievement areas, and not exhibiting any evidence of physical or sensory handicaps, emotional disturbance, or economic, environmental, or cultural disadvantage were included. The sample included one eighth grader, four ninth graders, and one eleventh grader. The students selected had IQ's ranging from 81 to 103 ($\bar{x}$ = 92.8). Their reading achievement grade level scores ranged from 4.1 to 7.3 ($\bar{x}$ = 5.8.); their math achievement grade level scores ranged from 3.9 to 6.6 ($\bar{x}$ = 5.0); and their writing achievement grade level scores ranged from 3.5 to 6.9 ($\bar{x}$ = 5.1). The students' ages ranged from 13 years, 7 months to 17 years, 7 months ($\bar{x}$ = 16 years, 1 month).

Instructional Materials

Each teacher was provided a step–by–step description of the instructional procedures for the visual imagery strategy and a similar description of the self–questioning strategy. Two sets of reading materials were provided for each student. The first set included reading passages at the student's reading ability level (as determined by a recently administered achievement test), and the second set included reading passages at the student's current grade placement level.[1]

All reading materials for visual imagery strategy instruction were selected for their "imageable" content; that is, the materials had to lend themselves to the formation of visual images as passages were read. Passages related to abstract concepts, often not easily imaged, were not used for this strategy. No other special attributes characterized the materials used in this study.

Procedures

General procedures. Each student received individual instruction from a teacher certified in learning disabilities.

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The two teachers involved in this study had written the instructional materials for the strategies and were well–versed in the procedures. They were supervised by senior investigators from the University of Kansas Institute for Research in Learning Disabilities.

Instructional sessions ranged from one to two hours in length; some sessions were held daily, and others were held once a week. Sessions took place in public school classrooms; students and teachers in this study worked in an area isolated from other students and teachers.

Instructional procedures. The instructional steps used to teach visual imagery and self-questioning were adapted for use from those outlined by Alley and Deshler (1979) and Deshler, Alley, Warner, and Schumaker (1982). They included: (a) testing the student's current level of functioning, (b) describing the steps of the strategy and providing a rationale for each step, (c) modeling the strategy so the student could observe all of the processes involved in the strategy, (d) verbal rehearsal of the steps of the strategy to 100% criterion, (e) practice in controlled materials written at the student's reading ability level, (f) practice in content materials from the student's grade placement level, (g) positive and corrective feedback, and (h) a posttest.

Visual imagery strategy procedures. The visual imagery strategy was designed to facilitate reading comprehension by requiring students to read a passage and to create visual images representative of the content of the passage. Students followed these procedures:

1. READ Read the first sentence
2. IMAGE Try to make an image—a picture in your mind
3. DESCRIBE Describe your image
   a. If you cannot make an image, explain why you cannot and go on to the next sentence
   b. If you can make an image, decide if it is the same as an old image (one held in memory from the most recent image), the old image changed somewhat, or an entirely new image (not at all similar to the most recent memory image). Make a changed image by adding or subtracting things from the picture you had in your mind.
   c. If you have an image, describe it
4. EVALUATE Evaluate your image for its completeness
   a. Check to make certain your image includes as much of the sentence content as possible. If content is missing, adjust your image and continue.
   b. If your image is comprehensive, continue.
5. REPEAT Read the next sentence and repeat steps 1 through 4

Self–questioning strategy procedures. The self–questioning strategy also was designed to facilitate reading comprehension by teaching students to form questions as they read to maintain interest and to enhance recall. Students followed these procedures:

1. **Read** the passage. Ask "WH" questions as you read to help yourself keep reading.
2. **Answer** your questions as you read.
3. **Mark** your answers with the appropriate symbol.

Before students applied the self–questioning strategy, they were provided examples of five common types of "WH" questions: (a) who, (b) what, (c) where, (d) when, and (e) why. Symbols were identified for each type of question so students could mark the answer to a specific question when it was located in the text. For example, a clock face was used for answers to "when" questions.

Testing procedures and measurement. Seven individually administered tests were given the students before and after training. Four tests measured the students' skills related to visual imagery. For the first two visual imagery tests, students were asked to read two 100 to 200 word passages (one at ability level, one at grade level). They were told that they would be asked to tell about the content when they finished reading. They were allowed as much time as needed to read the passage. After they finished reading, they were asked to answer six to ten comprehension questions. Scores were the percentage of correct responses to questions. Two more tests (one ability level, one grade level) then were administered. Students were directed to read a passage and to try to form an image of the story as they read. The testing then proceeded as described above.

Three tests were given to assess the students' self–questioning skills. First, students were asked to read two passages (one ability level, one grade level) or approximately 200 words and answer six to ten comprehension questions. Scores were the percentage of correct responses to the questions. Then students were asked to read another ability-level passage and to ask questions about the material that would make them interested in what they were reading. As students read the passage, the teacher probed five times, "Have you asked yourself any questions about what you have read?" If students responded affirmatively, they were asked to relate those questions. For each question, the teacher recorded the type of question and whether it was related to the content of the passage. If students responded negatively, the teacher also recorded that information.

Interobserver reliability was determined by having a second teacher independently score the student's responses once before training and once after training for each kind of test for each student. On the visual imagery tests, there were 99 agreements out of 106 opportunities to agree (93.4% agreement); on the self-questioning tests, there were 58 agreements out of 60 opportunities to agree (95.7% agreement).

Experimental Design

A multiple–baseline design across the two strategies was employed for each student. Four students were taught the visual imagery strategy followed by the self–questioning strategy. These students received all seven tests in baseline and then the first strategy, visual imagery, was taught. When the students reached criterion on visual imagery, the self–questioning tests were administered again. If a student's baseline had remained stable, self–questioning was taught. If the baseline was not stable, other self–questioning tests were administered until a stable baseline was achieved. Then the strategy was taught. When a student reached criterion on self–questioning, all three self–questioning tests and the four visual imagery tests were administered again. Two students were taught the self–questioning strategy followed by the visual imagery strategy.

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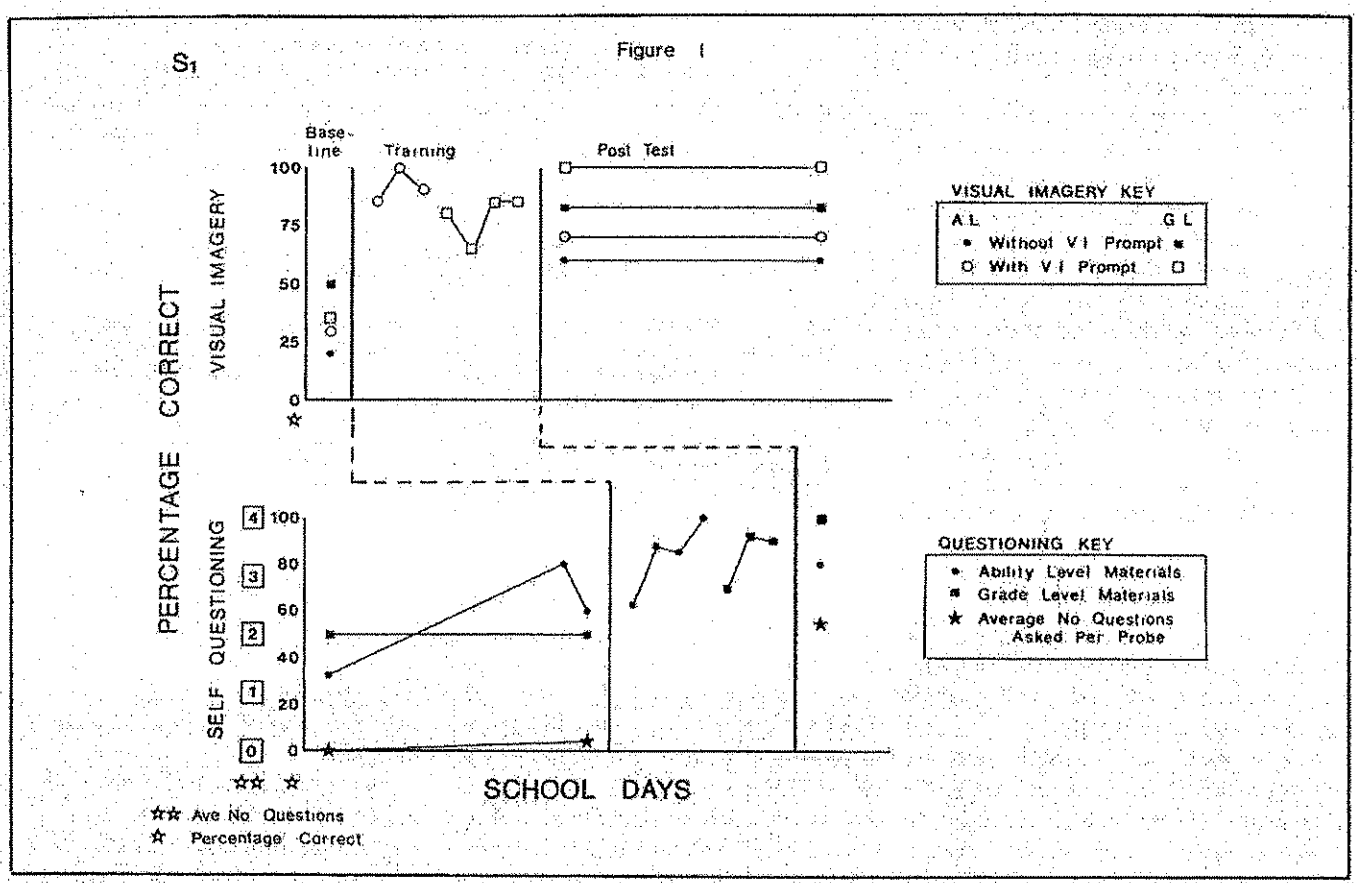

FIGURE 1.

RESULTS

Figure 1 shows the test results and practice results for Student 1, a ninth grader who was reading at a sixth grade level. Student 1 was taught the visual imagery strategy followed by the self–questioning strategy. Data recorded for the visual imagery strategy are the percentage of comprehension questions correctly answered for pretests (baseline) and posttests and the percentage of information given during free recall for the training sessions. For the self-questioning strategy, the percentage of comprehension is recorded for pretests and posttests, and the average number of content–related questions asked by the student per probe is recorded for the training sessions (indicated by the numbers in boxes to the left of the graph).

During baseline in visual imagery, when Student 1 was not prompted to form a visual image, 20% of the comprehension questions about to the ability level passage (fifth grade) and 50% of the questions about a grade level passage (ninth grade) were answered correctly. When directed to form a visual image, Student 1 scored 30% on the test for an ability level passage and 33% on the test for a grade level passage.

After the visual imagery strategy was introduced, Student 1 required only three practice sessions in ability level materials and four practice sessions in grade level materials to meet criterion in using the strategy. The posttests showed that he improved his comprehension scores from baseline in all four tests. These improvements were maintained on the follow-up test. When prompted to apply the strategy to grade level materials, Student 1 answered 100% of the questions correctly on both the posttest and the followup test. Without a prompt to use the strategy, the student scored 80% on the posttest and follow-up test.

During baseline in the self–questioning strategy, Student 1 correctly answered 33% of the questions on an ability level passage and 50% of the questions on a grade level passage. When Student 1 read an ability level passage and the teacher probed to see if he was asking questions, he asked no questions during the first pretest and an average of .2 questions per probe when tested after visual imagery strategy instruction. After the self questioning strategy was introduced, Student 1 required only four practice sessions in ability level materials and three practice sessions in grade level materials to meet criterion in using the strategy. The posttest showed that he not only had improved his comprehension of grade level materials but also had increased the number of questions asked per probe. He now asked an average of 2.2 content related questions per probe on the posttest.

Student 1 did not use either strategy to criterion (85% or higher comprehension of the passage) until he received specific training on each strategy. His use of the strategies allowed him to remember more

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information from reading passages and to perform better on comprehension tests of grade level passages.

Table 1 shows a summary of results (mean scores) for all six students who received visual imagery strategy instruction and self-questioning strategy instruction within the multiple baseline across strategies experimental design.[2]

All the results are similar to the results achieved by Student 1. All students mastered the strategies in ability level materials and (with one exception) were able to apply the strategy to improve their comprehension of grade level materials. One student did not reach criterion in applying either strategy to grade level materials. All other students learned to apply each of the strategies to grade level material within a maximum of four practice sessions. The students' use of the strategies resulted in greater comprehension scores from the pretest in baseline to the posttest after training.

For students who mastered the two strategies in grade level materials, the maximum number of total practice sessions required was seven. The instructional time needed to present each of the two strategies (steps 2 to 4) was three to four hours for each strategy. Visual imagery and self-questioning practice took about 15 to 20 minutes each. The total instructional time ranged from five to seven hours.

Table 1. Mean Performances of Six Students During Visual Imagery and Self-Questioning Strategy Training

Strategy	Material	Instruction	Baseline	Posttest	Followup Test
Visual Imagery	Ability level	Without V.I. prompt	31.9%	60.8%	72.5%[a]
		With V.I. prompt	45.0%	68.8%	76.3%[a]
	Grade level	Without V.I. prompt	54.8%	68.7%	60.5%[a]
		With V.I. prompt	42.0%	81.7%	77.5%[a]
Self-Questioning	Ability level		52.7%	89.6%	72.0%[b]
	Grade level		46.0%	89.8%	70.0%[b]
	Average number of questions per probe		.2	1.9	1.8[b]

[a] Following Self-Questioning Strategy Training; $n = 4$ students.
[b] Following Visual Imagery Strategy Training; $n = 2$ students.

DISCUSSION

The results of this study support the conclusion that LD students can be taught to use strategies designed to increase their reading comprehension. These results support data available in the literature regarding the effectiveness of visual imagery (Kerst & Levin 1973, Lesgold, McCormick, & Golinkoff 1975, Paivio 1969) and questioning (Manzo 1969, Robinson 1946). Specifically, these data support other results using visual imagery and questioning procedures with LD children (Wong 1980) and LD adolescents (Hori 1977, Warner 1977). In addition, these data show that LD adolescents can apply these learning strategies in materials written above their measured reading ability level. Six replications of a multiple-baseline design demonstrated that improved performance did not occur until each strategy had been specifically taught. Analysis of the data indicates that implementation of one strategy does not affect performance on the other regardless of the order of instruction. The two strategies are independent and each must be specifically taught.

Although one student achieved mastery of the two strategies in reading ability level material, that student was unable to apply the strategies in grade level material. The reasons for this difficulty are not known; however, the student exhibited a greater difference between reading ability level (fourth grade) and grade placement level (ninth grade) than any other student to whom these strategies were taught. A prerequisite for instruction in these two strategies is at least fourth grade reading level. Although the student met this prerequisite, it is possible that the leap from fourth grade to ninth grade materials is too great. Further research should investigate the effects of varying differences between ability and grade level on learning these strategies. If similar difficulties are experienced by other students, intermediate steps may need to be added. For example, the student might have been asked to apply the strategies first at ability level (fourth grade), then at an intermediate level (seventh grade), and finally at grade placement level (ninth grade). Another possible explanation for the student's difficulty in applying the strategy to grade level material may be a lack of vocabulary knowledge required in the grade level material.

Although the results of this study are promising, caution must be exercised in interpreting the results. These results are based on the performance of six students. They should be replicated with additional students before statements about the generality of the results can be made. All students in this study were reading at fourth grade level or higher. Application of these findings to LD students with reading levels below fourth grade level should await further research.

Two other areas appear fruitful for future research. Although the specific methodology and the strategies implemented here were effective with five of six students, future research should examine whether alternative procedures are successful when a great difference (five years or greater) exists between reading ability level and grade placement level.

During implementation of these strategies, no attempt was made to teach LD students how to judge when to apply one strategy or the other. It is probable that the visual imagery strategy may be applied more appropriately to some types of materials than to others. For other materials, the self-questioning strategy may be the strategy of choice. Future research should determine ways to teach students to evaluate material and to select a strategy appropriate to the content.

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FOOTNOTES

1. Test passages and reading ability practice passages were selected from 66 Passages to Develop Reading Comprehension and 88 Passages to Develop Reading Comprehension by M. Gilmore, A. Sack, and J. Yourman, published by College Skills Center, 1250 Broadway, New York. These materials were used because they contained a series of short, high interest passages which had been judged for readability. The readability of the passages in 66 Passages ranged from first to eighth grade and in 88 Passages ranged from sixth grade to college level.
2. The multiple baseline figures for all of the participating students are available through The Institute for Research in Learning Disabilities, 313 Carruth-O'Leary Hall, University of Kansas, Lawrence, KA 66045.

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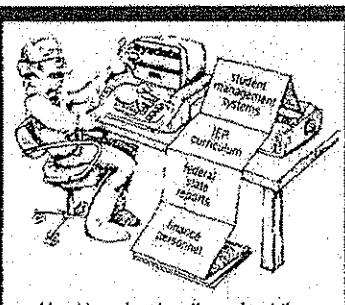

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