DOCUMENT RESUME

ED 208 019 TM 810 708

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TITLE The Compensatory Effect of Graphic Organizer Instruction on Text Structure.
PUB DATE Apr 81
NOTE 27p.; Paper presented at the Annual Meeting of the American Educational Research Association (65th, Los Angeles, CA, April 13-17, 1981).

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS *Advance Organizers; Cognitive Processes; Descriptive Writing; Grade 10; Prose; *Reading Comprehension; *Recall (Psychology); Retention (Psychology); Secondary Education; Student Attitudes
IDENTIFIERS *Graphic Organizers; *Text Structure

ABSTRACT

This study has three purposes: (1) to determine whether the graphic organizer (a schematic representation of text structure using key vocabulary terms) could be used to compensate for the effects of a passage organized with a description top-level structure; (2) to explore the effectiveness of providing students differing in reading ability with different types of instructional strategies and text structures; (3) to learn how graphic organizers, text structure, and reading comprehension level affect posttreatment attitudes. Tenth graders read two versions of an expository passage which contained identical information but differed in top-level structures (description versus comparison/contrast). Students were either exposed to or denied instruction with a graphic organizer that had been constructed to reflect the top-level structure of the comparison/contrast passage. Multiple regression analyses revealed these findings: first, immediate free recall performance was positively affected only under the description text condition; second, both skilled and unskilled readers appeared to benefit from the use of graphic organizers; third, text organized with a description top-level structure did not produce significantly better recall performance among poorer readers; and finally, multiple regression analyses of posttreatment attitude data did not yield any educationally significant results. (Author/GK)

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The Compensatory Effect of Graphic Organizer Instruction on Text Structure

AERA presentation

Los Angeles, April 1981

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ABSTRACT

This study has three purposes. One, to determine whether the graphic organizer (a schematic representation of text structure using key vocabulary terms) could be used to compensate for the effects of a passage organized with a description top-level structure. Two, to explore the effectiveness of providing students who differ in their reading ability with different types of instructional strategies and text structures. Three, to learn how graphic organizers, text structure, and reading comprehension level affect post-treatment attitudes.

Tenth graders (N = 128) read two versions of an expository passage which contained identical information but differed in their top-level structures (description versus comparison/contrast). Students in each text condition were either exposed to or denied instruction with a graphic organizer that had been constructed to reflect the top-level structure of the comparison/contrast passage. Thus, students in the description text condition were required to reorganize the information according to the comparison/contrast graphic organizer. Subjects were randomly selected and assigned to experimental and control groups on the basis of their Stanford Diagnostic Reading Test Scores. The dependent variable (number of idea units freely recalled) was measured immediately after students read the passage and one week later. Meyer's (1975) system of prose analysis was used to score students' recall protocols.

Multiple regression analyses revealed three important findings. First, as hypothesized, immediate free recall performance for students exposed to a graphic organizer was positively affected only under the description text condition. The same interaction was observed one week later on the delayed free recall. These results suggest that organizers may facilitate comprehension and retention when readers are required to reorganize information found in text but may have no effect when reorganization is unnecessary. Second, both skilled and unskilled readers appeared to benefit from the use of graphic organizers. Prior achievement in reading did not interact with type of instructional strategy as hypothesized. Third, text organized with a description top-level structure did not produce significantly better recall performance among poorer readers; nor did comparison/contrast text structure produce significantly better recall among the more able readers. Finally, multiple regression analyses of posttreatment attitude data did not yield any educationally significant results.

The fact that text organized with a description top-level structure occurs most frequently in secondary textbooks, yet has the least facilitative effect on students' recall, suggests the feasibility of using graphic organizers to induce student-imposed structure. By doing this, teachers may help students to compensate for the list-type features of descriptive text and ultimately to improve their comprehension and retention of what they read.

Portions of this text have been submitted for publication. D. Ahlermann 5/11/81

Purpose of the Study

The study had three purposes. One, to determine whether the graphic organizer (a type of advance organizer that activates a reader's prior knowledge and depicts the organizational pattern of a reading selection by schematically representing key vocabulary terms) could be used to compensate for the effects of a passage organized with a description top-level structure. Two, to explore the effectiveness of providing students who differ in their reading ability with graphic organizers and different types of text structure. Three, to learn how graphic organizers, text structure, and reading comprehension level affect posttreatment attitudes.

The importance of text structure in determining what readers will learn and retain is well documented in a number of recent investigations (Brandt, 1978; Meyer, 1975; Taylor, 1979). Reportedly, text organized with a descriptive top-level structure (general statement followed by specifics) is least facilitative for the reader (Brandt, 1978); yet, this type of structure is prevalent in secondary textbooks (Bartlett, 1978; Niles, 1965). Conversely, comparison top-level structure, though more facilitative, occurs less often.

In attempting to explain the facilitative differences between comparison and descriptive top-level structures, Brandt (1978) suggested that because ideas in comparison passages are related to each other as well as to a superordinate idea, recalling one idea " . . . may serve as a retrieval cue for other ideas, and these will be related to the idea first recalled" (p. 8). In a descriptive passage, however, the ideas are listed randomly and relate to one superordinate idea, not necessarily to each other. Brandt also acknowledged, as did others (Bartlett, 1978; Herber, 1978; Pearson & Johnson, 1978), that reading comprehension is facilitated to the extent that readers are able to recognize and use the author's top-level structure.

Nevertheless, Brandt (1978) cited two instances in which a student-imposed structure, even though it differed from an author's, might result in improved learning and retention. One, if an author uses description text structure, students might be encouraged to reorganize the information using a comparison structure. This active and greater "depth-of-processing" (Craik & Lockhart, 1972) should conceivably produce greater recall. Thus, I hupothesized that if an experimental procedure could be devised which included a means for inducing student-imposed structure on text organized with a description top-level structure, the opportunity for improved comprehension and retention might become possible.

Secondly, based on R. Mayer's assimilation encoding theory, I hypothesized that an organizer should have its greatest effects for low comprehenders---i.e., those readers who would not otherwise use a meaningful assimilative set. High comprehenders, on the other hand, were not expected to benefit greatly from the graphic organizer---they were considered "experts" in recognizing text structure on their own. In fact, it was thought that experimenter-induced strategies might even interfere with the high comprehender's text processing strategies.

Based on Brandt's (1978) findings that passages organized with a description top-level structure produced greater recall among low comprehenders while comparison/contrast text proved more facilitative for high comprehenders, the present study predicted a similar interaction effect for text structure and reading ability.

Finally, a series of questions examined the relationships of graphic organizer, textual organization, and reading comprehension level to students' posttreatment attitudes. According to Snow (1974), the inclusion of multiple outcome measures (i.e., both attitudinal and cognitive) is desirable in studies which deal with instructional strategies and student achievement. This is so because information gained from studying attitude outcomes may

often aid in the explanation of effects observed on cognitive outcome measures.

Design

This study contained one continuous variable (Reading Comprehension Level) and two categorical variables: Type of Instructional Strategy (graphic organizer versus no graphic organizer) and Type of Text Structure (comparison/contrast versus description). The dependent variable (number of idea units recalled) was measured immediately after students had read the experimental passage (immediate free recall) and one week later (delayed free recall).

Since students' posttreatment attitudes were also of interest, a second dependent measure included the number of points scored for each factor on the Adjective Rating Scale. The ARS consists of 24 adjectives which are rated on a 4 -point sclae (1 = extremely to 4 = not at all) against the following stimulus: "I found the graphic organizer to be_____." Within each factor are several adjectives which define the parameters. For example, adjectives comprising the "interest" factor include: informative, valuable, challenging, and interesting.

Subjects

A table of random numbers was used to select 128 students from a larger pool of tenth graders enrolled in Regents and non-Regents courses at a high school in Gloversville, New York. Those 128 students were ranked from high to low on the basis of their literal comprehension scores as reported on the Stanford Diagnostic Reading Test (Blue Level, Form B) which was administered as part of the routine school procedure in the fall of 1979. They were then assigned to four groups through stratified random

assignment by reading comprehension level. Subsequently, groups were randomly assigned to treatment conditions.

Absenteeism at either the immediate or delayed recall posttest times resulted in incomplete sets of recalls for 14 students. Consequently, 114 subjects composed the final sample for statistical analyses.

Passages

Both versions of the experimental passage used in this study dealt with the loss of body water and had a substantial research history (Brandt, 1978; Meyer, 1977a). One version, titled "Views Clash on Loss of Body Water," had a comparison/contrast top-level structure and contained 140 words and 77 scorable idea units. The other version, "Loss of Body Water", had a description top-level structure and contained the same number of words and idea units. Each version was embedded between two paragraphs containing information related to the loss of body water. The concluding paragraph served as a buffer and controlled for short-term memory effects.

In addition to the experimental passage, two versions of a practice passage on killer whales were used to acquaint subjects with the nature of the experimental treatment. This was done in view of McConkie"s (1977) recommendation that practice should be built in to insure fullest possible effect from any experimental manipulation.

Procedure. The experiment was conducted in two sessions, one week apart. In both sessions, students reported to a preassigned classroom during regularly scheduled class periods. Subjects were run in groups of approximately 16 each. Session one consisted of a trial passage followed by the experimental passage and immediate recall. Session two included the delayed recall.

In the two experimental conditions (graphic orgainizer/comparison and graphic organizer/description), the classroom teacher informed students that they were going to learn a strategy for remembering more of what they read. Before distributing the passages, the teacher activated students' prior knowledge about text organized with a comparison top-level structure by asking them to compare and contrast apples and oranges. They were told that remembering the color (or shape, texture, taste) of one fruit should trigger the recall of a similar characteristic of the other fruit. This analogy was briefly related to an author's use of comparison/contrast in organizing information for textbooks. Next, students in both text conditions were exposed to an* overhead transparency of the same graphic organizer. It had been constructed to reflect the top-level structure of the comparison passage so as to encourage reorganization on the part of those in the descriptive text condition. The organizer was only partially complete in that certain key terms had been omitted. This was done to force active processing of the passage. Students were told that they should keep the comparison structure of the organizer in mind while they read the passage. They were told that remembering key terms from the organizer would help them identify and later recall contrasting terms from the passage. The process involved a mental (as opposed to paper and pencil) filling-in of the organizer's empty slots. Finally, the overhead projector was turned off, and students were instructed to read and recall the passage.

The procedure differed for the two control groups. They were informed prior to reading that just taking a few minutes to <u>think</u> about how they read to remember would help them recall the most ideas.

Bonnie Meyer's (1975) system of prose analysis was used to score students' recall protocols. Each protocol's content structure was checked against the

* see p-12

content structure of the original passage for the presence or absence of specific content and/or relationship units. An individual's total score, which was expressed in "idea units" was found by summing the number of content units recalled with the number of relationship units recalled. Intrarater reliability was established by re-scoring 20 randomly selected recall protocols. Approximately two months elapsed between the initial and second scoring. A Pearson r = 0.96 was obtained.

Limitations

Several limitations are evident in this study. One is the reduced generalizability of the results to larger populations of passages due to the fact that a single passage was used. That limitation, however, was made less severe for two reasons: 1) two different versions of the "Loss of Body Water" passage were used, and 2) data which compared this particular passage to a passage with different content were already available (Brandt, 1978).

Another limitation concerns passage length. Each version of the experimental passage contained less than 200 words; yet most high school reading assignments are considerably longer. A short passage was chosen due to the present state of the art for scoring recall protocols.

A third limitation is the form of the recall measure. Since students were expected to write what they remembered, it may be assumed that the less able readers were doubly penalized. In addition to comprehending less initially, poorer readers usually experience considerable difficulty expressing what they do remember in writing.

RESULTS

Reading Comprehension Level and Recall

Table 1 p.13 incorporates information on the means, standard deviations, and ranges for reading comprehension level and recall by treatment groups.

The group which received a graphic organizer and read text organized with a description top-level structure recalled more idea units on the immediate free recall ($\bar{X}$ = 34.2) than any of the other three groups ($\bar{X}$ = 26.4, $\bar{X}$ = 19.9, $\bar{X}$ = 25.8). This pattern held one week later for the delayed free recall measures as well.

Results of a multiple regression analysis (Table 2- p. 14) indicated that the full model was significant, and accounted for 41 percent of the total variance. Although reading comprehension level was the primary predictor of the number of idea units recalled, the interaction between graphic organizer and text structure was also significant, and explained 8 percent of the total variance. However, if calculated relative to the amount of variance the full model explained (41 percent), the interaction between organizer and text accounted for 20 percent of the variance. As illustrated in Figure 1, p. 15, immediate free recall performance for students exposed to a graphic organizer was positively affected only under the description text condition. Hence, Hypothesis 1 was supported.

Results of the multiple regression analysis showed no significant interaction between organizer and reading comprehension level, F (1, 112) = 1.09, $p < .30$. As evidenced in Figure 3, p. 16 the regression lines for the graphic organizer and no graphic organizer groups do not intersect within the range of interest. Students at both the upper and lower levels of the reading comprehension continuum benefited from the use of graphic organizers. Hypthothesis 2, therefore, was not supported.

Nor was Hypothesis 3 supported. As Figure 8 p. 17 indicates, text organized with a description top-level structure did not produce significantly better recall performance in low comprehenders; nor did comparison/contrast text structure produce significantly better recall in high comprehenders. No main effect was observed for text, F (1, 112) = 0.23, $p > .60$.

Higher-Order Interaction

There was only one possible higher-order interaction. As reported in Table 2, this three-way interaction was not signficant.

Delayed Free Recall

A multiple regression analysis was performed to determine if the effects observed at the time of the immediate free recall were discernible one week later on a delayed free recall measure. The full model was significant, and accounted for 43 percent of the total variance (Table 3, p. 14). Although reading comprehension level continued to be the primary predictor of recall performance, the significant interaction between strategy and text was also maintained. It explained 7 percent of the total variance. Or, when computed relative to the variance accounted for by the full model, the interaction explained 15 percent of the variance. As Figure 2, p. 18 illustrates, delayed free recall performance for students exposed to a graphic organizer differed significantly only for the description text condition. Hence, the effects observed at the time of the immediate posttest were maintained over a one-week delay.

Posttreatment Attitude Outcomes

Posttreatment attitude data were collected in the present study on the assumption that any supplemental information derived from their analyses would provide insight that could be used in interpreting the cognitive learning outcomes (Snow, 1974). However, the proportion of variance accounted for by the regression of factors such as practical value, emotional appeal, dullness, interest, and difficulty on reading comprehension level, graphic organizer, and text structure was too small to be educationally significant. (See Table 7, p. 19)

Discussion of Findings.

Two interpretations may be made of the significant treatment effect found for graphic organizers when used in conjunction with description text. First, the organizer may have influenced the learner's encoding process by providing

anchoring ideas which helped "hold" incoming information from text that was less than optimal in its organization until that information could be pieced together or reorganized. This explanation would also help explain the absence of any effect for organizers under the comparison/contrast text condition. It appears that when information was presented in the form of logical, competing arguements, the reader who remembered an idea from one side of the argument may have been cued to recall an idea from the opposing side. Hence, organizers may have been superfluous for students in the comparison/contrast text condition and, conceivably, may even have interfered with some students' information processing strategies.

Second, the fact that the organizer's top-level structure did not match the top-level structure of the description passage (and thus required reorganization) may have facilitated greater depth in processing with a concomitant increase in recall.

The fact that in the present study students at both the upper and lower levels of the reading comprehension continuum benefited from the use of graphic organizers suggests that it may be incorrect to assume that high comprehenders possess greater expertise than low comprehenders, sufficient for superior recognition and use of structure on their own. This finding would support Herber/s position that all students, regardless of reading ability, can benefit from the increased instructional support provided by a graphic organizer.

Two alternative explanations could also account for the failure to find the hypothesized interaction between graphic organizer and reading comprehension level. It may have been that the training period in how to use graphic organizers was too brief. Unskilled readers, especially, might need more time to become

proficient in the use of such instructional aids. Or, it may have been that skilled readers, who supposedly already possessed expertise in recognizing and using top-level structure, simply became more "expert" as a result of being exposed to organizers.

Unlike earlier findings reported by Brandt, the predicted interaction between text structure and students' reading comprehension level was not confirmed in the present study. In attempting to explain these conflicting findings, it is informative to look briefly at the two studies. Both investigators used the same versions of the loss of body water passage. Brandt studied 144 ninth graders; I studied 114 tenth graders. Although the experimental treatments differed greatly, both studies were short term. Subjects in the Brandt study were studied in intact classes and were classified as good, average, or poor comprehenders based on their Stanford Achievement Test reading scores. In contrast, students in the present study were randomly selected and then assigned to groups through stratified random assignment by reading comprehension level, based on scores obtained from the Stanford Diagnostic Reading Test. Hence, in the Brandt study, reading comprehension level was treated as a categorical variable and in this study as a continuous variable. According to Kerlinger and Pedhazur (1973, p. 241) "It is possible that some of the conflicting evidence in the research literature of a given area may be attributed to the practice of categorization of continuous variables."

Implications for Current Educational Practice

Reportedly, text organized with a descriptive top-level structure occurs most frequently in secondary textbooks, yet is least facilitative of retention. Results from this study indicate that graphic organizers can compensate for the list-type features of descriptive text, seemingly by first activating a reader's prior knowledge about structure and then actively involving him in the reorganization of the information.

Finally, the fact that both skilled and unskilled readers benefited from instruction using organizers implies that those in the control group used less effective text-processing strategies. A case in point is Subject #150 (control) who responded to the question, "What did you do to help yourself remember the information you just read?" as follows: "When I read a sentence I read it twice. And then went on to the next sentence and did the same thing until I read the whole paragraph." As Spiro and Tirre (1979) pointed out, readers who have developed comprehension styles similar to Subject #150's may be biased toward the text (bottom-up processors). They may be able to understand single sentences but fail to integrate information across sentences. To alleviate this problem, teachers might consider using organizers to help readers assimilate incoming information with concepts already in their cognitive structure. In effect, bottom-up text processors are taught to become top-down processors as well. That should lead to better integration of information across sentences and paragraphs.

Loss Of Body Water

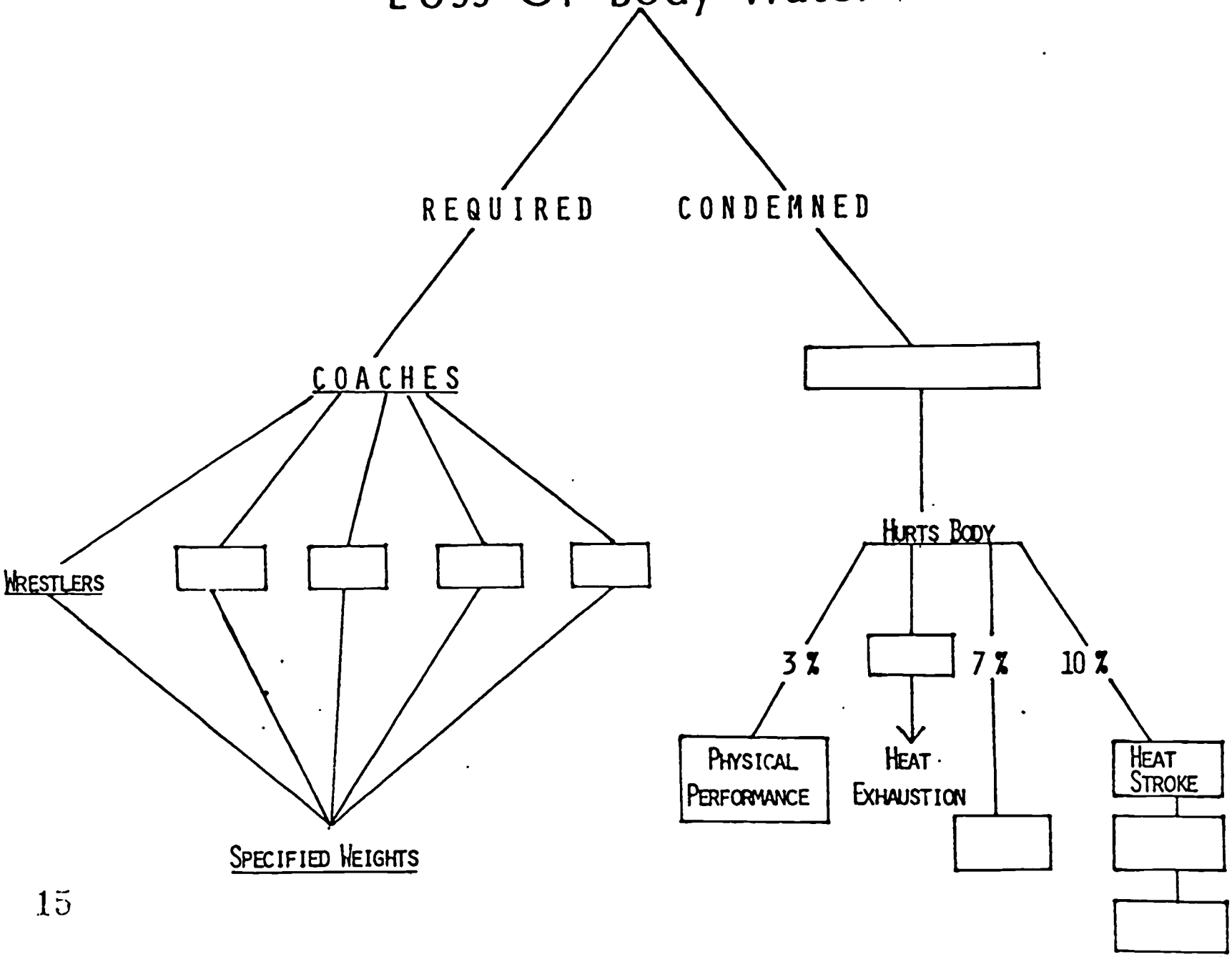

Table 1

Means, Standard Deviations, and Ranges of Reading Comprehension Level and Recall by Treatment Groups

	Graphic Organizer/ Descriptive (N = 28)			Graphic Organizer/ Comparison (N = 28)			No Graphic Organizer/ Descriptive (N = 29)			No Graphic Organizer/ Comparison (N = 29)		
	$\bar{X}$	S.D.	Range	$\bar{X}$	S.D.	Range	$\bar{X}$	S.D.	Range	$\bar{X}$	S.D.	Range
Reading Comprehension Level (grade equivalent)	9.91	1.87	5.3-12.6	9.98	1.79	5.3-12.6	9.96	1.76	5.3-12.6	9.92	1.62	5.9-12.6
Immediate Free Recall (idea units)	34.18	10.07	13.0-53.0	26.43	12.94	3.0-53.0	19.93	11.32	0.0-41.0	25.79	10.84	6.0-45.0
Delayed Free Recall (idea units)	23.78	9.79	3.0-38.0	18.46	10.63	0.0-40.0	9.59	8.06	0.0-29.0	14.83	8.92	1.0-30.0

Table 2

Summary of Multiple Regression Analysis
for Immediate Free Recall

Source of Variation	df	R^2	F Value	p <
Full Model	7	.41	10.33	.001
Main Effects				
Reading Comp. Level (RCL)	1	.22	39.44	.001
Organizer	1	.09	16.45	.001
Text	1	< .01	0.23	ns
Interactions				
Organizer x RCL	1	< .01	1.09	ns
Organizer x Text	1	.08	14.47	.001
RCL x Text	1	< .01	0.04	ns
RCL x Organizer x Text	1	< .01	0.63	ns
Residual	106	.59		

Table 3

Summary of Multiple Regression Analysis
for Delayed Free Recall

Source of Variation	df	R^2	F Value	p <
Full Model	7	.43	11.65	.001
Main Effects				
Reading Comp. Level (RCL)	1	.19	35.38	.001
Organizer	1	.18	33.27	.001
Text	1	< .01	0.00	ns
Interactions				
Organizer x RCL	1	< .01	0.34	ns
Organizer x Text	1	.07	12.32	.001
RCL x Text	1	< .01	0.15	ns
RCL x Organizer x Text	1	< .01	0.11	ns
Residual	106	.57		

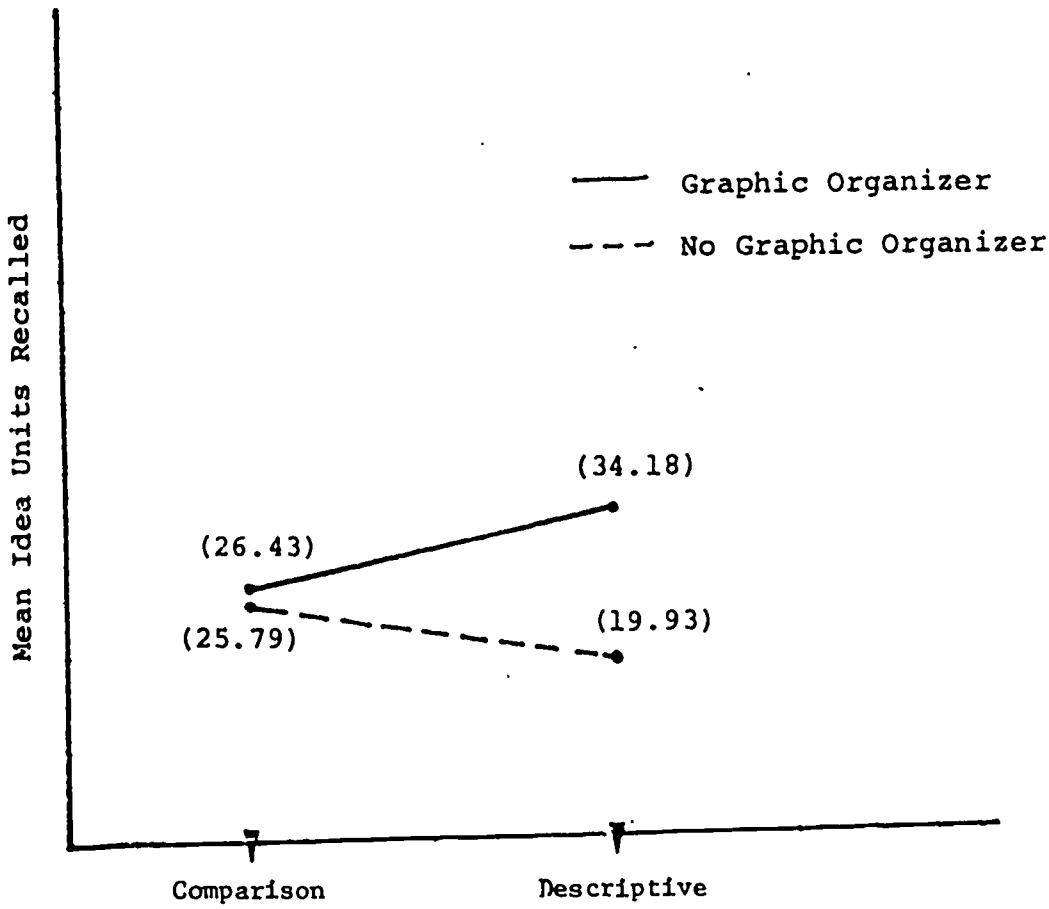

Fig. 1. Graphic Organizer x Text Structure Interaction on Immediate Free Recall.

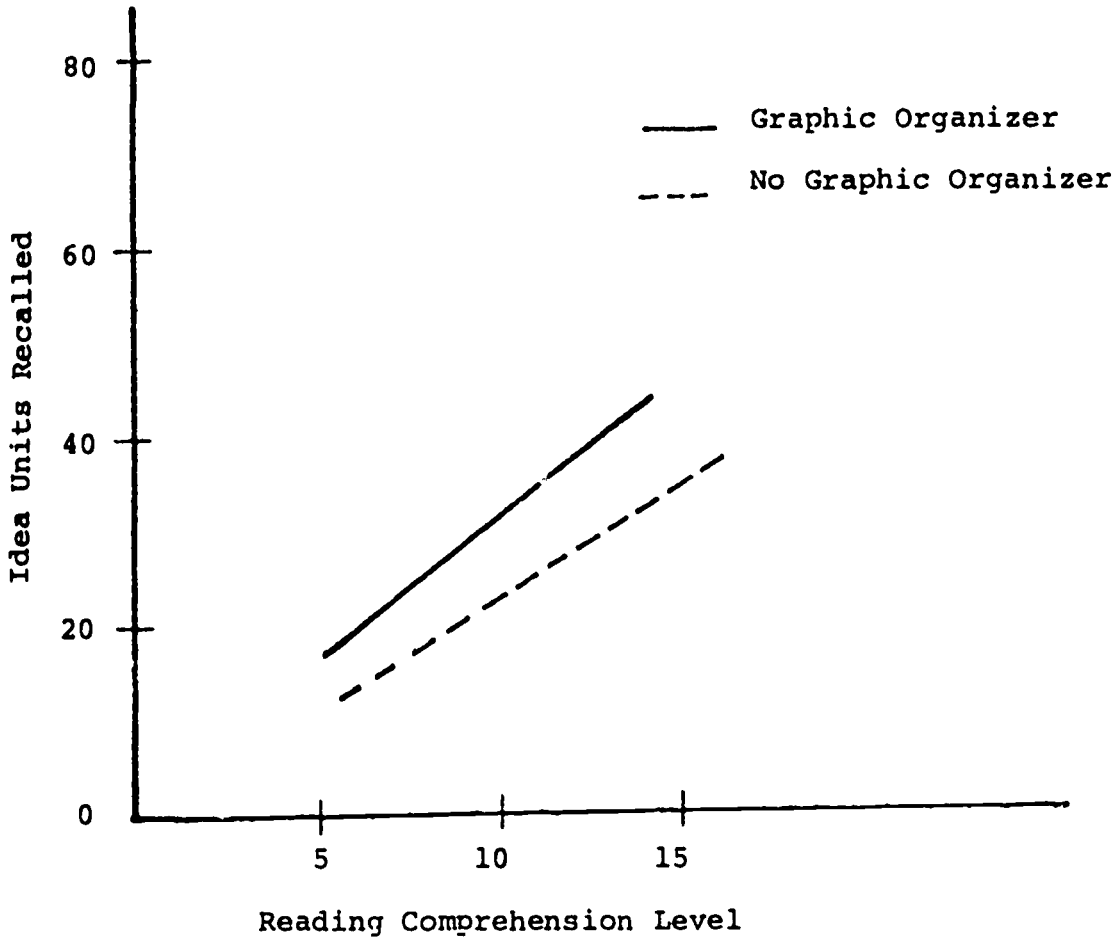

Fig. 3. Regression Lines for Graphic Organizer x Reading Comprehension Level.

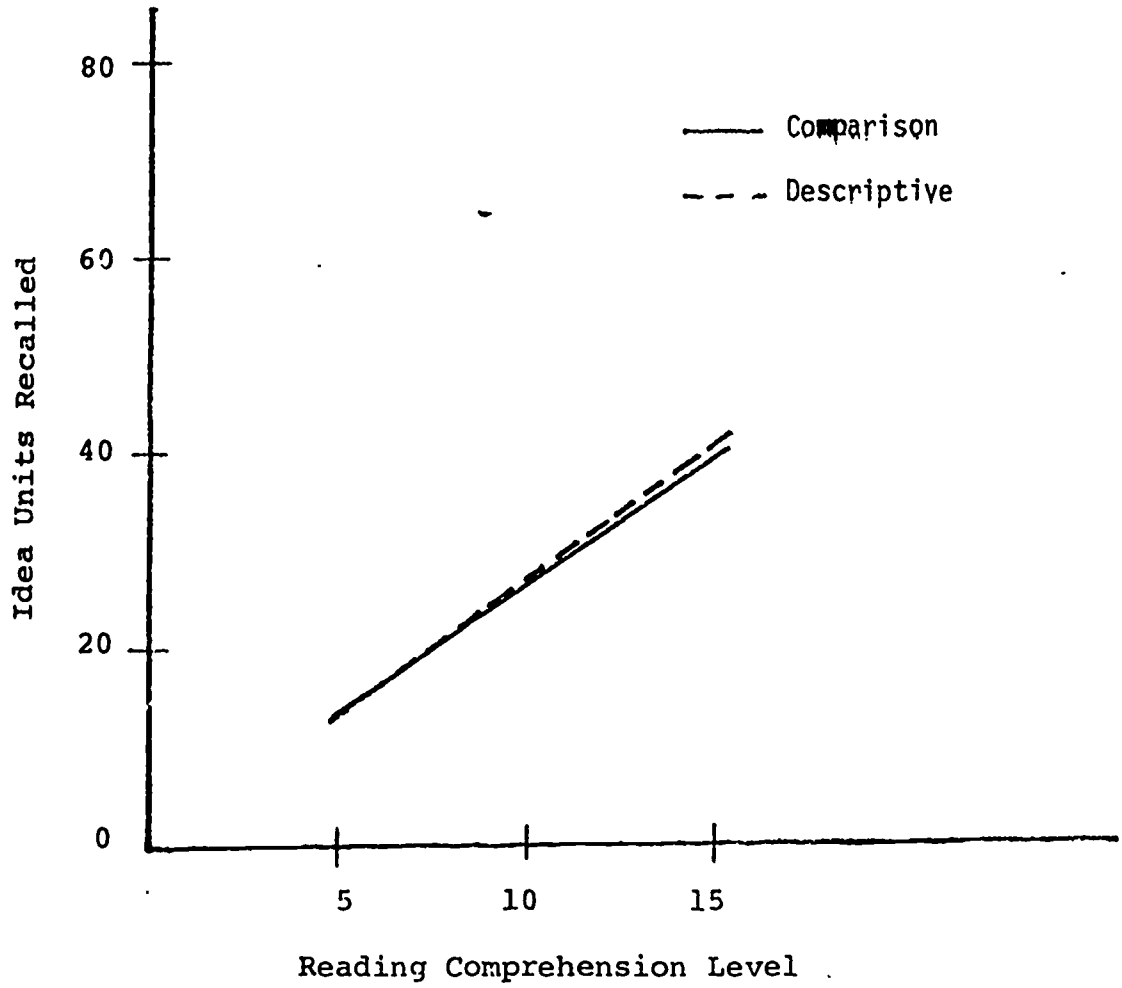

Fig. 8. Regression Lines for Textual Organization x Reading Comprehension Level Interaction.

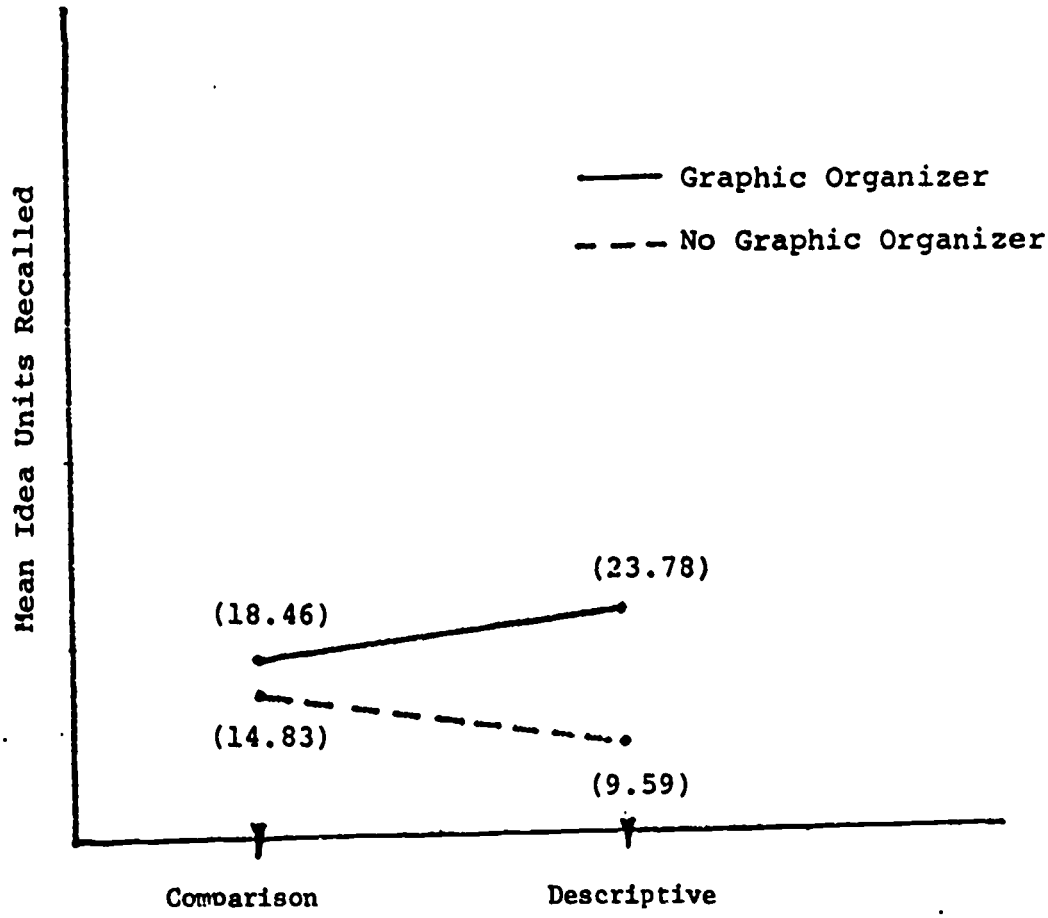

Fig. 2. Graphic Organizer x Text Structure Interaction on Delayed Free Recall.

Table 7

Summary of Multiple Regression Analysis
for Adjective Rating Scale (Total)

Source of Variation	df	R^2	F Value	p <
Full Model	7	.20	3.57	.01
Main Effects				
Reading Comp. Level (RCL)	1	.03	4.22	.05
Organizer	1	.01	1.05	ns
Text	1	.05	6.94	.05
Interactions				
RCL x Organizer	1	.02	3.00	ns
RCL x Text	1	.02	2.73	ns
Organizer x Text	1	.03	3.45	ns
RCL x Organizer x Text	1	.03	3.61	ns
Residual	103	.80		

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