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ABSTRACT

The comparative achievement effects of three types of worksheets across reading ability was investigated in fifth grade students of varying reading ability. Based on reading achievement scores, the students were divided equally into three levels (high, middle, and low) and assigned to worksheet treatment groups. The worksheets were designed to promote (1) recall or recognition of details, (2) concept comprehension, and (3) selection of main ideas. The results immediately following treatment indicated no significant effects for worksheet type or worksheet type by reading level. Four weeks following treatment, however, the high level readers in the drill and comprehension groups performed significantly better on a measure of comprehension than did low level readers in the drill and comprehension groups. Overall, reading ability and task difficulty, not worksheet type, appeared to be the primary variables in student achievement. (Author/RL)

A COMPARISON OF THE EFFECTS OF USING VARIOUS TYPES OF WORKSHEETS ON PUPIL ACHIEVEMENT

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Running head: Worksheets

Abstract

Teachers use a variety of lesson activities to promote learning. A common format for lesson activities is the worksheet. The achievement effects of using worksheets in classroom instruction has not been empirically demonstrated. This study investigated the effects of using three types of worksheets on achievement for students of various reading abilities. Students across randomly selected fifth-grade classrooms were equally divided into three levels on the basis of reading achievement test scores. Within levels, students were randomly assigned to treatments, consisting of different types of worksheets. The types of worksheets included those designed to promote: (a) recall or recognition of details, (b) concept comprehension, and (c) selection of main ideas. Immediately following treatment, no significant effects were demonstrated for worksheet type or worksheet type by reading level. Four weeks following treatment, significant interaction effects between worksheet type and reading level were demonstrated ($p < .05$). Results suggest that type of worksheet used does not have an immediate differential effect on student achievement. Rather, reading ability and task difficulty appear to be primary variables in student achievement.

A COMPARISON OF THE EFFECTS OF USING VARIOUS TYPES OF WORKSHEETS ON PUPIL ACHIEVEMENT

Students' needs and how students' time in the classroom is typically spent are critical variables in the study of teaching. Student needs are often assumed to be met by a curriculum which traditionally focuses on skill development. Reading, writing, and the ability to compute are some of the major cognitive skills that students hopefully develop as a result of time spent in school.

During school time students are presented with diverse lesson activities presumably designed to facilitate cognitive skill development. Lesson activities may assume a variety of formats such as recitation, discussion, and seatwork. Research findings demonstrate that seatwork is the category of lesson activity to which the greatest amount of pupil time is assigned (Good & Beckerman, 1978; McDonald, 1977). The average amount of time students spend in independent seatwork activities appears to be 50 percent of the school time allocated for lesson activities. A typical format for seatwork activities is the worksheet or ditto sheet (Redfield, 1979).

An implication of the extensive classroom use of worksheets is that educators believe such a format to be an efficient and effective mode for meeting students' instructional needs. Teachers report using worksheets to particularly increase two types of learning (Redfield, 1979): (a) recall or recognition of facts and details and (b) increased knowledge of concepts requiring what is commonly referred to as "comprehension." In this study, comprehension refers to the knowledge of superordinate ideas which allow for the application, analysis, synthesis, and/or evaluation of factual material.

If, indeed, classroom teachers use worksheets to facilitate the recall/recognition and/or comprehension of instructional material, a crucial question becomes, "What types of worksheet activities will have the desired effect(s)?" To provide clues for examining this question, two theoretical issues demand consideration: (a) depth of cognitive processing and (b) incidental learning.

In recent years, a depth of processing model of memory has been proposed (Craik & Lockhart, 1972) and empirically investigated (e.g., Hyde & Jenkins, 1973; Epstein, Johnson & Phillips, 1975). A basic assumption of the depth of processing model is that learning is a function of the degree or depth to which information is processed. It is further assumed that tasks requiring structural, phonemic, and semantic analysis result in deeper levels of processing, respectively. Hence, tasks which result in cognitive processing at the semantic level should result in the greatest achievement.

A manner in which level of processing may be experimentally manipulated is via various question types. For example, a typical question designed to elicit processing at the structural level would be, "Is the word with which you are being presented written in capital letters?" A question designed to encourage processing at the phonemic level might ask, "Does the word rhyme with TRAIN?" Questions designed to promote processing at the semantic level necessitate knowledge of word meaning, e.g., "Is the word with which you are being presented the name of a type of animal?" After the primary grades in school, nearly all learning goals require cognitive processing at the semantic level.

A large number of studies appear to support the depth of processing model of memory (e.g., Hyde & Jenkins, 1969; Till & Jenkins, 1973; Walsh & Jenkins, 1973). Other studies have demonstrated the need to differentiate sublevels of processing within the semantic level of analysis (e.g., Craik & Tulving, 1975; Klein & Saltz, 1976; Schulman, 1974; Seamon & Murray, 1976). Taxonomies of cognitive functions (e.g., Bloom et. al., 1956) suggest a hierarchical continuum of processes within the semantic level, ranging from the simple (viz., recognition of details) to the complex (viz., evaluation of information). Hence, worksheet questions requiring application, analysis, synthesis, and/or evaluation of information would, presumably, result in greater knowledge acquisition than questions requiring recall or recognition of detail.

The other theoretical issue requiring consideration is that of incidental learning. Incidental learning is learning which occurs but is not prescribed by the assigned or orienting task. For example, an orienting task may require the student to match a series of vocabulary words with a corresponding list of definitions. While searching for various vocabulary words in a dictionary, the student may, by accident or out of personal interest, additionally learn the meaning of words not appearing on the vocabulary list. Learning the meaning of unassigned vocabulary words, then, would constitute an incidental learning experience for the student.

From a depth of processing perspective, if the orienting task causes the student to process the material at a deeper level than the incidental information requires, then incidental learning will occur. In other words, learning should be greater when the orienting task requires semantic processing than when the task requires structural or phonemic analysis. If sublevels of processing exist within the semantic domain and are hierarchical in nature, it logically follows that learning will be greater when the orienting task calls for application, analysis, synthesis, and/or evaluation of information than when it calls for recall or recognition of details.

Depth of processing and incidental learning theories provide implications for the design of instructionally sound worksheet tasks. That is, classroom teachers provide worksheet tasks to, presumably, encourage student processing of information at levels which will facilitate the desired outcomes (viz., recall/ recognition of details and/or comprehension of concepts). However, only two studies reported in the research literature have been specifically designed to investigate worksheet or workbook page variables influencing achievement outcomes (Frank, 1970; Willins, 1976).

Worksheets, like other forms of seatwork, are widely used. The academic content and cognitive processes tapped by worksheet activities are amenable to experimental manipulation. The purpose of this study was to investigate the immediate and long-range effects of using three different types of worksheets on achievement for students of various reading abilities. The worksheets consisted of questions designed to promote cognitive processing at various sublevels within the semantic domain.

Methods

Students across five randomly selected fifth-grade cl srooms were ranked on reading ability as measured by the reading subtest of the Comprehensive Test of Basic Skills (CTBS). Subjects were then divided into equal thirds--high, middle, and low reading levels. Within each level, students were randomly assigned to one of three treatment groups.

The treatment was type of worksheet. Types of worksheets were designed to reflect sublevels within the semantic domain of cognitive skills. Types of worksheets were: (a) those designed to elicit recall or recognition of factual information or details, hereafter referred to as the "drill" treatment; (b) those designed to promote application, analysis, synthesis, or evaluation of factual lesson material, hereafter referred to as the "comprehension" treatment; and (c) those requiring the student to locate and write main ideas appearing in the text, hereafter referred to as the "structuring" treatment. The comprehension and structuring worksheets were designed to promote similar levels of cognitive processing. The cognitive processing required by the comprehension and structuring worksheets was hypothesized to be at a deeper level than that required by the drill worksheets.

Prior to the first day of the experiment, teachers of classes participating in the study were trained in experimental procedures by the experimenter. On each of three days during the week of the experiment, students were presented with an experimenter-prepared, teacher-read introduction to the day's lesson. Scripted lessons were used to facilitate equality of presentation across classrooms.

After presentation of the scripted introduction, students were asked to follow along in their textbook while the teacher read the designated textual material aloud. Teacher reading of the text was required to ensure that each student was exposed to the lesson material at least once despite a variation in student reading abilities.

Following teacher reading of each lesson, folders were distributed to the students. Treatment group assignment determined the type of worksheet contained in each student's folder. Students were told they could refer to their textbooks to aid in worksheet completion.

To provide for consistency of teacher participation across classrooms, teachers were instructed to be available for assistance to individual pupils upon request, but were also instructed not to initiate any teacher-pupil interaction. Feedback to students consisted of returning their corrected worksheets on the school day following worksheet completion. All worksheets were experimenter corrected; incorrect answers were marked with a check (✓) to reflect the procedure normally used by the participating teachers. Students were directed to individually approach the teacher with any questions regarding their corrected worksheets. This instruction was used to avoid having different classrooms of children exposed to differing questions and possible ensuing discussions.

Time allowed for lesson presentation and worksheet completion across all classrooms on each of the treatment days was 50 minutes. This amount of time proved sufficient for even the slowest workers to complete their worksheets. Those students who finished before 50 minutes had elapsed were instructed to silently read a library book or complete other unfinished class assignments.

Five controls, then, were implemented to allow for clear interpretation of the effects of the worksheets on achievement. These controls were provisions for: (a) consistency of lesson format via use of scripted lessons and teacher reading of the text, (b) consistency of teacher involvement by limiting teacher-initiated interactions with pupils during the time allotted for worksheet completion, (c) consistent time allotments for lesson completion across class-rooms, (d) consistency of activities for students completing their worksheets before the end of the lesson period, and (e) consistency of feedback to students.

On the Monday directly following the week of the experiment, an experimenter-developed achievement test over the instructional material covered the previous week was administered. Each student received four scores on the achievement posttest. These four scores were for the following categories, each containing ten items: (a) recall or recognition of nonincidental material (RN), (b) recall or recognition of incidental material (RI), (c) comprehension of nonincidental material (CN), and (d) comprehension of incidental material (CI). "Incidental", here, designated material covered by the textbook but not by the worksheets.

Four weeks following administration of the achievement posttest, a 20-item follow-up test was administered. The follow-up test consisted of five items from each of the RN, RI, CN, and CI categories on the posttest. The follow-up test was limited to 20 items for pragmatic reasons.

Because of the limited number of items and because items previously used on the posttest could no longer be considered measures of incidental learning, only Comprehension and Recognition/Recall subscores were computed. That is, RN and RI items were combined to form a ten item Recognition/Recall (R) subscale; CN and CI items were combined to form a ten item Comprehension (C) subscale.

Results

Posttest Achievement

The achievement test data obtained after three days of treatment were analyzed using a 3 (treatment groups) x 3 (levels) x 4 (trials) analysis of variance for equal n's with repeated measures on the trials variable. Data were randomly deleted to obtain equal n's of ten per cell. Descriptive statistics for posttest achievement are presented in Table 1; a summary of the analysis of variance is presented in Table 2.

Insert Tables 1 and 2 about here

Significant main effects were found for reading levels ($F=21.08$; $df=2, 81$; $p<.001$) and for trials ($F=80.98$; $df=3, 243$; $p<.001$). Tukey's HSD test (Kirk, 1968) was used to make pairwise post hoc comparisons of the significant findings.

Post hoc comparisons revealed that both high and middle level readers performed significantly better than low level readers across all trials and treatments ($p<.01$). The difference between high and middle level readers was significant for the CN trial only ($p<.05$). These results are depicted in Figure 1.

Insert Figure 1 about here

Post hoc comparisons also demonstrated that performance on the RN subscale was significantly higher than performance on the RI, CN, and CI subscales across all treatments and levels ($p<.01$). In addition, performance on the RI and CN subscales was significantly superior to performance on the CI subscale across all treatments and levels ($p<.01$). This consistent finding with regard to scale performance, despite treatment or reading level (viz., RN>RI or CN>CI), is illustrated in Figures 2 and 3.

Insert Figures 2 and 3 about here

While the main effect for treatment was nonsignificant, additional examination of the raw data revealed some trends worthy of future study, particularly for high and low level readers. Differences among treatment groups for middle level readers appeared negligible.

High level readers in the drill and comprehension groups performed better or test items requiring recall or recognition than did high level readers in the structuring group. High level readers in the drill group outperformed high level readers in the comprension and structuring groups on comprehension items.

Low level readers in the drill and structuring groups performed better on test items requiring recall or recognition than did low level readers in the comprehension group. On the comprehension items, treatment group differences among low level readers were relatively small. The mean scores for Recall/Recognition and Comprehension items by reading level and treatment group are presented in Table 3.

Insert Table 3 about here

Follow-Up Achievement

The achievement test data obtained four weeks following posttesting were analyzed using a 3 (treatment groups) x 3 (reading levels) x 2 (trials) analysis of variance for equal n's with repeated measures on the trials variable. Data randomly deleted for subjects in the posttest analysis were deleted from the follow-up analysis. Several other deletions were necessary due to absence of four subjects from school on the day of follow-up testing. Hence, additional random deletion of data resulted in an n of nine per cell. Descriptive statistics for follow-up achievement are presented in Table 4; a summary of the analysis of variance is presented in Table 5.

Insert Tables 4 and 5 about here

Significant effects were found for reading levels (F=17.73; df=2, 72; $p<.001$), for trials (F=60.00; df=1, 72; $p<.001$), and for the treatment x reading levels interaction (F=2.53; df=4, 72; $p<.05$). Tukey's HSD test was used to make pairwise post hoc comparisons of the significant findings.

Post hoc comparisons for the levels effect revealed that high level readers and middle level readers performed significantly better than low level readers across all treatment levels and trials ($p<.01$). This finding is depicted in Figure 4.

Insert Figure 4 about here

Post hoc comparisons for the trials effect demonstrated that performance on the R subscale was superior to performance on the C subscale across all treatments and levels ($p<.01$). This consistent finding with regard to subscale performance, despite treatment or reading level, is illustrated by Figures 5 and 6.

Insert Figures 5 and 6 about here

Post hoc examination of the treatment by reading levels interaction indicated no significant interactions for the R trial. That is, on the R subscale high and middle level readers performed significantly better than low level readers across all treatments ($p < .01$). The differences between high and middle level readers were not significant. This finding is illustrated by Figure 7.

Insert Figure 7 about here

Significant treatment by levels interactions were found for the C trial. High level readers in the drill treatment group performed significantly better on the C subscale than low level readers in the drill or comprehension treatment groups ($p < .01$). High level readers in the comprehension treatment group also performed better on the C subscale than low level readers in the drill or comprehension treatment groups ($p < .05$). These findings are illustrated by Figure 8.

Insert Figure 8 about here

Discussion/Conclusions

Theories and previous research dealing with depth of processing and incidental learning appear to have implications for classroom instruction.

The greatest percentage of classroom instructional time has been shown to be spent in seatwork activities. Worksheets are a widely used format for seatwork. The thrust of this research has been to determine how the use of specific types of worksheets designed to promote differential processing of information affects the type of knowledge acquired.

Analysis of the posttest data support four conclusions:

1. High and middle level readers outperformed low level readers on all subscale measures (RN, RI, CN, and CI).
2. All groups of students, regardless of treatment or reading level, performed best on the RN subscale and least well on the CI subscale.
3. The finding for treatment was nonsignificant.
4. Examination of the raw data may suggest instructional considerations for high and low level readers.

The finding that high and middle level readers outperformed low level readers on all subscale measures was expected. It seemed reasonable to anticipate that better readers would outperform poorer readers on tasks requiring reading, e.g., completion of worksheets and test taking. Other researchers (e.g., McPeake, 1979; Meyer, 1977; Smiley et al., 1977) have obtained similar findings with regard to the relationship between ability and performance.

The finding that all groups of students, regardless of treatment or reading level, performed best on items requiring recall of information previously called for by the drill worksheets (i.e., the RN subscale) is not surprising from a theoretical standpoint. Of the items on the four subscales, items of the RN subscale were designed to tap the lowest taxonomical levels of cognitive processing. Therefore, worksheets designed to promote deeper levels of semantic processing (i.e., comprehension and structuring worksheets) should also have facilitated the recall of detailed information processed at lower levels (vide Meyer, 1977) by the structuring and comprehension treatment groups. However, item difficulty within subscales may have been a confounding factor. That is, regardless of treatment or reading level, the RN subscale may have contained the easiest test items.

The other significant finding for trials was that all students, regardless of treatment or reading level, performed significantly better on the RI and CN subscales than on the CI subscale. From a theoretical point of view, this finding was also to be expected. Items on the CI subscale called for comprehension of concepts not presented on even the comprehension worksheets. The only group that might have been expected to perform relatively well on the CI subscale was the structuring group. The structuring procedure may have, for some individuals, resulted in a higher sublevel of semantic processing than that called for by the comprehension worksheets. Again, difficulty of test items may have been a confounding factor. The CN subscale may have contained the most difficult test items for all treatment groups within all reading levels.

Although scientific methodology does not allow for proving the null hypothesis, the nonsignificant finding for worksheet type does appear to support the depth of processing model. All worksheets used in this study consisted of questions requiring semantic processing. Results, therefore, suggest that if students process information requiring semantic analysis of any kind, the nature of the task is irrelevant to ultimate achievement. In other words, type of worksheet does not seem to differentially affect student achievement providing the worksheet questions require processing within the semantic level. Thus, teachers may select the type of worksheet which best fits the instructional needs of given students without concern for differential achievement effects.

Examination of the raw data suggests that the instructional needs of students, particularly high and low level readers, may be influenced by reading ability. That is, for high level readers, drill-type tasks may be the most efficient for producing both recall/recognition and comprehension of textual material. Findings from classroom research studies (e.g., Fisher, et al., 1978; Rosenshine and Berliner, 1978) have demonstrated a positive correlation between time spent on-task and achievement. In this study, high level readers may have spent time on-task most efficiently while engaged in drill activities. This time on-task issue is further examined by Redfield and Roenker (1981).

While drill-type activities appear to result in the greatest recall/recognition of textual material for low level readers, none of the tasks appear to particularly facilitate content comprehension. Smiley et al. (1977) contend that poor readers have difficulty with all types of activities requiring comprehension. Hence, if a student does not easily comprehend, tasks requiring comprehension or relatively high sublevels of processing (viz., comprehension worksheets) will not prove beneficial.

Analysis of the follow-up data support two conclusions:

1. Four weeks following treatment, high and middle ability readers outperformed low ability readers on a measure of recognition and recall regardless of type of worksheet used.
2. Four weeks following treatment, high level readers in the drill and comprehension groups performed significantly better on a measure of comprehension than did low level readers in the drill and comprehension groups.

Follow-up testing, like immediate posttesting, yielded a significant trials effect for the R subscale over the C subscale. However, a finding which did not manifest itself at the time of posttesting was the significant interaction for treatment by reading levels. Specifically, it was found four weeks posttreatment that high level readers in the drill and comprehension groups performed significantly better than low level readers in the drill and comprehension treatment groups on the C subscale. Yet, for some reason, high level readers in the structuring treatment group did not maintain their relatively higher performance on the comprehension items over time.

Perhaps while the posttest had presented another episode of cued practice for the drill and comprehension groups, it had been a new experience for the structuring group; hence, the structuring group had less practice with the test format by nature of the worksheets to which they had been exposed. A review of studies in which types of curriculum materials served as the independent variable (Popham, 1969) supports the notion that test performance improves when curriculum materials allow for practice with the test format.

In summary, the present study suggests that type of worksheet used does not necessarily determine the type of knowledge acquired. Rather, reading ability appears to be a primary variable in whether a student will process information at a level necessary to facilitate both comprehension and recall.

TABLE 1. Posttest achievement--means and standard deviations for RN, RI, CN, and CI subscales

Group x Level	RN $\bar{X}$	RN SD	RI $\bar{X}$	RI SD	CN $\bar{X}$	CN SD	CI $\bar{X}$	CI SD
Drill x High	8.2	1.25	6.2	1.78	6.4	1.74	5.0	1.79
Drill x Middle	7.0	1.10	6.5	.92	5.2	1.33	4.3	1.42
Drill x Low	6.3	1.73	5.1	2.02	4.7	1.62	2.5	1.20
Comprehension x High	8.6	1.50	6.8	1.33	6.1	.83	4.2	2.36
Comprehension x Middle	7.5	1.57	6.1	1.22	5.5	1.43	3.6	1.96
Comprehension x Low	5.4	1.74	4.0	1.34	4.7	1.10	2.7	1.95
Structuring x High	7.4	2.06	5.4	1.69	6.6	1.62	3.9	1.64
Structuring x Middle	7.7	1.90	5.5	1.86	5.8	1.33	3.8	1.17
Structuring x Low	5.1	1.58	5.2	1.99	4.8	1.72	2.8	1.08

TABLE 2. Posttest achievement--summary of analysis of variance

Source	df	MS	F	P
Between Groups				
Treatment	2	2.48	.51	n.s.
Levels	2	101.80	21.08	<.001
Treatment x Levels	4	2.32	.48	n.s.
Error	81	4.83		
Within Group				
Trials	3	173.29	80.98	<.001
Groups x Trials	6	1.53	.71	n.s.
Levels x Trials	6	2.54	1.19	n.s.
Groups x Levels	12	2.58	1.21	n.s.
Error	243	2.14		

TABLE 3. Posttest achievement -- mean scores for recall/recognition and comprehension items

Level by Group	Recall/Recognition	Comprehension
High by Drill	14.1	11.4
High by Comprehension	15.4	10.3
High by Structuring	12.8	10.5
Middle by Drill	13.5	9.5
Middle by Comprehension	13.6	9.1
Middle by Structuring	13.2	9.6
Low by Drill	11.4	7.2
Low by Comprehension	9.4	7.4
Low by Structuring	10.3	7.6

TABLE 4. Follow-up achievement--means and standard deviations for R and C subscales

	Subscale			
	R		C	
Group x Level	$\overline{X}$	SD	$\overline{X}$	SD
Drill x High	7.56	.83	6.44	1.77
Drill x Middle	7.11	.99	4.22	1.39
Drill x Low	6.00	1.41	3.22	1.75
Comprehension x High	7.55	1.64	6.22	1.03
Comprehension x Middle	7.00	1.49	5.22	1.75
Comprehension x Low	4.89	1.37	3.22	1.31
Structuring x High	6.44	1.89	4.56	1.42
Structuring x Middle	7.33	1.49	5.11	1.79
Structuring x Low	5.33	1.33	4.33	2.21

TABLE 5. Follow-up achievement--summary of analysis of variance

Source	df	MS	F	P
Between Groups				
Treatment	2	.82	.26	n.s.
Levels	2	56.86	17.73	<.001
Treatment x Levels	4	8.10	2.53	<.05
Error	72	3.21		
Within Groups				
Trials	1	138.89	60.00	<.001
Groups x Trials	2	1.72	.74	n.s.
Levels x Trials	2	2.47	1.06	n.s.
Groups x Levels x Trials	4	2.02	.87	n.s.
Error	72	2.31		

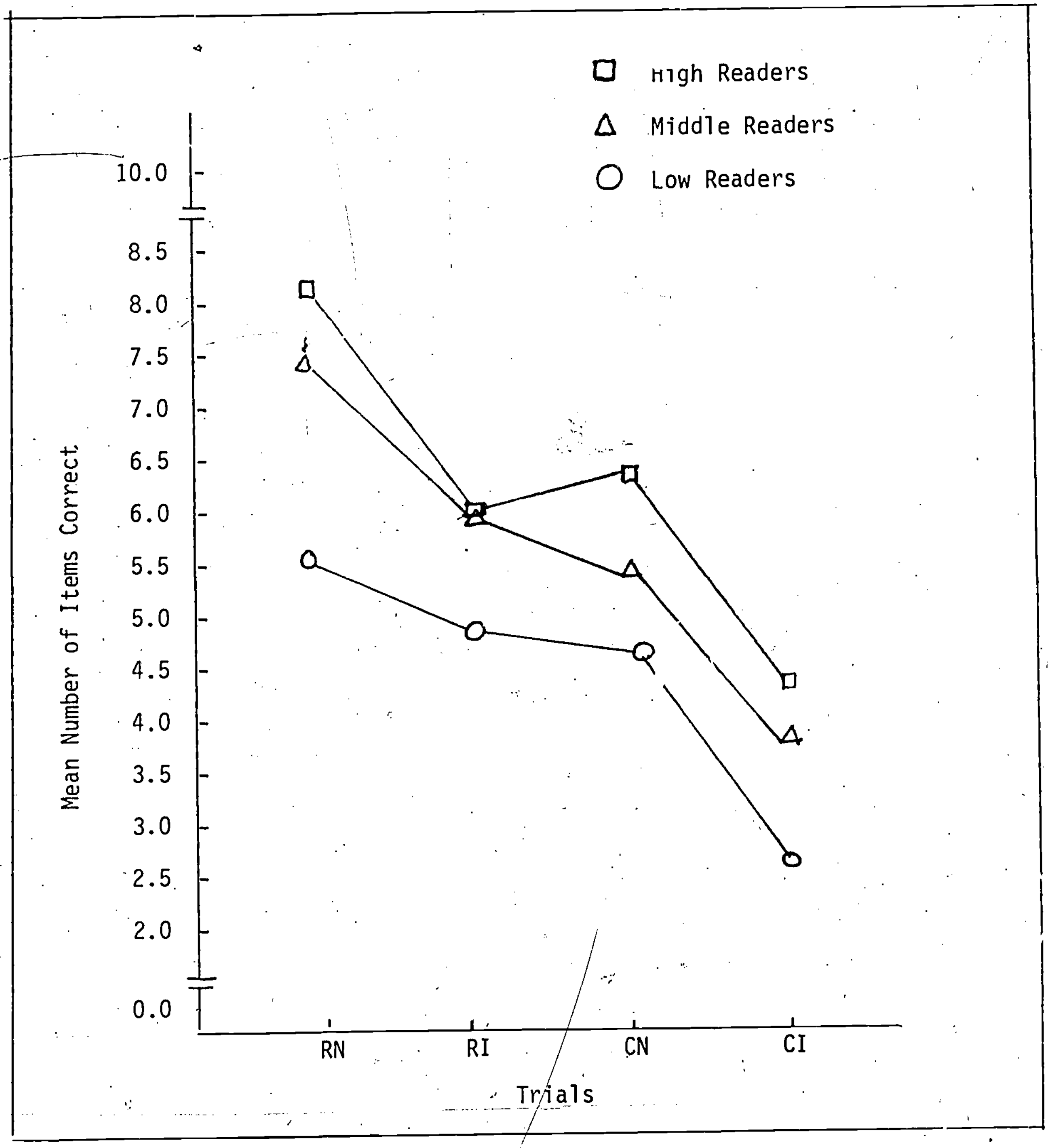

FIGURE 1. Posttest means for reading levels by trials

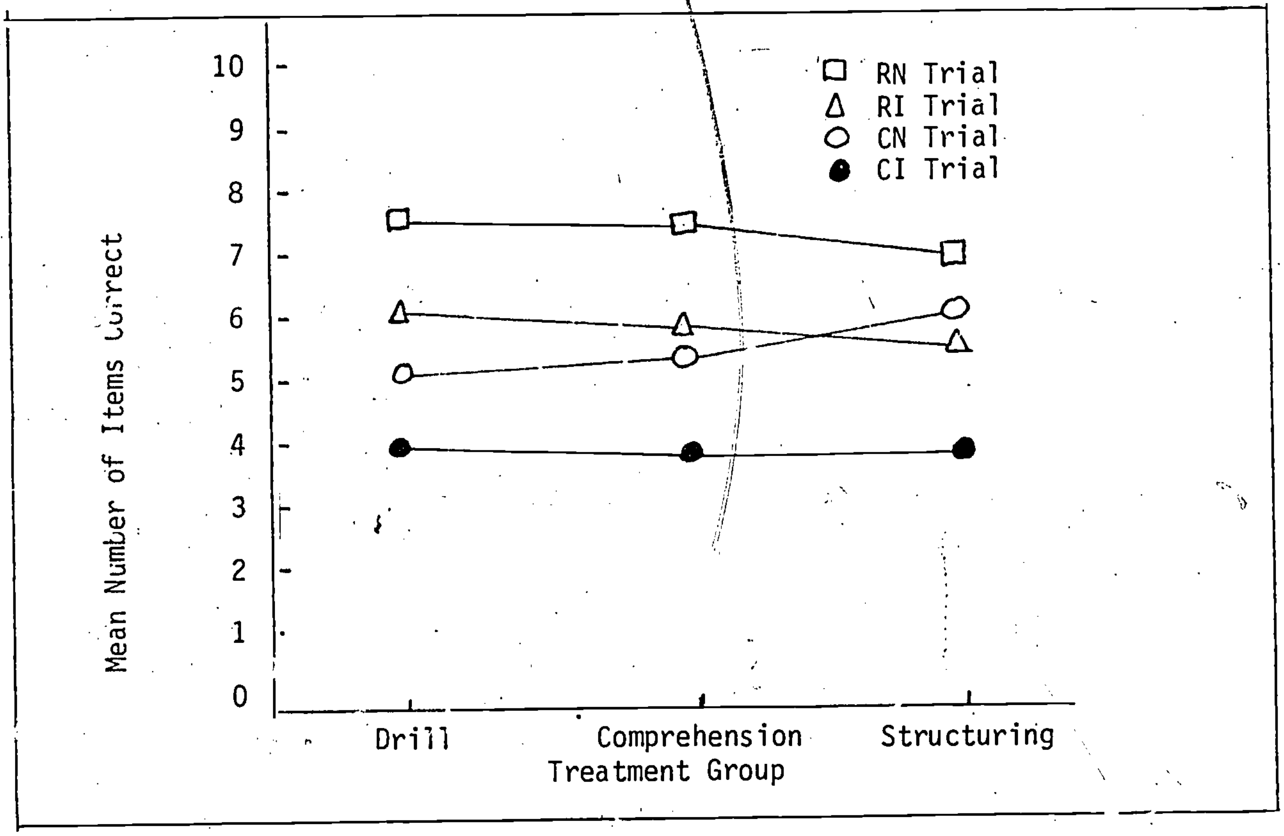

FIGURE 2. Posttest means for trial performances by treatment group

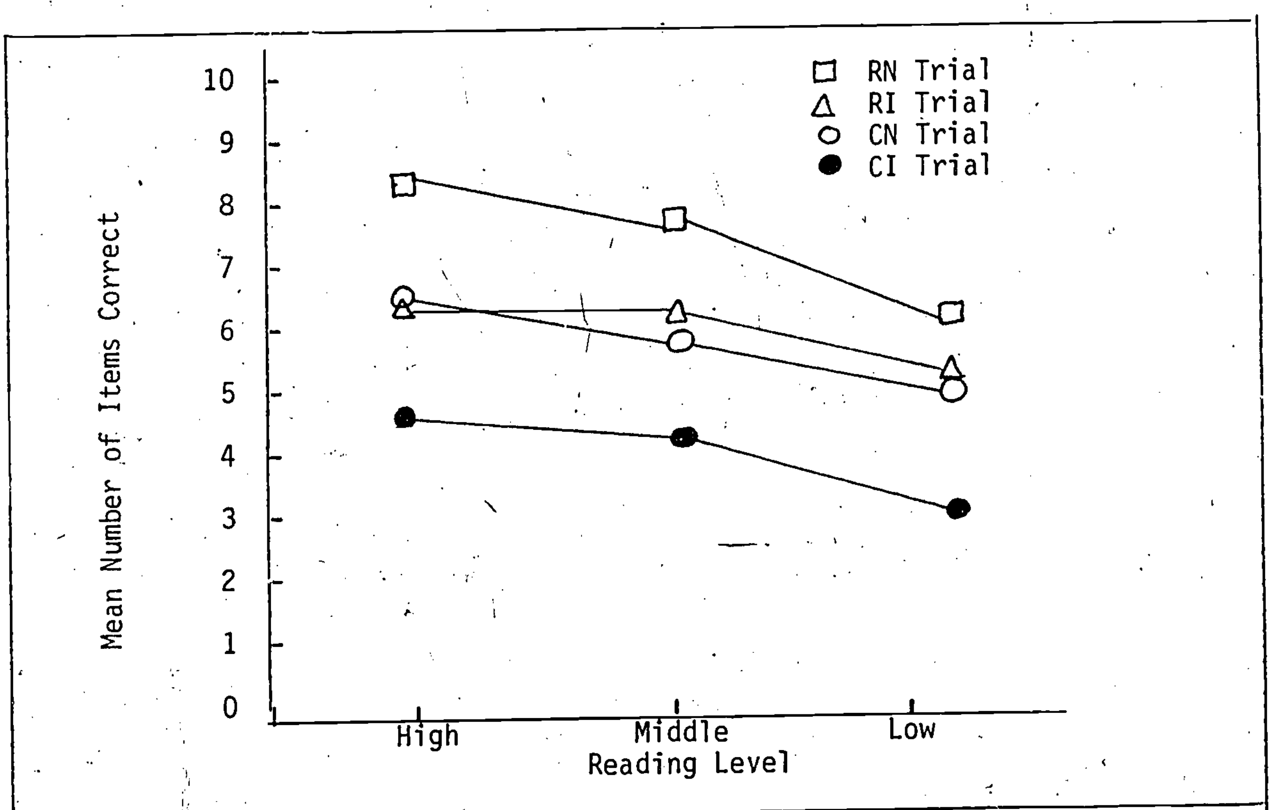

FIGURE 3. Posttest means for trial performances by reading level

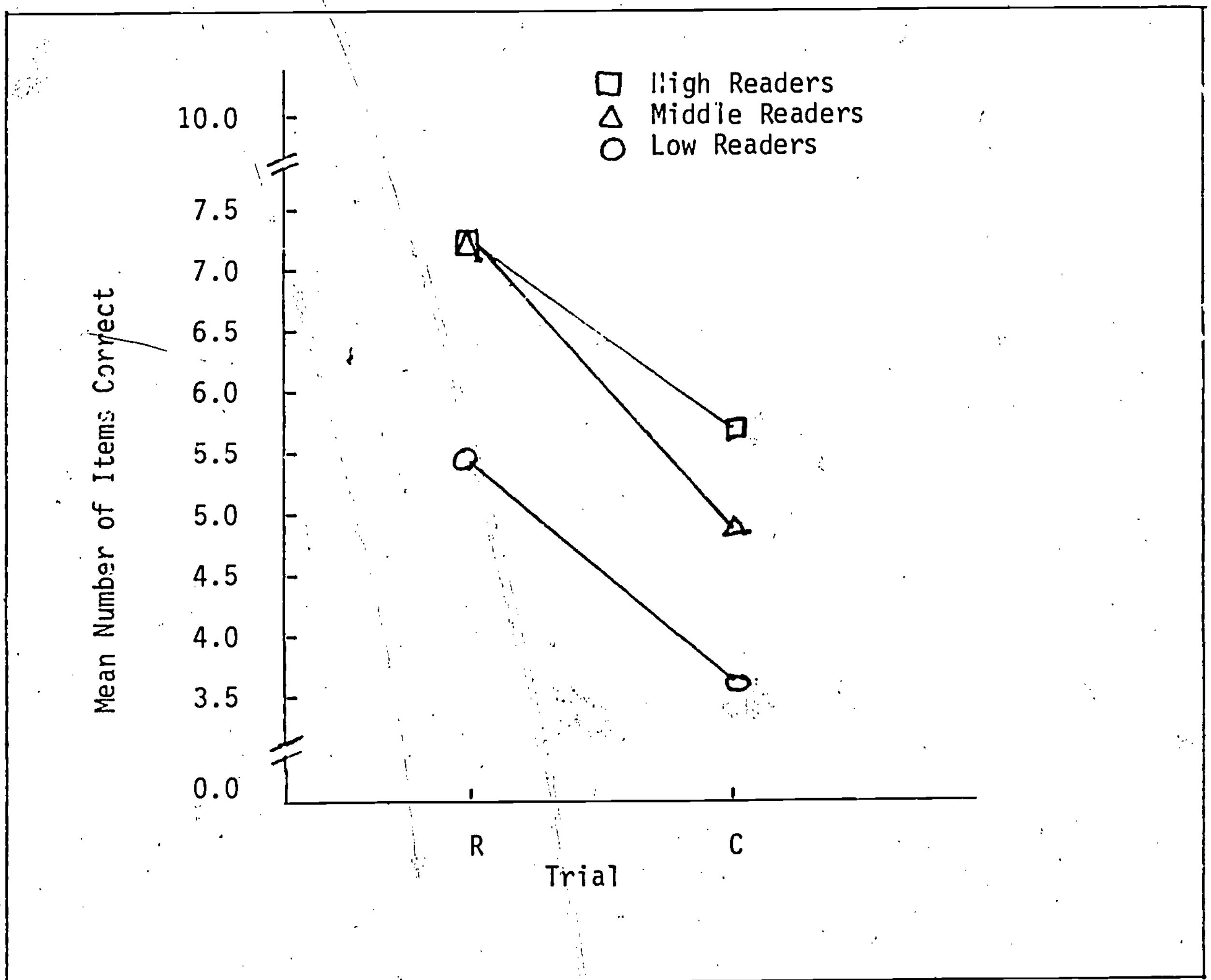

FIGURE 4. Follow-up achievement test means for levels by trials

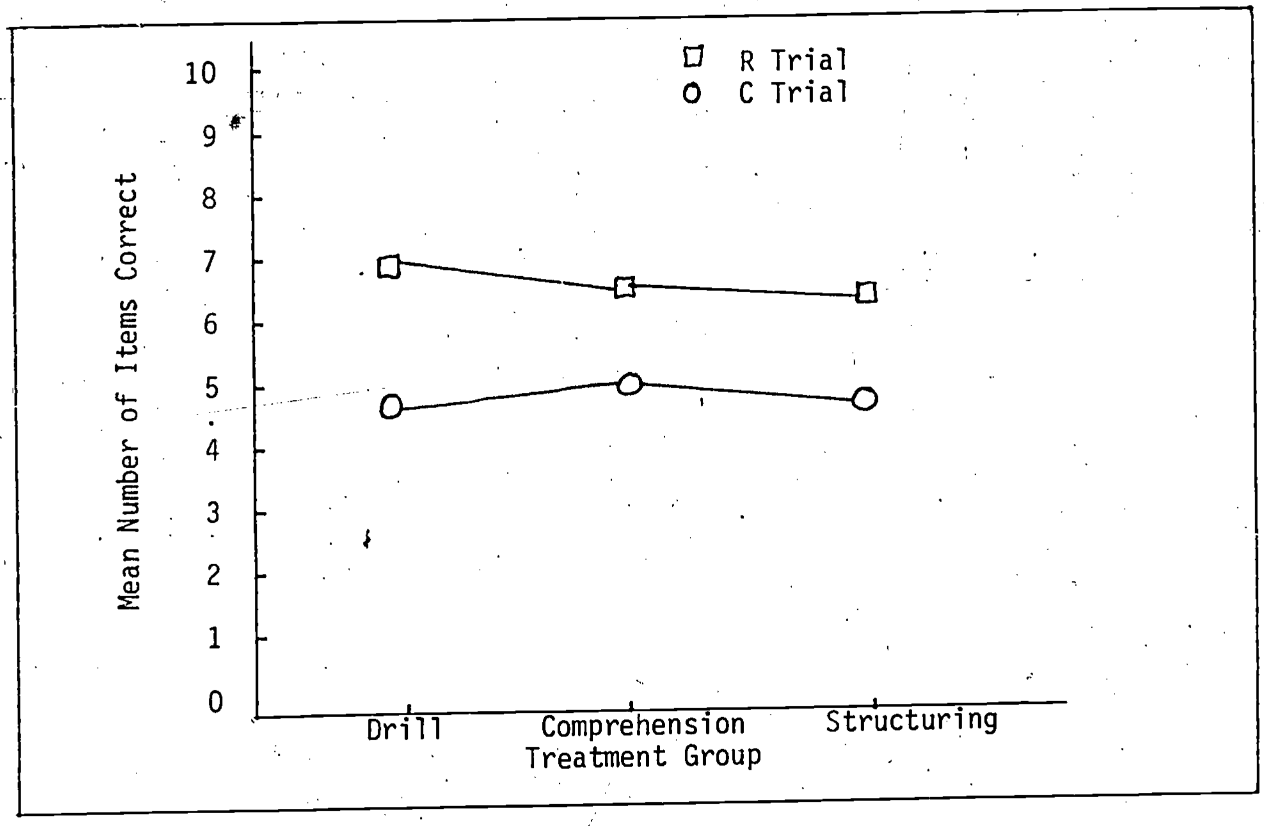

FIGURE 5. Follow-up achievement test means for trial performance by treatment group

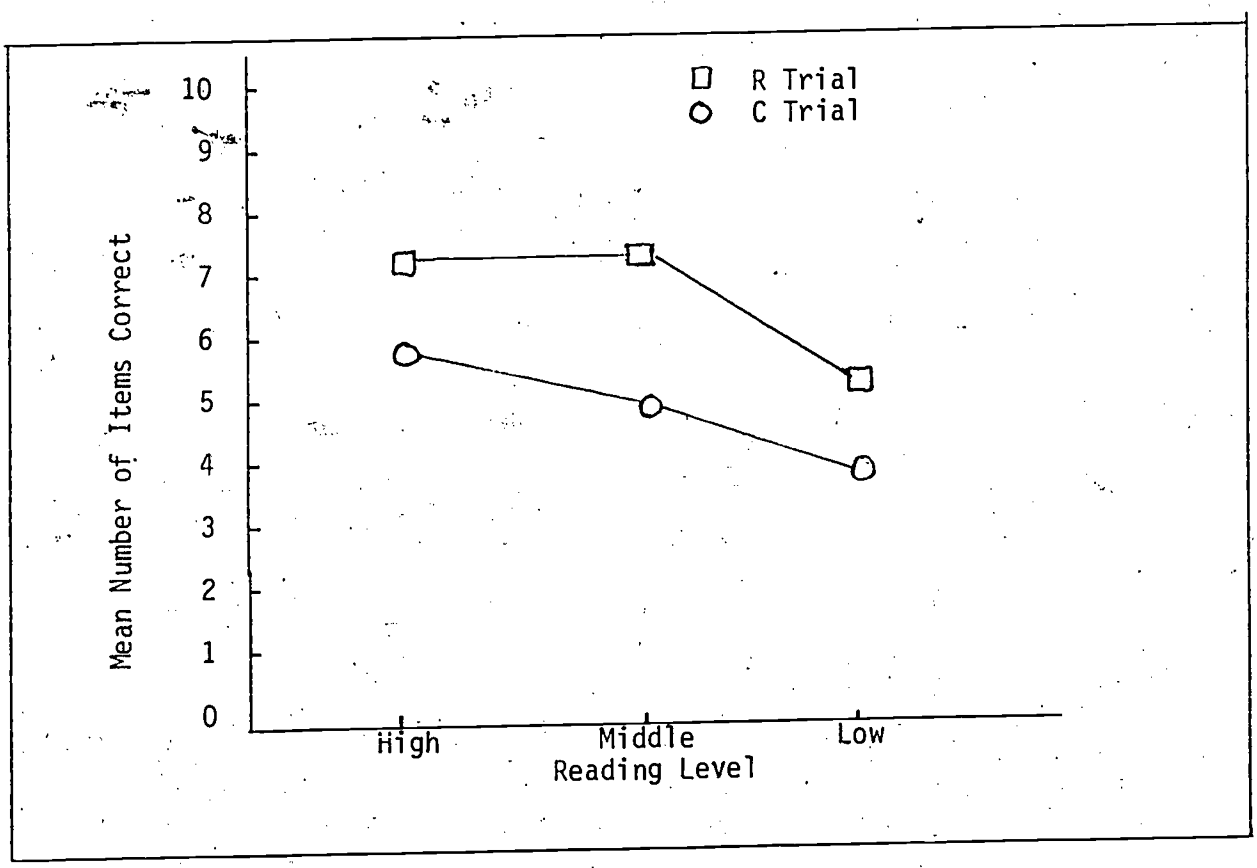

FIGURE 6. Follow-up achievement test means for trial performances by reading level

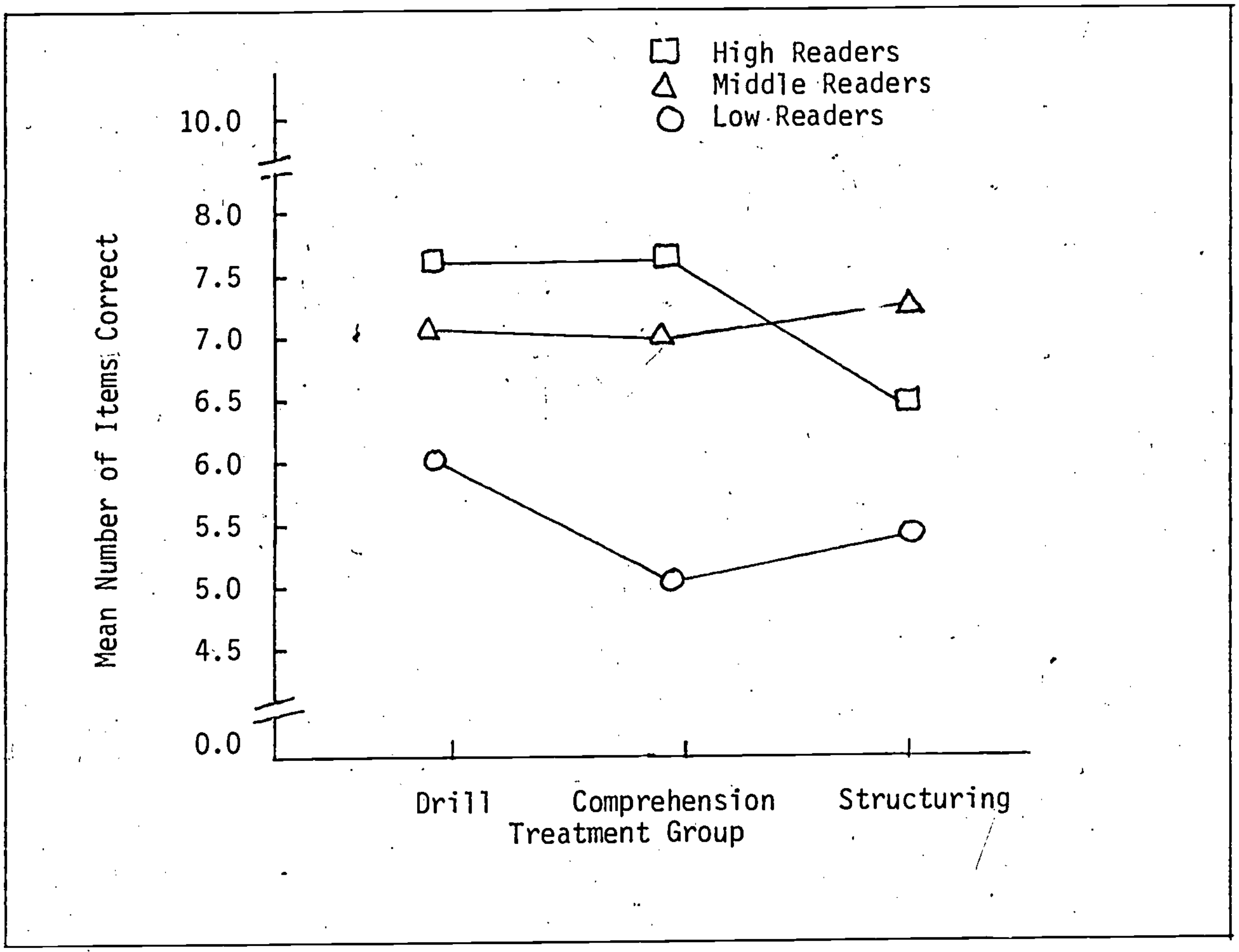

FIGURE 7. Follow-up achievement test means for levels by treatment groups for the R subscale

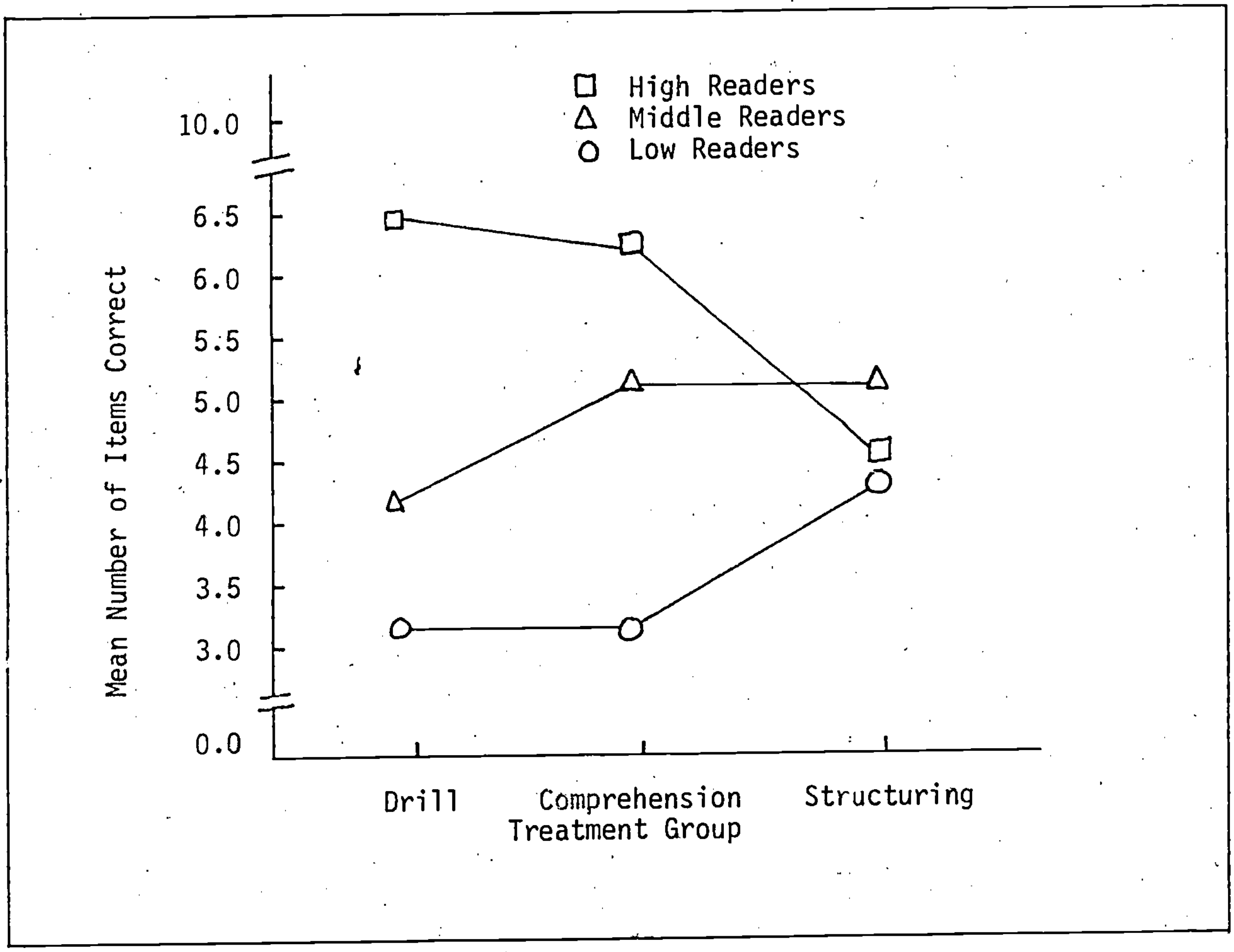

FIGURE 8. Follow-up achievement test means for levels by treatment groups for the C subscale

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