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ABSTRACT

To determine whether less able readers could use the strategies they had been taught, a study investigated the transfer effects of training in the use of graphic organizers and summary writing on readers' recognition of the compare/contrast text structure. Subjects, 79 freshmen at a western New York state college of liberal arts and sciences in a required developmental reading/study skills course, were randomly assigned to an experimental or a control group and divided into four ability levels for each group according to raw score performance on the Stanford Diagnostic Reading Test comprehension subtest. Subjects were given instruction on eight readings consisting of scientific expository text, each of which had a comparison-contrast internal organization; they then took an evaluation posttest consisting of four scientific comparison-contrast passages. Results indicated that transfer of training to real-world tasks did occur at each of the ability levels tested. However, training in the strategy did not appear to have any effect on the subjects (as compared to those in the control groups), except for the lowest ability group which apparently did benefit from the training. (One table of data and nine figures are included, and 17 references and one appendix are attached.) (MS)

EFFECTS OF TRANSFER TO REAL-WORLD SUBJECT AREA MATERIALS FROM TRAINING IN GRAPHIC ORGANIZERS AND SUMMARIZING ON DEVELOPMENTAL COLLEGE READERS' COMPREHENSION OF THE COMPARE/CONTRAST TEXT STRUCTURE IN SCIENCE EXPOSITORY TEXT

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EFFECTS OF TRANSFER TO REAL-WORLD SUBJECT AREA MATERIALS FROM TRAINING IN GRAPHIC ORGANIZERS AND SUMMARIZING ON DEVELOPMENTAL COLLEGE READERS' COMPREHENSION OF THE COMPARE/CONTRAST TEXT STRUCTURE IN SCIENCE EXPOSITORY TEXT

This study investigated the effects of training college developmental readers in use of graphic organizers as an aid to summarizing and comprehending expository texts with comparison/contrast organizational structures. Special attention was paid to the study's transfer effects to reading actual content area textbook material.

A wide variety of researchers and theorists have advocated the use of active, strategic learning for improved performance (Anderson, 1980; Ausubel, Novak, & Hanesian, 1978; Rothkopf, 1981; Weinstein, 1982). These and others have demonstrated that application of learning strategies is associated with improved comprehension and retention, performances essential for successful academic work at the college level.

Several researchers have found that training in use of graphic organizers has beneficial effects on students' comprehension and summarizing (Weisberg & Balajthy, 1985, 1986; Berkowitz, 1986). Such studies, however, have often used artificially constructed texts with consistent organization patterns. In fact, real-life material encountered by students is rarely so well organized (Schallert & Tierney, 1981), and questions have been raised as to the practical transfer benefits

of such training (Moore & Readence, 1984). Alvermann and Boothby (1986) found that both length of training and the form of comprehension assessment affected transfer results.

The compare/contrast text structure presents special challenges for less able readers (Englert & Hiebert, 1984; Rafael & Kirschner, 1985; Richgels, et al., 1987), who have difficulty summarizing even easier text structures (Head & Buss, 1987).

The purpose of this research was to investigate the transfer effects of training in the use of graphic organizers and summary writing on readers' recognition of the compare/contrast text structure. Content area textbook materials were used in which the organizational structure is not as clearly apparent as in the artificially constructed passages used for training. That is, the researchers sought to determine whether these less able readers could use the strategies they had been taught, to recognize the specific text structures with which they had been successful during training. The students' ability to transfer training was examined in the light of reading ability level and prior knowledge of content.

The Study

Subjects

The study was carried out at an western New York state college of liberal arts and sciences. Subjects were drawn from a college freshman population (n =70) required to take a developmental reading/study skills course. Many subjects were

members of minority groups from New York state's urban areas. Three groups of students were required to take the developmental course: 1) Educational Opportunity Program (EOP) students were admitted to the college based on combined low high school performance and economic need; 2) Talented Opportunity Program (TOP) students were admitted to the college through a special program designed primarily to encourage admission of minority students who had insufficient economic need for admission through the state-funded EOP program; 3) Special Talent Athletes (STA) students were admitted because of exceptional athletic ability, despite poorer high school performance than typically required for matriculation at the college.

Subjects were randomly assigned to an experimental or a control group and divided into four ability levels for each group according to raw score performance on the Stanford Diagnostic Reading Test comprehension subtest. The mean performance for Ability Level One was 43.5, normed as the 6.9 grade equivalency and the 15th percentile on twelfth grade norms. (s.d. of 3.1 and range from 39 to 48). The mean performance for Ability Level Two was 49.5, normed as the 10.6 grade equivalency and the 38th percentile (s.d. of .52 and range from 49 to 50). The mean performance for Ability Level Three was 52.9, normed as the 12.9 grade equivalency and 54th percentile (s.d. of .77 and range from 52 to 54). The mean performance of Ability Level Four was 56.1, normed as post high school grade equivalency and 76th percentile (s.d. of 1.3 and range from 55 to 58).

The present paper summarizes results of the study by

concentrating attention on subjects in the top and bottom quartiles. The 14 subjects in Ability Level One consisted of 3 males and 11 females. 2 were STA students and 11 were EOP students. The 15 subjects in Ability Level Four consisted of 8 males and 7 females. 9 were STA students, 4 were TOP students, and 2 were EOP students.

Prior to beginning training, all subjects were administered multiple choice test of prior knowledge on several topics, including the four topics to be included in the posttest passages. These posttests were used to verify our assumptions as to which passages presented topics associated with low and with high prior knowledge on the part of the subjects.

Training

Instruction was centered on a collection of 8 readings consisting of scientific expository text, each of which had a comparison-contrast internal organization. Five were taken from science textbooks and adapted to reflect tightly constructed organizational patterns. Three were taken directly from content area textbooks and, though they did have a central comparison-contrast pattern, the organization was not as neatly presented.

Students in the experimental group were trained to follow this basic procedure:

1. Read the passage to identify topics and categories of comparisons.

2. Use underlining and annotation to identify and organize comparisons and contrasts.

3. Using telegraphic writing, complete a graphic organizer (see Figure 1 for example).

4. Incorporate those comparisons and contrasts highest in the hierarchy of passage ideas into a summary statement.

Instruction included explicit rules and modeling for constructing graphic organizers and writing summaries. Experimental Group subjects received 4 training sessions of forty minutes each over a two-week period, and short homework assignments for three of the sessions. Initial training was carried out through whole-group instruction and modeling in the first session. The last three sessions followed this schedule:

1. The instructor collected homework and briefly modeled the process of constructing a graphic organizer and summary for the homework passage.

2. Students were divided into cooperative learning groups of three. Cooperative learning groups were used in order to increase motivation, colleaguiality, and accountability.

3. Each group was given the same reading assignment and told to study as a group for a possible posttest. Each group was required to annotate passages, then construct a graphic organizer and a summary. Work was monitored by the instructor.

4. Graphic organizers and summaries were collected. A short answer fill-in comprehension test was administered on one occasion.

The Control Group was not entirely untrained in the procedure. During the four training sessions for the Experimental Group, the Control Group carried out different

comprehension-oriented activities that did not deal with either graphic organizers or comparison-contrast relationships. They did, however, receive a one-half hour presentation that introduced them to comparison-contrast graphic organizers and summaries, so that they could complete the posttest.

Post-testing

Both the Experimental and Control Groups were administered the evaluation posttest consisting of four scientific comparison-contrast passages. Two of the passages were adapted. Appendix A presents one of these adapted passages. Two other passages were not adapted but were included to determine ability of students to transfer their performance to real-world content area textual material. One passage was drawn from Jantzen and Michel (1986) and the other from Heimler and Price (1981). The four passages were administered in counterbalanced order to eliminate effects of order.

One of the adapted passages and one of the transfer passages were designated as a high prior knowledge passage based on pretesting. They were entitled "States of Matter" and "Organic Compounds", respectively. The other two passages were designated as low prior knowledge. The adapted passage was entitled "Different Kinds of Mixtures" and the transfer passage "Types of Fish".

Subjects were instructed to first read and annotate the passage. They then constructed a graphic organizer and a summary. All materials were then collected and the subjects

completed a immediate retention multiple choice test (see Appendix A). A delayed retention test was administered two weeks later.

Data Analysis

The present paper reports results on the immediate retention multiple choice posttests. Data were analyzed using a four-factor split plot ANOVA with repeated measures. The two between-subjects factors were group (experimental and control) and ability level (in quartiles). The two within-subjects factors were passage (adapted passage and transfer passage) and prior knowledge (low and high).

Results

Results of the analysis of multiple choice posttest results are reported in Table 1. Figures 2 to 9 present the results in graphic form. The analysis of variance showed no overall differences between the experimental and control groups for the multiple choice test. There was an expected main effect for ability level ($p < .001$; 3,48). Ability group level one (the lowest) obtained a mean score of 68.15%, level two 79.88%, level three 81.07%, and level four (the highest) 85.9%.

The analysis also indicated a main effect for prior knowledge ($p < .001$; 1,48). The low prior knowledge passages obtained an overall mean score of 70.63% and the high prior

knowledge passages a score of 86.89%.

No main effects were found for the type of passage. Students performed equally well, in general, on the transfer as on the adapted passages. The overall mean score for the adapted passages was 78.17% and for the transfer passages 79.34%.

One interaction was significant, that for group by ability by prior knowledge ($p < .05$; 3.48). Examination of the data (see Figures 1 and 2) indicated that the crucial performance differences occurred in the lowest ability group under the low prior knowledge condition. In the high prior knowledge condition, both experimental and control groups at this ability level scored about the same (76.00% and 80.44%, respectively). In the low prior knowledge condition, the experimental group performed significantly better than the controls (67.67% and 48.63%, respectively).

Discussion

One primary purpose of this study was to investigate whether effects of applying graphic organizer and summarizing learning strategies to expository text would hold up when subjects moved from reading highly structured adapted passages to reading actual material from content textbooks. The results indicated that transfer of training to real-world tasks did occur at each of the ability levels tested.

These findings help validate past studies (Weisberg & Balajthy, 1985, 1986) in which researchers have employed posttest passages that were adapted from content textbooks so as to

highlight the text structure. The positive results from such studies, in which subjects were similarly trained to recognize text structure, are apparently transferable to real-world content materials.

The limitations of this transfer, however, must be noted. The actual transfer passages were similar to the adapted training passages in a variety of ways. The readability levels were similar, in the upper high school range. The lengths varied from 400 to 900 words, but many real-world tasks involve reading selections which are much longer. The training was carried out using a specific text structure, the comparison-contrast structure, and both the adapted and transfer passages employed that structure. Whether training in one text structure will transfer to another structure is an issue not addressed in the present study. Also not addressed is the issue of transfer between content areas. As Tobias (1987) has noted in his survey of research on the generality of aptitude-treatment interaction research, there is little evidence that learning strategies transfer across content areas.

In addition, the subjects in this study were all advanced readers. Though they may be at-risk students in the college they are attending, and though the passages they read were at readability levels comparable to the levels of material they will encounter in their content area college coursework, the general ability level was high.

As McKeachie (1988) has noted, research on learning strategies has long since recognized the futility of "horse race"

studies that pit one strategy against another. Instead, researchers have focused on issues of why particular strategies are effective and under what circumstances they are effective. Previous research had indicated the effectiveness of spatial learning strategies, such as graphic organizers, for improving achievement (Holley & Dansereau, 1984). Weisberg and Balajthy (1985) had found indications that such strategies are effective by improving students' ability to recognize text structure and therefore pinpoint and remember key ideas within that structure.

While not all the pertinent data has yet been analyzed for the present study, some conjecture is possible as to why no main effect was found for training. A preliminary look at the subjects' graphic organizers and summaries indicated that both the experimental and control groups were able to identify the comparison-contrast structures in the passages. This suggests that training in use of the graphic organizer and summarization strategy does not result in important improvement in this ability since there is no real disability in the first place.

Such a finding does not, of course, obviate the importance of training in the strategy. Informal conversation with some of the subjects in the study showed that many appreciated the learning strategy. They suggested that the strategy made them more aware of authors' use of comparison-contrasts, so that they would be more likely to spot its use in textbooks and employ their already well-developed ability to analyze the structure of concepts presented. They also suggested that the training convinced them of the importance of using text structure as a tool in retaining information. They also appreciated the

usefulness of the graphic organizer as an effective method of spatially reorganizing information from text. The present study does not address the issue as to how much training is enough, though some other significant research indicates that 12 to 24 hours of training are necessary to ensure effective use of spatial learning strategies under real-world study conditions (Holley & Dansereau, 1984). Subjects in the present study continued to receive practice with feedback on the strategy after the end of the study, as the strategy became an important component of their developmental coursework.

The important exception to the conclusions drawn above, as far as the present study is concerned, is the lower ability group. In that group, findings were otherwise than with the other three ability groups, as training apparently did have beneficial effects on comprehension. Those findings implicated the prior knowledge factor as relevant to this study, and this raises the crucial issue of prior knowledge, an issue that has had the attention of the present authors in previous studies as well as a variety of other researchers. Results of the prior knowledge component of this study will be presented in a forthcoming paper.

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Table 1. Mean Group Results of the Multiple Choice Retention Measure.

		Experimental		Control	
	Prior Knowledge	Adapted	Transfer	Adapted	Transfer
Ability Group One (lowest) n=6,8	High	68.67 (24.9)	83.33 (15.1)	82.13 (13.1)	78.75 (16.42)
	Low	63.33 (17.5)	72.0 (16.4)	48.75 (19.6)	48.50 (13.4)
Ability Group Two n=5,5	High	75.60 (21.5)	94.00 (8.9)	89.00 (19.1)	90.00 (10.0)
	Low	74.00 (11.4)	71.20 (13.7)	74.00 (20.7)	71.20 (16.1)
Ability Group Three n=10,7	High	85.70 (10.4)	87.00 (10.6)	93.71 (12.5)	85.71 (12.7)
	Low	71.00 (13.7)	70.00 (13.0)	74.29 (18.1)	81.14 (15.3)
Ability Group Four (highest) n=5,10	High	100.00 (0.0)	86.00 (15.2)	95.60 (7.7)	95.00 (8.5)
	Low	76.00 (13.4)	78.40 (10.0)	79.00 (16.0)	77.20 (18.3)

s.d. in parentheses
In report of the group n, the first number is the experimental group and the second number is the control group

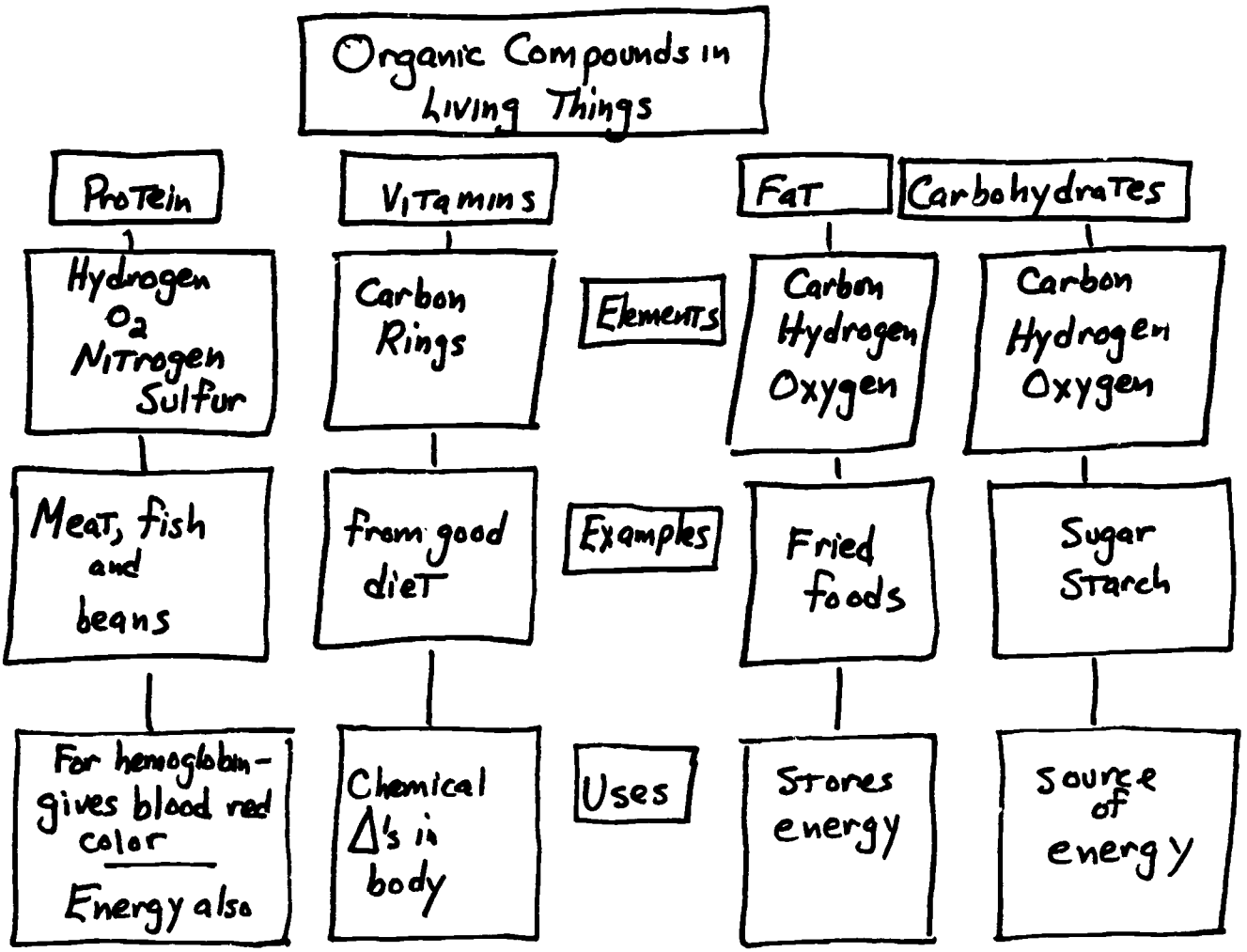


Figure 1. Sample student graphic organizer.

Figure 2. Results of Multiple Choice Assessment, Experimental Group, Ability Level One

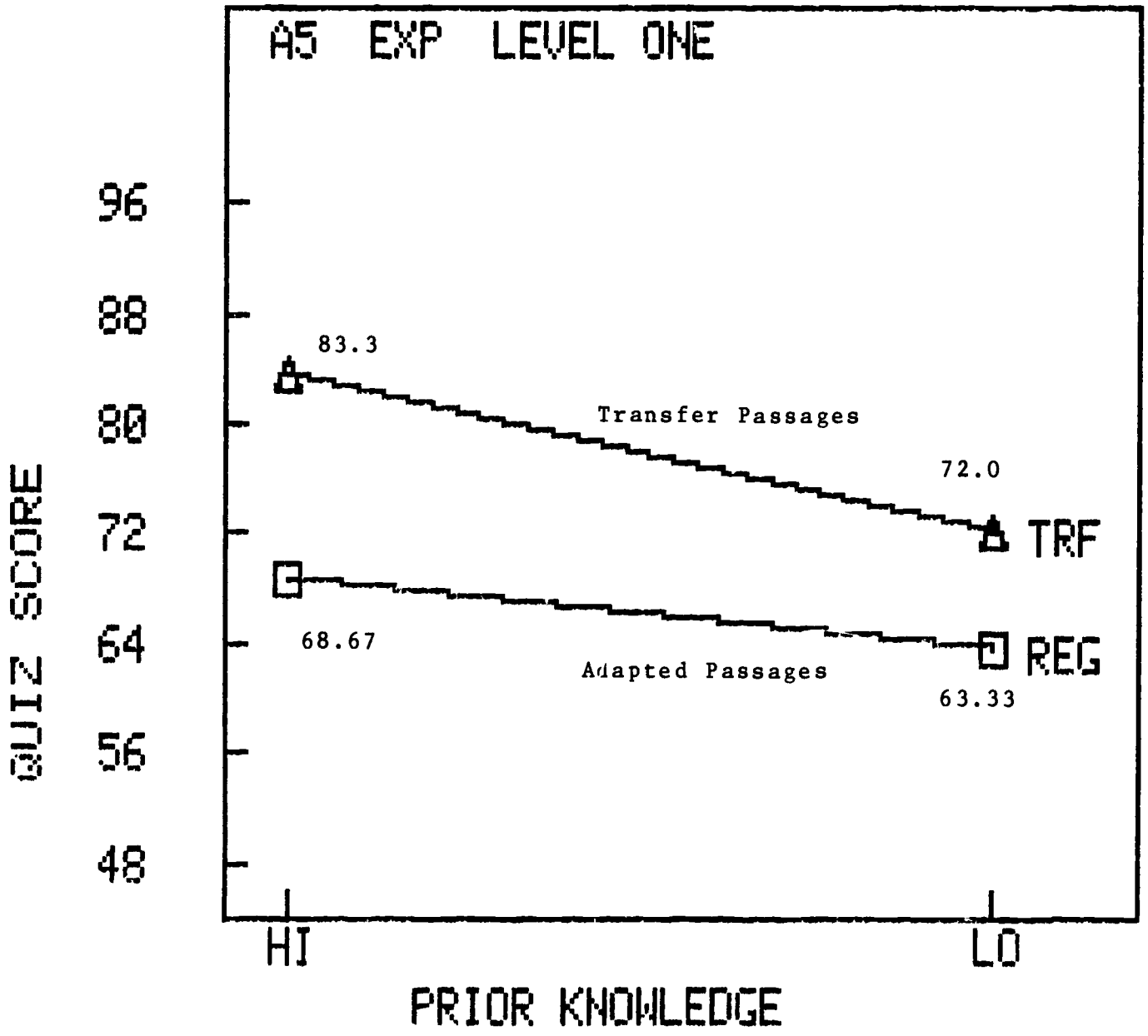


Figure 3. Results of Multiple Choice Assessment, Control Group, Ability Level One

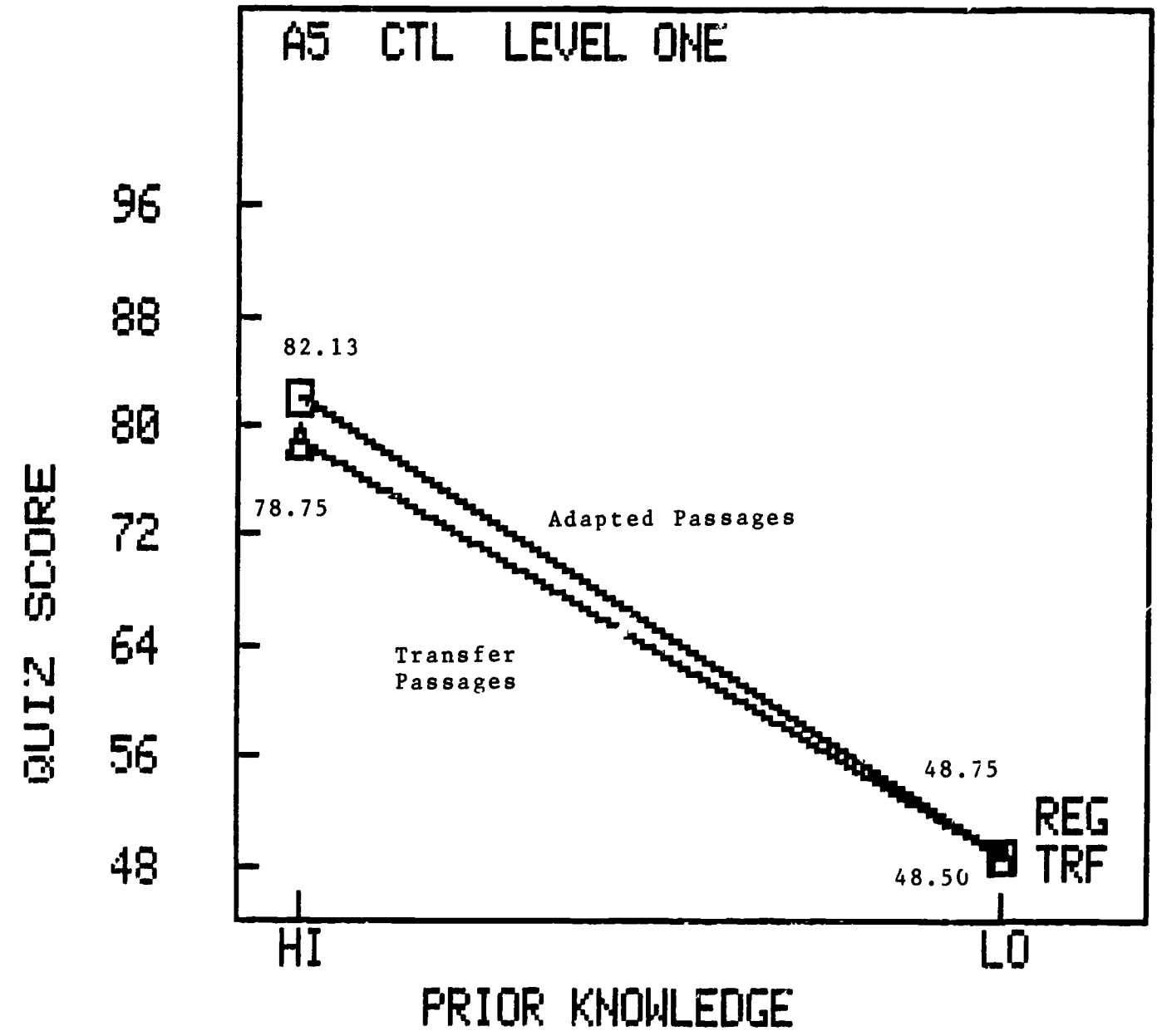


Figure 4. Results of Multiple Choice Assessment, Experimental Group, Ability Level Two

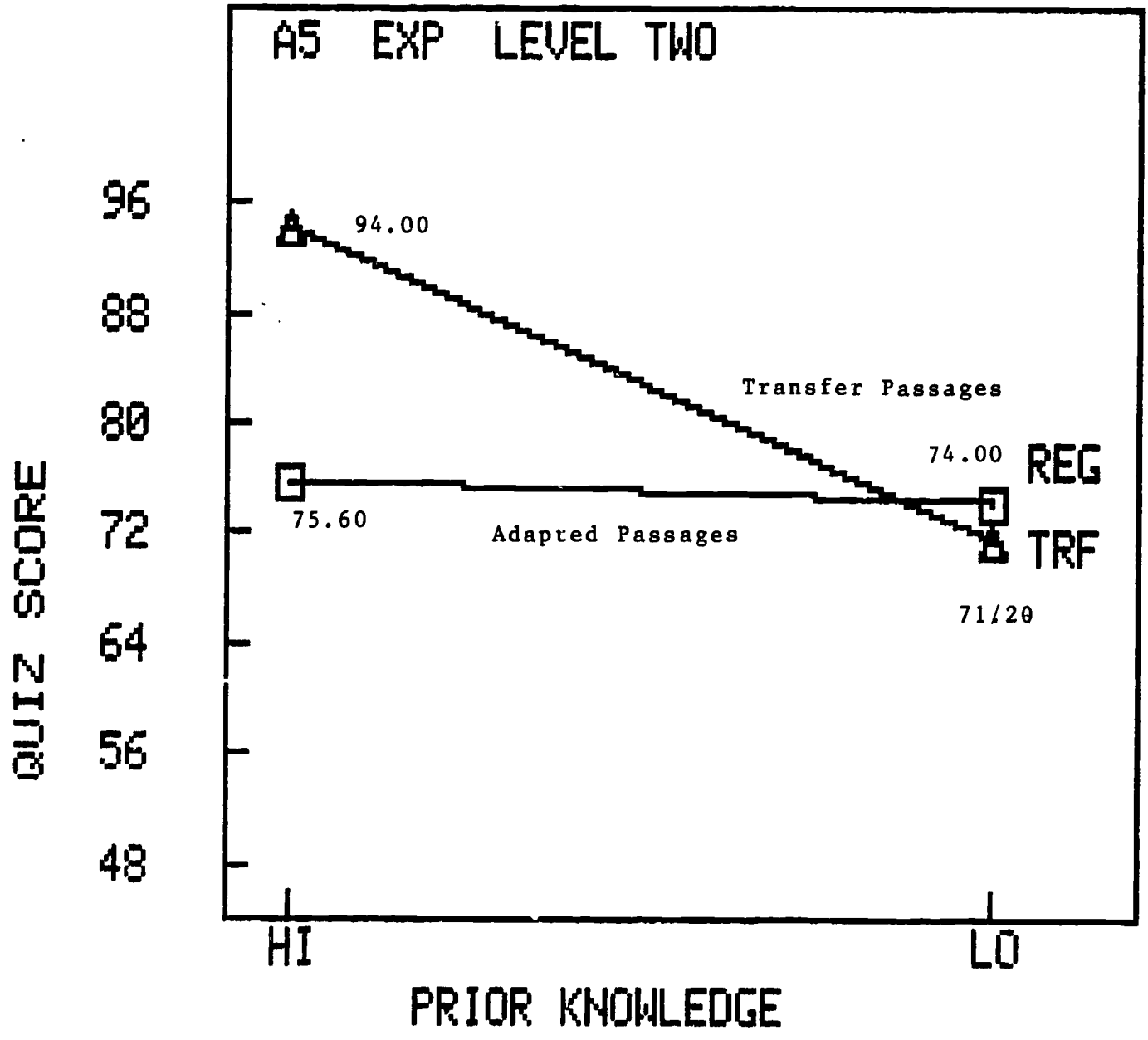


Figure 5. Results of Multiple Choice Assessment, Control Group, Ability Level 2

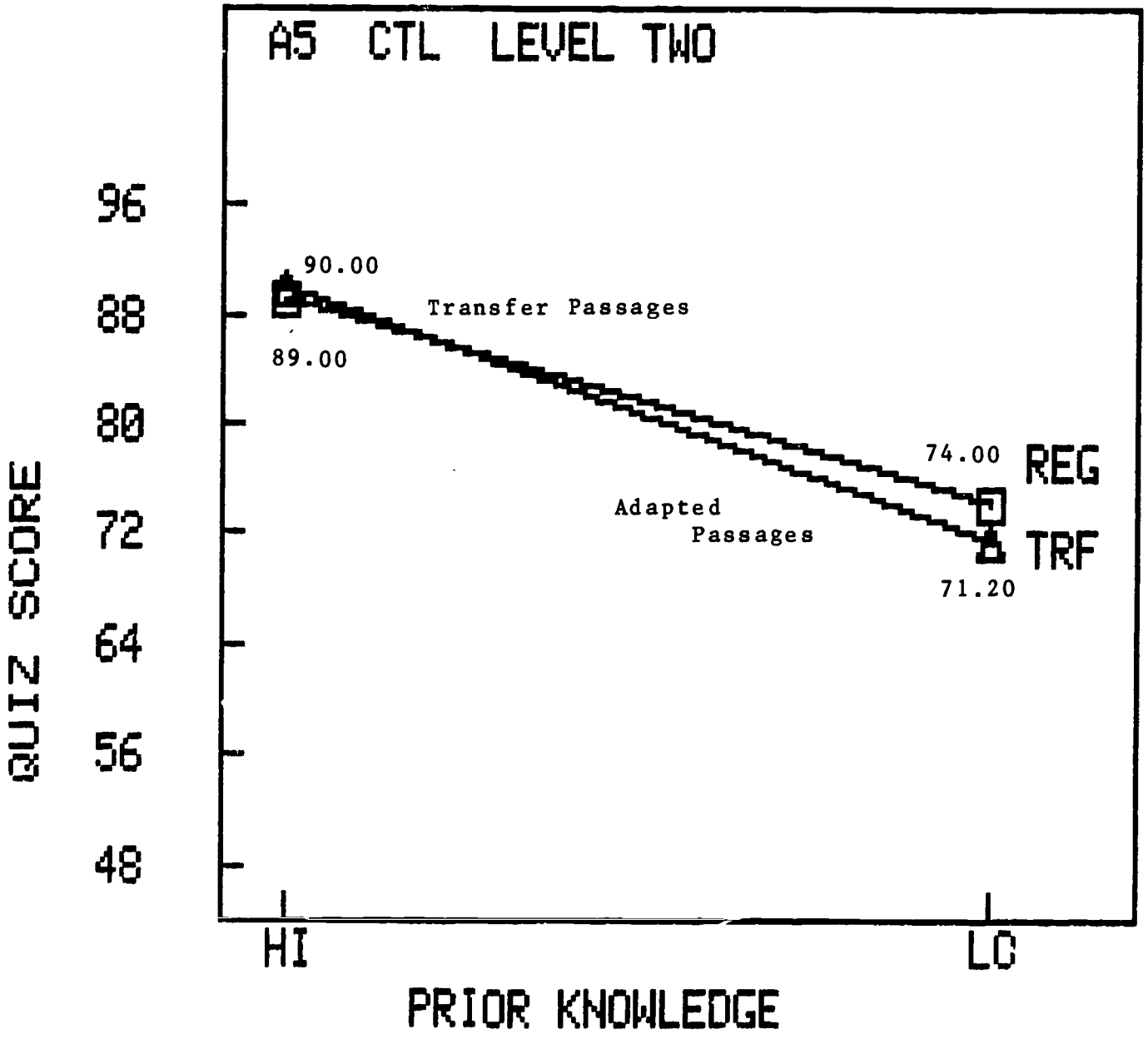


Figure 6. Resultsof Multiple Choice Assessment, Experimental Group, Ability Level Three

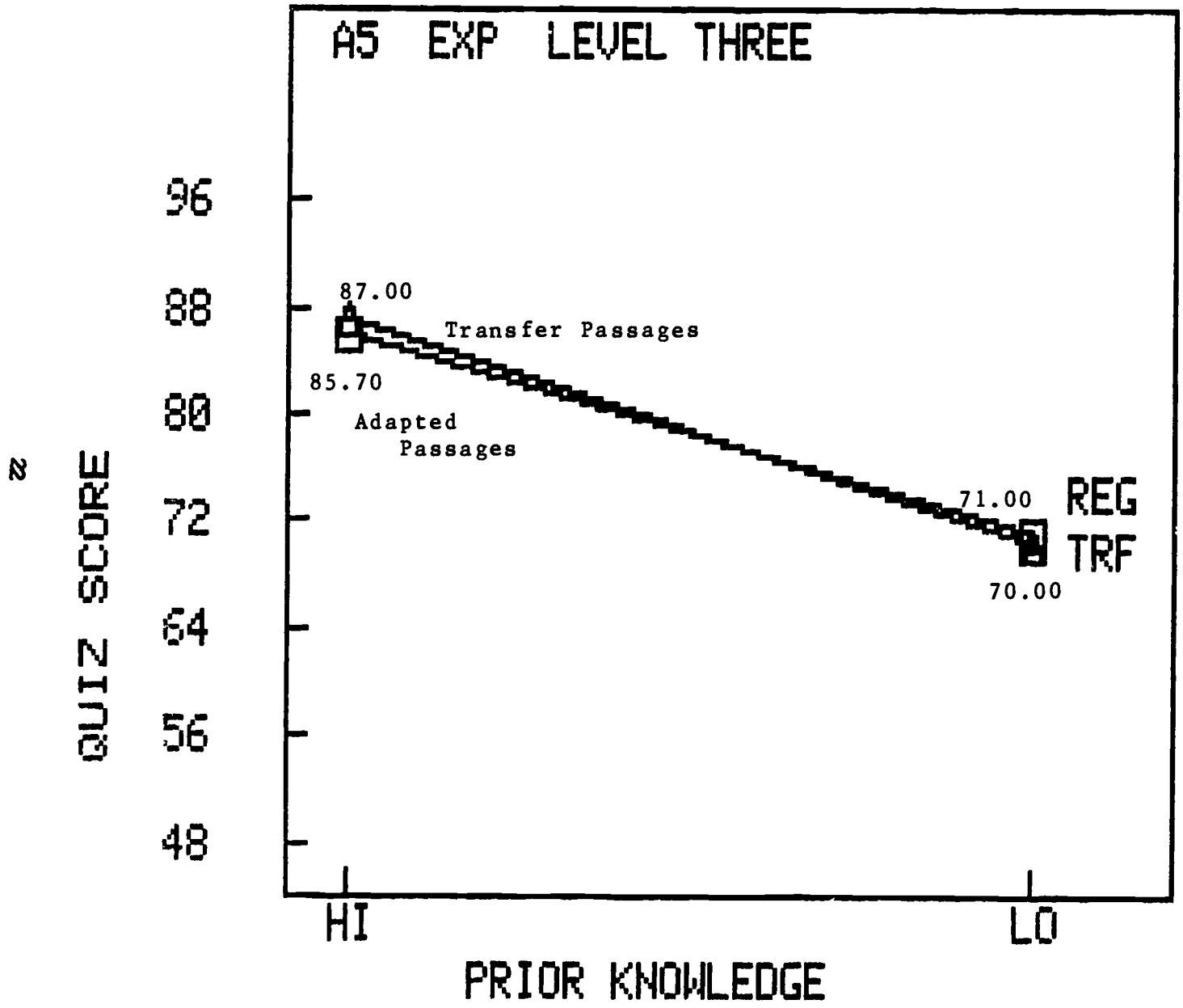


Figure 7. Results of Multiple Choice Assessment, Control Group, Ability Level Three

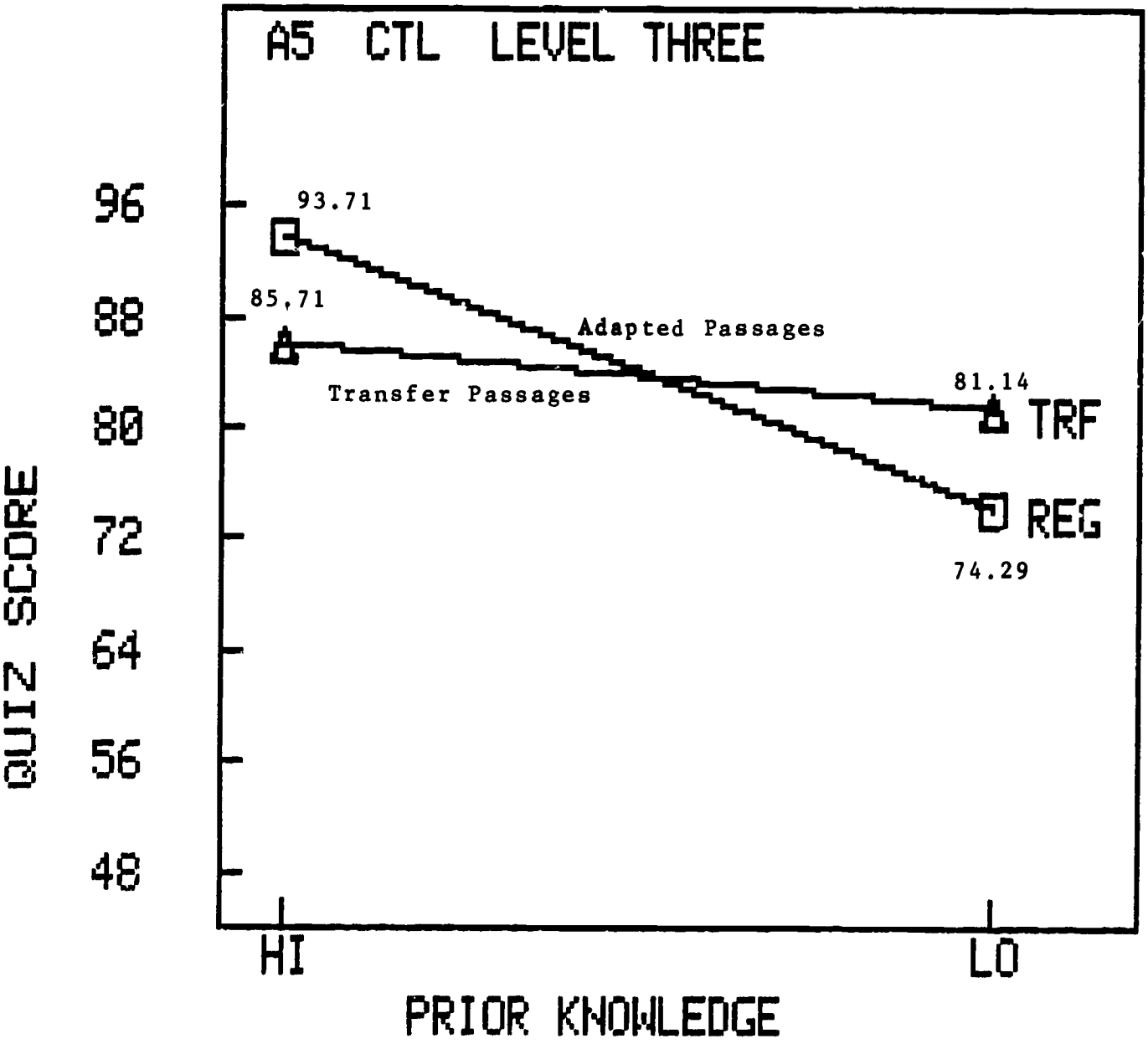


Figure 8. Results of Multiple Choice Assessment, Experimental Group, Ability Level Four

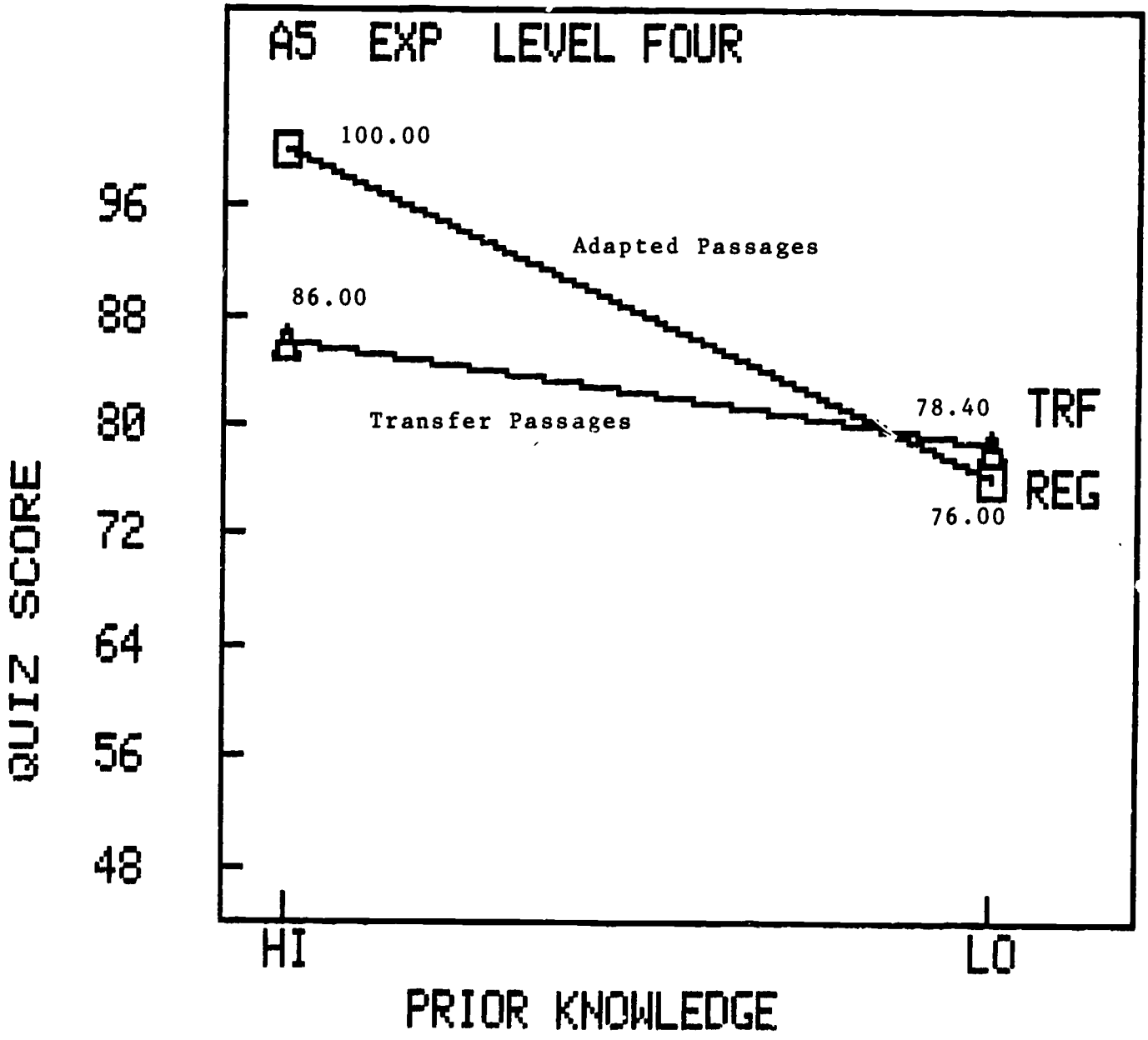
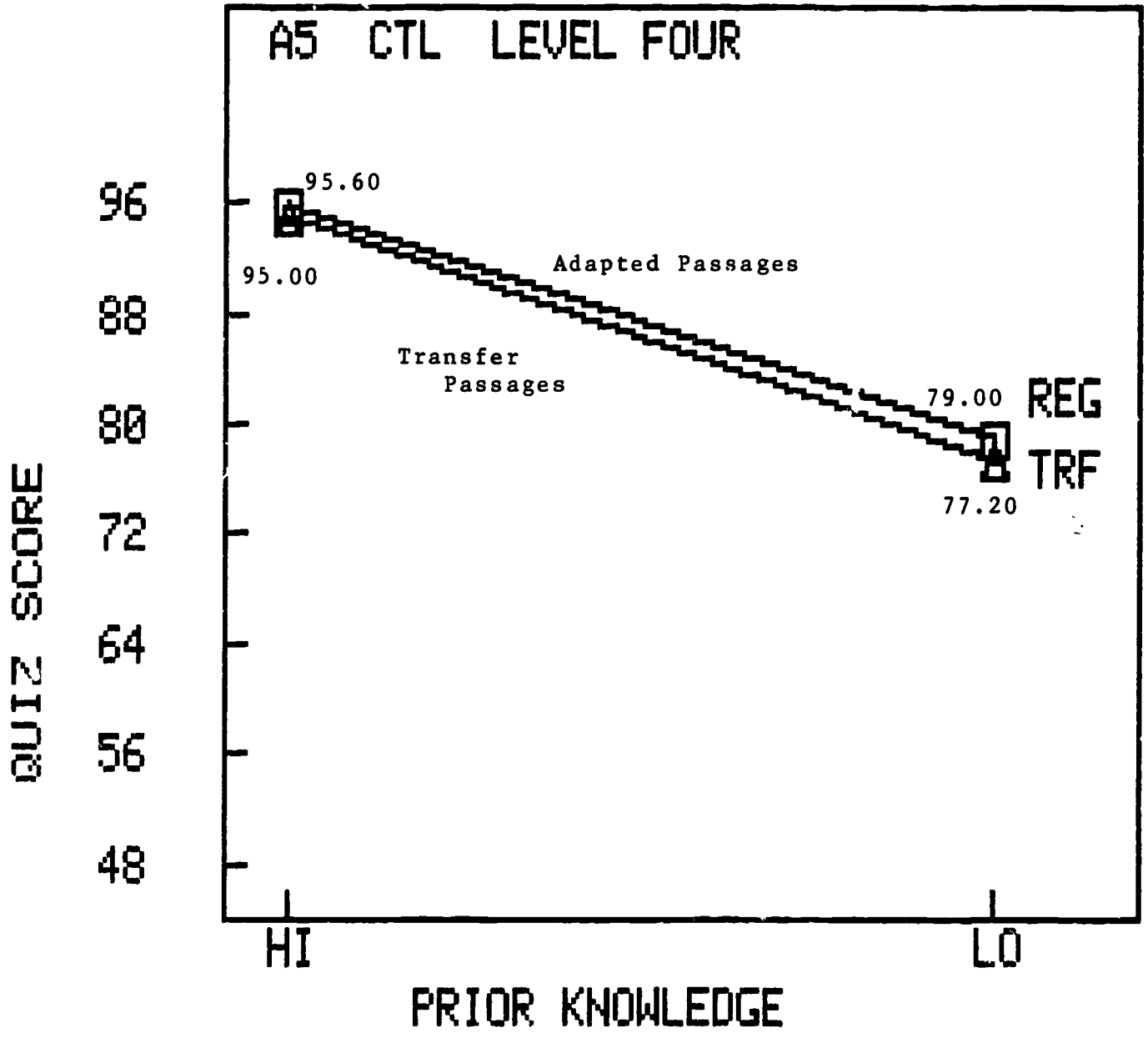


Figure 9. Results of Multiple Choice Assessment, Control Group, Ability Level Four.



Appendix A. Adapted Posttest Passage and Multiple Choice Assessment.

Matter and its States

Everything consists of matter. Matter can be found in many shapes and sizes from a speck of dust to a giant sequoia tree. Matter is the name we use to describe what things are made of. Matter is made up of atoms and is anything that has mass and takes up space. Large amounts of matter exist in one of three physical states - gas, liquid or solid. Whether matter will assume a particular state or not depends on the arrangement of its atoms. Each state has its own special properties. All matter has what is called a native state which is the state that it is usually found in at a standard temperature (usually room temperature) and pressure. For example, at standard temperature and pressure (STP), the native state of water, H_2O , is a liquid. If the temperature and/or pressure is increased, water goes from a liquid to a gas phase. It becomes steam. If the temperature is lowered the water will go into a solid phase as ice. In all states the water is still made of hydrogens and oxygen in a 2:1 ratio. What has changed though is the distance between individual water molecules and the amount of energy that they contain. Solids have a definite shape and volume because the molecules are packed tightly together. Matter is usually heavier in its solid state. Liquids do not have a definite shape but they do have a definite volume. Liquids conform to the shape of the container they're in. The molecules in a liquid are farther apart and can slide past each other. This allows liquids

to flow. A gas has neither definite volume or shape and its container determines both properties. The molecules in a gas can move quickly because they are very far apart and gases are able to both expand and contract.

Water is an unusual type of matter because its solid state is lighter than its liquid state. The molecules in ice are spread far apart and have very little energy in them. Therefore there are fewer molecules in a volume of ice than there are in the same volume of water, so ice floats.

Quiz on Posttest Passage #1: "Matter and Its States"

1. Which of the following do not have definite shapes? a) Liquid and gas b) Gas and Solid c) Solid and Liquid d) Liquid, solid and gas

2. Which of the following do have definite volumes? a) Liquid and gas b) Gas and Solid c) Solid and Liquid d) Liquid, solid and gas

3. Which is usually the heaviest form of matter? a) Liquid b) gas c) solid

4. In this, the molecules are very far apart. a) Liquid b) gas c) solid

5. Water at its native state. a) Liquid b) gas c) solid

6. Water under higher temperature or pressure. a) Liquid b) gas c) solid

7. Water at lower temperature. a) Liquid b) gas c) solid

8. Molecular structure is tightly packed. a) Liquid b) gas c) solid

9. Usually heavier. a) Liquid b) gas c) solid