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ABSTRACT

This study examined the effects of episodic-mapping, traditional notetaking, and rereading on eighth-grade students' recall of historical text. Episodic-maps are a kind of notetaking procedure that requires students to represent ideas from a text in the form of a graphic diagram. As predicted, both episodic-mapping and traditional notetaking enhanced free recall performance when contrasted with rereading. Episodic mapping also was found to enhance the recall of noted information when compared to traditional notetaking. However, the two notetaking methods were not found to differ in the amount or type of passage information noted. Contrary to prediction, both traditional notetaking and episodic mapping were found to enhance overall recall performance as a direct result of increased recall for noted passage elements. The results are discussed in terms of the metacognitive development of eighth-grade students. Thirteen tables of statistical data are appended. (Contains 43 references.) (Author)

# Comparison of the Effects of Episodic Mapping and Traditional Notetaking on the Recall of Historical Text

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Abstract

This study examined the effects of episodic-mapping, traditional notetaking, and rereading on eighth-grade students recall of historical text. Episodic-maps are a kind of notetaking procedure which require students to represent ideas from a text in the form of a graphic diagram. As predicted, both episodic-mapping and traditional notetaking enhanced free recall performance when contrasted with rereading. Episodic mapping was also found to enhance the recall of noted information when compared to traditional notetaking. However, the two notetaking methods were not found to differ in the amount or type of passage information noted. Contrary to prediction, both traditional notetaking and episodic mapping were found to enhance overall recall performance as a direct result of increased recall for noted passage elements (a selective attention/assimilative encoding effect). The results are discussed in terms of the metacognitive development of eighth-grade students.

# Comparison of the Effects of Episodic Mapping and Traditional Notetaking on the Recall of Historical Text

This study explored the effects of traditional notetaking, episodic-mapping and rereading on adolescents' encoding of historical text. Episodic-maps are a type of semantic map or web that have been suggested as an alternative to traditional notetaking (Clelland, 1981; Freedman & Reynolds, 1980; Armbruster & Anderson, 1980; Pehrsson & Robinson, 1985, Pehrsson & Denner, 1988). Maps and webs are notetaking procedures which involve representing ideas from texts in a graphic diagram. Because semantic maps require the reader to trace the connections among the ideas and facts presented in the passage, it was predicted they would promote better organized encoding of an expository text passage than traditional linear notes or rereading.

Notetaking has long been advocated as a strategy for enhancing the coding and retention of text information. The viewpoint that notetaking per se facilitates learning has been termed the encoding effect (DiVesta & Gray, 1972; Rickards & Friedman, 1978). This view suggests the mere act of extracting information from a text passage and writing it down as a note, without any opportunity to review the note, enhances recall performance by increasing the likelihood that the noted material will be meaningfully coded and stored in memory. Research has frequently shown (see Ladas, 1980; Kiewra, 1985 for reviews) that groups which take notes are superior in passage recall to groups which do not take notes, or which merely reviewed notes, thus providing verification for the encoding hypothesis. Many studies, however, have failed to find positive results (see Kiewra, 1985 for a review).

One reason for the inconsistent findings may be the type of encoding process prompted by traditional notetaking. For example, Pepper and Mayer (1978) found that taking notes encouraged college students to assimilate new information with past experience, but it did not lead to an overall increase in recall. Hence, the main encoding effect of traditional notetaking, according to Cook and Mayer (1983), may be to increase the reader's attention toward certain information in the text, thereby increasing its direct acquisition by adding it to the notetaker's long-term memory in a more or less verbatim form (a selective-

attention/acquisition effect). From this perspective, traditional notetaking is still judged to be an effective study-method, but only because it promotes selective recall of high-importance information or increases retention of information relevant to the reader's purpose for reading. Thus, notetaking may sometimes be found to yield greater overall retention of passage material when compared to non-notetaking conditions, but this would most often be found to be the result of increased recall for noted-passage information.

Other research has shown that notetakers can be induced or trained to use notetaking as a strategy for constructing a meaningful retrieval structure, and when this occurs it results in enhanced retention for both noted and non-noted passage material. In all cases (Bretzing & Kulhavy, 1979; Bretzing & Kulhavy, 1981; Glover, Plake, Roberts, Zimmer, & Palmere, 1981; Shimmerlik & Nolan, 1976), notetaking which involved paraphrasing, summarizing, elaboration or reorganization was found to be more effective than traditional verbatim notes. Cook and Mayer (1983) have termed this the "reorganization encoding hypothesis (p. 107)". This view of notetaking suggests that readers, who use notetaking to build a meaningful retrieval structure, will be more efficient at storing details that fit into that structure (a constructive encoding effect). Thus, they will be better able to recall both noted ideas and other passage information closely associated with the ideas in their notes, but not included in their notes.

To get students to engage in constructive notetaking, however, they must be trained or specifically induced to take notes in a prescribed fashion, according to their assigned conditions in the experiments. Other studies (Brown & Smiley, 1978; Hidi & Klaiman, 1983) suggest that left to their own devices younger students (including most junior high school students) tend to copy notes directly from the text. That is, they are more likely to engage in traditional notetaking, than constructive notetaking. The encoding effects of notetaking for adolescent readers, therefore, rests upon the propensity of individual readers either to copy notes directly from the text or to couple notetaking with other strategies which promote deeper text processing, such as summarization, or reorganization.

In the present study, eighth-grade readers were trained to use traditional notetaking (to write down extracted information in a linear fashion without reorganization) as a control condition against which to compare the encoding effects of episodic mapping. One goal of the present study was to verify the type of encoding process promoted when adolescent readers were trained to take traditional notes. It was predicted that such training would promote a selective attention/assimilative encoding process. Nevertheless, it was also predicted that notetaking would produce greater recall of the experimental passage than simple rereading-- a study-strategy favored by the majority of junior high school students (Barnett & Seefeldt, 1989)-- largely due to the notetakers increased recall of noted information.

In contrast to traditional notetaking, it was anticipated that semantic mapping would foster deeper text processing by operating as a form of constructive notetaking. To construct a map (also known as a web, network, or semantic organizer), the reader must organize and reorganize ideas abstracted from the text-passage and then display them as clusters of related ideas. The major ideas are drawn in circles, rectangles, or other shapes, then lines are used to connect the ideas together in a spatial arrangement. Hence, unlike traditional, linear notes, a semantic map has both a verbal (semantic) and a graphic component. They also require students to display the interrelationship of concepts and facts recorded in the notes.

Various studies (Armbruster & Anderson, 1980; Berkowitz, 1986; Dansereau, Collins, McDonald, Holley, Garland, Diekhoff, & Evans, 1977; Holley, Dansereau, McDonald, Garland, & Collins, 1979; McCagg & Dansereau, 1991) have investigated the general effects of semantic maps on students acquisition of expository text material. Results of all these studies indicate students who constructed maps recalled more information than students in the other study conditions. None of these studies, however, examined the nature of the encoding effects produced by semantic mapping nor did they directly compare semantic mapping to traditional notetaking (See Lambiotte, Dansereau, Cross, & Reynolds, 1989 for a review and call for investigations aimed at examining the processing effects of semantic mapping). Moreover, the type of maps used in these studies (hierarchical or cluster-maps) are different from the episodic-maps employed in the present investigation.

Pehrsson & Robinson (1985) and Pehrsson & Denner (1988) have revealed that semantic maps can be categorized as one of two basic types: cluster or episodic (see also, Lambiotte, Dansereau, Cross, & Reynolds, 1989 for a similar classification). Cluster-maps are constructed around a central idea and depict superordinate-subordinate relations, whereas episodic-maps are based on and centered around actions and events. Episodic-maps resemble a flow chart depicting changes in events over time. Figure 1 presents the basic structure for an episodic map. Historical text, with its narrative-like text structure (Brewer, 1980), may be better represented by an episodic map, due to the fact that historical accounts describe events and historical events can be ordered along a time-line.

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Insert Figure 1 about here

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To date, little research has been conducted to investigate the effectiveness of episodic-maps. Reutzel (1985) studied the use of a story map (similar but not identical to an episodic-map) as a prereading and postreading activity with average fifth grade students. He found that it was superior to a traditional Directed Reading Activity lesson. However, in the above study, the effects of story-mapping were not compared with the effects of traditional notetaking or rereading. Moreover, the effects of episodic- type maps have not previously been investigated using historical text structures. Examination of the possible differential effects of traditional notetaking, rereading, and episodic mapping on the encoding and retention of an historical text passage was the prime purpose of the present investigation. It was predicted that episodic mapping would foster constructive encoding and thereby have a greater facilitative effect on the recall of both noted and non-noted passage material than either traditional notetaking or rereading.

Strategy Training

Every study which trains students to use a study strategy is also by default a test of the method chosen to teach that strategy. The method of strategy training used in this investigation to train eight-grade students in episodic-mapping and traditional notetaking as a strategies for studying history texts was the "direct explanation approach" (Pressley, Johnson, Symons, McGoldrick, & Kurita, 1989, p. 26). The direct explanation approach to strategy instruction suggests that the best way to foster student control over a strategy is to explicitly guide them there via direct instruction and lots of guided practice (Anthony & Raphael, 1989; Roehler, Duffy & Meloth, 1984).

There are several common elements to this approach identified in the research literature. First, the students must know why the strategy is appropriate and the nature of the benefits to be gained from its use (Brown, 1982; Cross & Paris, 1988; Paris, Cross, & Lipson, 1984; Pressley, Johnson, Symons, McGoldrick, & Kurita, 1989; Roehler et al., 1984). Second, the teacher must model the thinking processes necessary to make sense out of text using a "think-out-loud" procedure (Cross & Paris, 1988; Paris, Cross, & Lipson, 1984; Pressley et al., 1989; Roehler et al., 1984). Third, the teacher must give the students ample opportunity to apply the strategy with guided practice using real content materials (Cross & Paris, 1988; Pressley et al., 1989; Roehler, Duffy, & Meloth, 1984). As a fourth component, student collaboration is often recommended (Garner, 1987; Roehler, et al., 1984). Fifth, the focus throughout training must be on strategy use (process), with repeated emphasis on the value of the strategy for achieving personal learning goals (Pressley et al., 1989; Roehler et al., 1984). Finally, instruction continues until the students capable of self-monitoring their own performances and deploying the strategy independently. It was predicted that all students trained to use a study strategy during this investigation (episodic mapping, traditional notetaking, or rereading) via the direct explanation approach would perform as trained during the final independent deployment assessment.

## Methods

### Subjects

The subjects for this study came from regular eighth-grade English classes taught in a small-city junior-high school in southeastern Idaho. All participants were volunteers, who gave their informed consent. The participants ($n$ = 159) were classified as above-average or below-average readers based on a median split of their Iowa Tests of Basic Skills (ITBS) reading comprehension scores ($Md$ = 51.0, $Q$ = 18.0). These students were also screened beforehand for the propensity to take notes when studying, and classified as notetakers or non-notetakers. This was used as a second blocking factor. No attempt was made to screen students for the quality of the notes they took. A greater percentage of above average readers (61%) were classified as note-takers than below average readers (49%). Within each block, the students were randomly assigned to the treatment conditions, according to the hour in which they took their English class.

Due to absence, 10 students were lost from this study before it was completed (3 from 2 of the treatment groups and 4 from the other). The loss of these subjects affected the number of above average readers (n = 72) compared to below average readers (n = 77) in the experiment, but it did not affect differentially the characteristics of the subjects across the treatment groups, so their loss was judged to be random in nature. As a consequence, however, the actual number of subjects completing the experiment was $n$ = 149.

### Materials

The historical passage used as the final passage for assessing independent strategy use was selected from the Be a Better Reader Series (Smith, 1984). This series is designed to improve the developmental reading skills of junior-high students. The selection chosen was titled, "Alaska's Struggle To Statehood" (Smith, 1984). It was 1250 words in length. The passage was modified so idea units would occur in only one location. Mainly, this was accomplished by eliminating the introductory paragraph and a few redundant statements. The readability of the passage as computed by the Fry (1977) and Dale-Chall (1948) formulas was placed at the ninth grade reading level.

Several additional passages, which I composed from source materials, were written to parallel the structure and length of the experimental passage. These passages also dealt with a sequence of historic events. They were used during the training phase of the experiment. The titles of the passages were "The Kingdom of Kush," "The Republic of Liberia," and "Canada's Struggle for Independence." The training passages were also examined for readability level using the Fry (1977) and Dale-Chall (1948) formulas. In each case, the readability fell at the 8th-9th grade reading level.

For each sentence of the experimental passage (Alaska's Struggle To Statehood), normative ratings of the structural importance (SI) were computed according to procedures outlined by Johnson (1970). This involved asking 30 college students to rate each text sentence, divided into pausal units, as to its overall importance to the meaning of the passage. A pausal unit represents a break between sentence segments where the reader pauses to take a breath and encode a chunk of the text (Johnson, 1970). The college students were divided into three subgroups and assigned the task of eliminating 1/4, 1/2, or 3/4 respectively of the sentence units that were least important to the overall semantic content of the passage. A count of the number of times a sentence unit was judged indispensable (retained rather than eliminated) provided the index of its structural importance. Based on these ratings, the pausal-units were classified according to six SI levels (Johnson, 1970).

Procedures

All teachers (trainers) were college graduates with experience teaching at the secondary level. All teachers were also familiar with metacognitive theory and metacognitive approaches to study strategy training. To equate teacher effects across treatment groups, each of the teachers was randomly assigned to one treatment group for the first class hour of the school day. Next, a rotation system was followed for the remaining 6 class periods, so that each teacher taught an approximately equal number of students under each of three treatment conditions.

Before data collection, the teachers and I met together on three separate occasions for a total of six hours. For each treatment condition, an identical training packet was received by each teacher. Each packet contained a day by day lesson plan for one of the treatments. Together the teachers reviewed and

revised each lesson until there was agreement as to the clarity and appropriateness of the language utilized for eighth-graders. Concerns and questions posed by the teachers were addressed until each teacher was confident she could follow the procedures and teach each of the strategy lessons. During our discussions, I emphasized my expectation that each teacher closely follow the scripted lessons (final version). I also asked them to report any deviations from the scripted lessons, if they occurred. No important deviations were reported.

All the study-strategy training sessions took place during the students' regularly scheduled English class (across six hours of the school day). During the hour they had their English class, the students reported to one of three separate, prearranged classrooms, according to their randomly assigned treatment condition (see the subjects section above for assignment method information). At the beginning of instruction all study participants were told that the purpose of the activity was to examine the effectiveness of different ways to study a history passage. Next, they were informed of the value of their assigned study strategy (episodic mapping, traditional notetaking, or rereading) for enhancing learning from text, and it's application to their needs in future learning. All participants were also told that they would be expected to use the study technique at the end of the training sessions to study a history passage, and that they would be asked to take a test on the information contained in that passage. They were not, however, informed about the precise nature of the test. The students were also told not to discuss the study with fellow students until after the study was completed.

Students assigned to the episodic-mapping groups were first given a verbal description of episodic-mapping (called sequence-mapping when presented to the student), and shown an example. All instruction then proceeded according to the common elements of a metacognitive or "self-regulated" strategy-lesson design (Brown, 1980; Baker & Brown, 1984; Roehler, Duffy, & Meloth, 1984; Pressley, Johnson, Symons, McGoldrick, & Kurita, 1989). The teachers first modelled episodic-mapping for an historical text ("The Kingdom of Kush") while providing "think-aloud" statements about effective strategy deployment. This was accompanied by a rationale for the strategy and discussion of when the strategy could be applied.

The students were taught to follow the organization of the passage (temporal sequence) by placing the side-headings in circles. The side-headings cued an important historic event. Next, the students were taught to attach selected facts to the event labeled in the circle, using a line as a connector. The students were then taught to draw an arrow to represent a sequence shift to the next major event (indicated by the next major side-heading). Telegraphic notes and the importance of the telegraphic nature of the notes to be included in the map were also explained and demonstrated. As the students, caught on to the procedure, they were encouraged to contribute ideas from the passage for inclusion in the episodic map the teacher was making (on a transparency at an overhead projector). The students then completed their own maps for a second passage as the teacher model the steps using a transparency and overhead projector.

On the second day, the students in the episodic-mapping groups worked together in teams of 2 or 3 to construct an episodic-map for another passage. Each student was given a handout which listed the key components of the episodic-mapping strategy. The students were allowed to use this handout as a reference while they constructed their maps. Within the teams, the students developed their own maps, but they were allowed to compare their maps and to discuss map construction procedures with their fellow team members. The teachers guided this process, providing re-explanations of the procedures, as necessary. The teachers also gave feedback about how to improve strategy use. Toward the end of the hour, the teachers reviewed the steps with the students, and discussed the value of the mapping strategy. Examination of the individual student maps indicated that all students followed the mapping strategy, and each student completed an acceptable map.

During the first two days of training, the students assigned to the traditional notetaking groups received comparable training in notetaking. These lessons were similar to those described above for the episodic-mapping groups, but relied more heavily upon the students own ideas about how to take notes, rather than providing them with explicit instruction in the steps of a notetaking strategy, as was the case for the episodic-mapping lessons. Notetaking was discussed as the act of writing ideas down to help fix them in memory and to have them for studying later. The students were then asked to share what they knew about notetaking and its value as a study strategy. The teacher modeled the steps identified by the students.

This was followed by a teacher-led lesson using as second historical passage during which the students and teacher decided together, and thought-aloud about what information should be noted. All students then incorporated this information into their own notes.

On the second day, the students in the notetaking groups worked together in teams of 2 or 3 to take notes on another historical passage. Within the teams, the students developed and wrote their own notes. They also compared their notes and discussed note-taking procedures with their fellow team members. The teachers provided guidance and correction during this process. Toward the end of the hour, the teachers reviewed the steps of notetaking with the students, and discussed the value of notetaking as a study strategy. Examination of the individual student notes taken during this practice session indicated that all students took acceptable notes (i.e., wrote selected information from the history passage on the provided notepaper).

In a manner comparable to the other treatment conditions, the students in the read/reread groups were taught during the first two days of training the value of rereading as a strategy for studying historical passages. The lessons were similar to those described above for the traditional notetaking groups. Again, as was the case for the notetaking groups, the initial lesson relied upon the students' own ideas about how and why to reread a history passage (rather than directly instruct them in the steps of a predetermined rereading strategy). The students ideas related to the value of rereading were first summarized by the teachers (e.g., "read again to learn information you couldn't remember the first time"). During this discussion, the teachers also stressed the value of repeating ideas by rereading them in order to fix them in memory. Another historical passage was then distributed and the students were instructed to read its first section. After this, they were asked to reflect upon what they could remember. Then, they were asked to reread the that section of the passage. This same procedure was followed for the remaining sections of the passage.

During the second day's training session, the students in the rereading groups first reviewed the goals of rereading as a study strategy. Next, they read sections of another historical passage together in teams of 2 or 3. After the students read a section of the passage, they discussed what they could remember; then,

they reread it. This procedure was followed for the remaining sections of the historical passage. While the students were working, the teachers walked around the room to be sure the student were completing the assignment. The teachers answered questions, and praised students for their performance. Toward the end of the class hour, the teachers collected the passages and reviewed with the students the value of rereading as a study strategy.

Although the training received by each of the treatment groups was not completely identical, it was comparable. All treatments were exposed to the same instructional materials, in the same order, and for approximately the same time under intentional strategy-instruction conditions. This was done to equate the treatment groups in time spent with the teachers, and also to familiarize all students with the common structure of the historical passages. Where the treatments varied, it was due to the fact that many students were already familiar with the strategies of notetaking and rereading, and the fact that the episodic-mapping strategy required more steps. Special effort was made to keep students in all treatment conditions meaningfully engage for the entire training sessions.

On the third day, the experimental passage (titled, "Alaska's Struggle to Statehood") was distributed. All students then read and studied the historical passage, using their trained study method (either episodic-mapping, notetaking or rereading). The students performed independently from both peers and the teacher on this final passage using the strategy they had been trained to use. At the end of the class, the teachers collected all materials, including the episodic-maps or notes made by the students in those treatment conditions. Because there was no visible record of the study activities of the students in the rereading groups, special care was exercised by the teachers during this session. Each student was monitored closely to be sure he or she reread (at each hour the groups were small so this was easily accomplished). As they finished, the students were also asked whether or not they had used the rereading strategy during this session. All responses were affirmative.

On the final day, the teachers first distributed lined notebook paper and pencils. Next, they asked all students to recall and retell in writing as much of the historical passage ("Alaska's Struggle for Statehood") as they could remember. All students completed this activity within the 45 minute class hour.

Design

The effects of episodic-mapping were compared with the effects of traditional notetaking and rereading using a replicated Latin squares split-plot design (Kirk, 1982), with teacher, hour, and study method forming the Latin square and reading level (above versus below average) forming the split-plot. Session (morning versus afternoon) served as the replication factor. The dependent measures derived from the students free-recall responses included both total recall, and the number of passage units recalled at three tiers of structural importance (high SI = level 1 + level 2, medium SI = level 3 + level 4, and low SI = level 5 + level 6). These dependent variables were analyzed using the design described above and SAS GLM procedures on a Unix platform (SAS, 1988). Pairwise post hoc mean comparisons were made using the Newman-Keuls procedure. The level of significance set for all tests was alpha = .05, although exact probabilities are reported in the results section.

The type of information as indicated by SI level (high, medium & low tiers) contained in the students' episodic-maps was compared to the type of information chosen by the students who took their own notes. Because the rereading subjects did not take any notes, the design reverted to a simple split-plot design, using only the factors of teacher and notetaking method as the whole plot and reading level as the split-plot. The dependent measures were the total number of notes taken by the two groups (episodic-mapping versus regular notetaking), and the number of notes taking by SI level. An additional analysis was made using the same design, which assessed the proportion of total recall due to recall of noted-information.

Scoring

Recall performances were scored by comparing the students written statements to the original sentences (pausal units) of the historical text. To receive credit, a student's statement had to contain a sizable segment of the original statement or be judged to convey the same meaning as the text unit. This method of scoring was originally developed by Cofer (1941) and later reintroduced by Johnson (1970) using the smaller pausal units as the units of comparison instead of the original text sentences. The notes taken by students in the active episodic mapping and notetaking conditions were scored according the SI level of the pausal units of the original passage to which the notes refer. As mentioned previously, the

experimental text passage was modified so that ideas units occurred in only one location. Any recall statement or note taken by a student, therefore, could only refer to one pausal unit of the original text.

The objectivity of the scoring procedures was assessed by having two independent raters (both blind to treatment conditions) score all recall performances. These judgments were then correlated to determine the inter-rater reliability of the scoring procedure. The Pearson correlation was $r = .95$, $p < .001$ ($n = 149$), indicating high inter-rater reliability. The same procedure was followed for examining the inter-rater reliability of the judgements and counts these raters made for the number of notes taken. The Pearson correlation was $r = .96$, $p < .001$ ($n = 149$), supporting the reliability of the scoring procedure. One of the two scorings was randomly selected for use in all subsequent analyses.

## Results

### Total Story Recall

Examination was made of the effects of episodic-mapping, traditional notetaking, and rereading on the total recall of passage elements. The replicated Latin squares split-plot ANOVA (table 2) for total recall scores revealed a significant main effect for study method, $F(2,4) = 56.11$, $p = .001$, $MSe = 13.23$, and a significant main effect for reading level, $F(1,12) = 496.97$, $p < .001$, $MSe = 8.77$. No other main effects or interaction effects were found to be statistically significant. Table 1 presents the means and standard deviations for the total recall scores and for the number of passage units recalled by level of structural importance (high, medium, and low) for each of the study methods by reading ability level. Post hoc mean comparisons using the Newman-Keuls procedure disclosed that episodic mapping ($M = 19.2$) did not significantly ($p < .05$) increase total passage recall when compared to traditional notetaking ($M = 16.5$); however, as expected, both episodic-mapping and traditional notetaking significantly enhanced total recall ($p < .05$) when compared to rereading ($M = 11.2$). In addition, the above average readers ($M = 21.3$) recalled significantly ($p < .05$) more total passage information than below-average readers ($M = 10.2$).

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Insert Table 1 about here

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Insert Table 2 about here

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Recall by Level of Structural Importance

The replicated Latin squares split-plot ANOVA for recall of high SI passage units (table 3) revealed a significant main effect for study method, $F(2,4) = 122.17$, $p < .001$, $MSe = 1.55$, and a significant main effect for reading level, $F = 258.77$, $p < .001$, $MSe = 4.23$. No other main effects or interactions achieved statistical significance. Pairwise mean comparisons using the Newman-Keuls procedure indicated that both episodic mapping ($M = 9.85$) and traditional notetaking ($M = 9.29$) significantly ($p < .05$) enhanced eighth-grader's recall of high SI passage units when compared to rereading ($M = 6.12$). Episodic mapping and traditional notetaking, however, were not found to differ significantly from each other. Again, the above-average readers significantly ($M = 11.3$) outperformed below-average readers ($M = 5.7$).

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Insert Table 3 about here

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The replicated Latin squares split-plot ANOVA for recall of medium SI passage units (table 4) revealed a significant main effect for study method, $F(2,4) = 61.56$, $p = .001$, $MSe = 1.53$, a significant main effect for reading level, $F = 150.07$, $p < .001$, $MSe = 2.77$, and a significant main effect for teacher, $F(2,4) = 11.07$, $p = .023$, $MSe = 1.53$. No other main effects or interactions achieved statistical significance. Mean comparisons using the Newman-Keuls procedure showed that episodic mapping ($M = 6.40$) significantly enhanced recall of medium SI passage units when compared to both traditional notetaking ($M = 4.96$) and rereading ($M = 3.54$). The performance of the eighth-graders who took traditional notes ($M = 4.96$) was also found to be significantly higher than the performance of the students who merely reread the passage. Above-average

readers, once more, significantly ($\underline{M}$ = 6.72) outperformed the below-average readers ($\underline{M}$ = 3.28). Post hoc mean comparison for the differential effect of teachers using the Newman-Keuls procedure did not yield any significant differences ($\underline{M}_1$ = 4.47, $\underline{M}_2$ = 4.94, and $\underline{M}_3$ = 5.35, respectively for the three teachers).

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Insert Table 4 about here

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The replicated Latin squares split-plot ANOVA for recall of low SI passage units (table 5) revealed a significant main effect for study method, $\underline{F}(2,4)$ = 9.46, $\underline{p}$ = .030, $\underline{MSe}$ = 2.25, a significant main effect for reading level, $\underline{F}$ = 116.82, $\underline{p}$ < .001, $\underline{MSe}$ = 1.31, and a significant reading level by study method interaction, $\underline{F}$ = 6.50, $\underline{p}$ = .012, $\underline{MSe}$ = 1.31. Figure 2 depicts the interaction effect. No other main effects or interactions achieved statistical significance. The mean comparisons for study methods did not yield any significant differences among the means of the treatment groups for low SI passage information ($\underline{p}$ = .05) using the Newman-Keuls procedure. The above-average readers ($\underline{M}$ = 3.3) recalled more low-importance information than the below-average readers ($\underline{M}$ = 1.2).

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Insert Table 5 about here

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Insert Figure 2 about here

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Examination of the reading level by study method interaction revealed that only the above-average readers in the episodic mapping condition ($\underline{M}$ = 4.4) exceeded the recall of above-average readers in the rereading condition ($\underline{M}$ = 2.17). The mean of the above-average readers in the traditional notetaking condition ($\underline{M}$ = 3.5) fell between the other study methods without differing significantly from either of them. The mean of the above-average readers in both the episodic mapping and notetaking conditions exceed ($\underline{p}$ < .05) the means for the below-average readers across all three study conditions. There were no

significant differences among the means of the below-average readers for recall of low SI passage units across the three study methods. In addition, the mean of the above-average readers in the rereading ($\underline{M}$ = 2.17) condition did not differ significantly from the mean of the below-average readers in across any of the treatment conditions. These results suggest episodic-mapping significantly enhanced the recall of low SI passage units for above-average readers only.

Overall the findings indicate that active notetaking techniques are superior to rereading, supporting the encoding hypothesis with regard to the function of taking notes (DiVesta & Gray, 1972). They also indicate one effect of notetaking methods is to enhance recall of high and medium importance information. Although episodic-mapping did not exceed traditional notetaking in its effects on total recall, the means were in the predicted direction, and episodic-mapping was shown to enhance recall of medium-importance information when compared to traditional notetaking. The findings also support the effectiveness of episodic-mapping as a method for studying historical text.

Passage Content Noted

The total number and types of passage units included in the notes of the students who were trained to complete episodic-organizers was compared to the number and types of passage content noted by the students who were trained to take traditional notes. Table 6 presents the means and standard deviations for the total number of passage units noted and for the number of notes taken at each level of structural-importance by reading level for the two notetaking treatments (episodic-mapping versus traditional notetaking). The split-plot ANOVA for the total number of passage units noted (table 7) revealed no significant difference between the two groups, $\underline{F}(1,2) = .340$, $\underline{p} = .618$, for total units noted. None of the other effects were found to reach statistical significance either.

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Insert Table 6 about here

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Insert Table 7 about here

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To examine whether or not the pattern of notetaking varied between these two groups separate split-plot ANOVA were conducted for the number of notes taken by SI level. Table 8 shows the analysis for high SI units noted. The results indicated no significant main effect for notetaking method, $F(1,2) = .19$, $p = .7089$, no main effect for reading level, $F(1,4) = 4.068$, $p = .1139$, no reading level by method interaction, $F(1,4) = 4.122$. The same pattern of results was found for medium SI units noted (table 9), and for low SI units noted (table 10).

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Insert Table 8 about here

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Insert Table 9 about here

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Insert Table 10 about here

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Taken together, these results suggest there were no major differences between the two notetaking techniques in either the amount of story-content noted or the type (as determined by SI level) of notes taken. Interestingly, reading ability level was not shown to influence significantly the number of notes taken or type of information noted for either traditional notetaking or episodic mapping. However, the means for reading level were all in the anticipated direction. The non-significant findings may have been due to the high degree of variability among the above and below average readers across groups in amount of notes taken.

Note Recall and Proportion of Recall Attributed to Note-Recall

In order to assess the encoding effects of the notes taken, separate analyses were conducted to compare episodic mapping and traditional notetaking on the total number of notes recalled and the proportion of total recall due to notes recalled. Table 11 presents the means and standard deviations for the two notetaking methods by reading level. The split-plot ANOVA for the total number of notes recalled (table 12) revealed a significant main effect for notetaking method, $F(1,2) = 18.80$, $p = .0493$, $MSe = 2.512$, and a significant main effect for reading level, $F(1,4) = 129.04$, $p = .0002$. Students who developed episodic maps recalled significantly more noted passage units ($M = 13.21$) than students who took traditional notes ($M = 11.86$). Above-average readers recalled significantly more of their notes ($M = 17.35$) than did below-average readers ($M = 7.96$). This suggests that recall of noted information was aided by the structure of the episodic maps.

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Insert Table 11 about here

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Insert Table 12 about here

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The split-plot ANOVA for the proportion of total recall due to notes recalled revealed no significant main effects and no interaction (table 13). This result means the facilitative effects for both the episodic mapping and traditional notetaking groups were approximately equal in impact on both note related and non-note recall. The mean proportions themselves, .71 for traditional notetaking and .69 for episodic mapping, revealed that total recall in each case was highly dependent upon the recall of noted passage units. This pattern suggests that both types of notetaking promoted a selective attention/assimilative encoding effect.

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Insert Table 13 about here

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## Discussion

The results of this study confirm those of previous experiments (see Ladas, 1980; and Kiewra, 1985, for reviews) with regard to the benefit of taking notes when reading. They also provide additional support for the encoding view of traditional notetaking (DiVesta & Gray, 1972), which suggests that the mere act of writing down information excerpted from a text as a note enhances total recall performance. Significantly, this study also demonstrated a positive encoding effect for episodic mapping when reading historical text passages. This adds to the results of previous studies on semantic mapping (Armbruster & Anderson, 1980; Berkowitz, 1986; Dansereau, Collins, McDonald, Holley, Garland, Diekhoff, & Evans, 1977; Holley, Dansereau, McDonald, Garland, & Collins, 1979; McCagg & Dansereau, 1991; Reutzel, 1985) which have found networking or mapping to have facilitative effects on passage recall. The present study extends these findings to episodic-type semantic maps for use with historical text patterns.

The findings of this study were also consistent with those of Brown and Smiley (1978). The results indicated that one function of active notetaking for junior-high readers was to increase recall of important information. Both traditional notetaking and episodic mapping were found to enhance eighth-graders' recall of passage units rated medium and high in structural importance when compared to rereading. In addition, episodic mapping exceeded traditional notetaking in recall of medium importance passage units.

The findings of the present study did not verify those of previous investigations (Bretzing and Kulhavy 1979, 1981; Glover, Plake, Roberts, Zimmer, & Palmere, 1981; Shimmerlik & Nolan, 1976), which have found that notetakers who reorganize their notes invariably outperform notetakers who take linear or verbatim notes. Nevertheless, the results were consistent with the view that active reorganization has a positive influence on learning. In this study, the students who developed episodic maps recalled significantly more

of their notes than the students who took traditional notes. Thus, the organization of notes in the form of an episodic map apparently influenced the retention of passage-ideas noted without in this instance producing more total learning when compared to traditional notetaking.

Type of Encoding Promoted by Notetaking

The kind of encoding effects produced by traditional notetaking and semantic mapping when used by eighth graders to study historical text was also examined in the present study. Evidence for the encoding effects was provided by the data on the proportion of total recall due to recall of noted information. For the traditional notetaking group the findings were consistent with previous investigations (Cook & Mayer, 1983). Recall of noted information, on the average, accounted for 71% of their free recall. Thus, traditional notetaking increased learning when compared to rereading mainly through direct acquisition of information that was included in the students' notes. This pattern supports the view that the main encoding effect of traditional notes is one of selective-attention given to noted material (Mayer, 1984).

Contrary to expectation, however, the proportion of total recall due to note recall was not found to be significantly different for students who were trained to take notes as episodic maps. Recall of noted information was also found to account for a high percentage of total recall, in this case 69%. Hence, the facilitative effect of episodic mapping in this instance was also shown to result mainly from its effect on note recall. This suggests that the encoding effect when eighth graders generate an episodic map while studying historical text is one of selective-attention to noted information. This finding does not conform to those of previous investigations with high school readers (Bretzing & Kulhavy, 1979; Shimmerlik & Nolan, 1976) or college readers (Bretzing & Kulhavy, 1981; Glover, Plake, Roberts, Zimmer, & Palmere, 1981), with respect to the encoding effects of notetaking when notetakers were induced or trained to use a constructive form of notetaking, such as paraphrase or reorganization. It was thought that episodic-mapping would have a similar constructive effect, but this was apparently not the case for eight-grade students.

One explanation for this outcome may be that the encoding effects associated with proficiency in strategy usage is related to the developmental level of the students. The findings in the present study were consistent with the research of Brown and Smiley (1978), who found that the most common strategy used

by fifth and seventh graders while taking notes and outlining was a copy-delete strategy. This strategy combines choosing text elements (selective attention) and copying the elements more or less verbatim from the text (a rehearsal effect). It appears that training eight-grade students to map historical text did not alter this strategy. This occurred despite the fact that strategy instruction focused on the importance of note organization to memory. Future research should focus on whether older (high school and college) students trained to use episodic-mapping will do so in a constructive fashion, and whether different or more extensive approaches to strategy instruction would induce constructive usage among junior high students. In addition, the present findings do not preclude the possibility that an opportunity to review a student-generated episodic-map prior to recall might produce a reconstructive effect (Rickards & Friedman, 1978) on retrieval processes, since students were not given an opportunity to review their maps in the present study. Future studies should investigate this potentiality as well.

A Further Delimitation of the Findings

The reading demands of the material may have affected the outcome of this investigation. The history passage used in this investigation for assessing independent deployment of the study strategies may have been too difficult for many of the students to read effectively. Overall, the students in this investigation demonstrated low levels of recall for this passage. Although the study was conducted late in the school year during the Spring term, the history passage was determined to be at the 9th grade reading level according to the Dale-Chall (1954) formula for computing readability; therefore, it was likely difficult for the eighth graders to read and comprehend. Moreover, readability formulas may underestimate the comprehension difficulties posed by unfamiliar expository text passages. Thus, the lack of difference in total recall between traditional notetaking and episodic mapping should be judged limited to circumstances where junior-high students are required to study difficult history passages beyond their own independent reading levels. Future investigations should examine the effects of training junior-high students to episodically map a variety of historical texts at differing levels of difficulty and with varying degrees of relation to the students' prior background knowledge.

Direct Explanation Approach to Strategy Instruction

The training sessions in this study employed all elements of the direct explanation approach to strategy training as specified by numerous researchers (Brown, 1980; Baker & Brown, 1984; Paris, Cross, & Lipson, 1984; Pressley, Johnson, Symons, McGoldrick, & Kurita, 1989; Roehler, Duffy & Meloth, 1984); hence, it was also a test of the direct explanation approach. The findings of the present investigation support this approach to strategy training. All students across study conditions performed as trained and the students trained to use active notetaking methods outperformed the student who were merely trained to reread. Hence, training led students to employ the strategy they were trained to use. This study did not, however, compare the direct explanation approach to other methods of strategy instruction; so, it does not support its differential effectiveness when compared to other approaches. Nevertheless, the present study did demonstrate successful application of the direct explanation approach to strategy instruction.

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Table 1

Mean Total Recall and Recall by Level of Structural Importance (SI) for Study Method and Reading Level.

| Group | | Total Recall | | High SI | | Medium SI | | Low SI | |
|---|---|---|---|---|---|---|---|---|---|
| | n* | M | SD | M | SD | M | SD | M | SD** |
| ReReading | 12 | 11.22 | 4.88 | 6.12 | 2.80 | 3.54 | 1.66 | 1.56 | .88 |
| Below Average Readers | 6 | 6.65 | .98 | 3.69 | .93 | 1.96 | .81 | 1.00 | .52 |
| Above Average Readers | 6 | 16.17 | 1.36 | 8.75 | .85 | 5.25 | .31 | 2.17 | .83 |
| Traditional Notetaking | 12 | 16.53 | 6.23 | 9.29 | 3.48 | 4.96 | 1.85 | 2.24 | 1.32 |
| Below Average Readers | 6 | 10.85 | 1.48 | 6.35 | .82 | 3.50 | .90 | 1.00 | .25 |
| Above Average Readers | 6 | 22.44 | 1.54 | 12.36 | 1.70 | 6.48 | .91 | 3.52 | .63 |
| Episodic Mapping | 12 | 19.19 | 6.40 | 9.85 | 3.06 | 6.40 | 2.39 | 2.94 | 1.36 |
| Below Average Readers | 6 | 13.32 | 1.68 | 7.24 | .72 | 4.44 | 1.26 | 1.64 | .84 |
| Above Average Readers | 6 | 15.56 | 1.87 | 12.70 | 1.22 | 8.52 | .93 | 4.35 | .42 |

* Number of Means (Group Mean = Experimental Unit)

** Standard Deviation of the Group Means (Experimental Units)

Table 2

Replicated Latin Squares Split-Plot ANOVA Results for Total Recall Performance.

| SOURCE | df | MS | F | p |
|---|---|---|---|---|
| Session | 1 | 11.491 | .869 | .404 |
| Group | 2 | 742.220 | 56.110 | .001 |
| Teacher | 2 | 25.155 | 1.902 | .263 |
| Hour:Session | 4 | 2.125 | .161 | .947 |
| SessionxGroup | 2 | 12.474 | .943 | .462 |
| SessionxTeacher | 2 | .752 | .057 | .946 |
| (Error 1) | | | | |
| TxGxH:Session | 4 | 13.228 | | |
| Level | 1 | 4357.072 | 496.973 | .000 |
| LevelxSession | 1 | .141 | .016 | .901 |
| LevelxGroup | 2 | 26.469 | 3.019 | .087 |
| LxGxS | 2 | 7.786 | .888 | .437 |
| (Error 2) | | | | |
| TxL + TxGxL | 12 | 8.767 | | |

Table 3

Replicated Latin Squares Split-Plot ANOVA Results for Recall of High Structural Importance (SI) Information.

| SOURCE | df | MS | F | p |
|---|---|---|---|---|
| Session | 1 | 1.60 | 1.0365 | .366 |
| Group | 2 | 189.163 | 122.168 | .000 |
| Teacher | 2 | 5.246 | 3.388 | .138 |
| Hour:Session | 4 | .774 | .500 | .741 |
| SessionxGroup | 2 | 2.226 | 1.438 | .338 |
| SessionxTeacher | 2 | 2.664 | 1.701 | .292 |
| (Error 1) | | | | |
| TxGxH:Session | 4 | 1.548 | | |
| Level | 1 | 1094.256 | 258.765 | .000 |
| LevelxSession | 1 | .155 | .037 | .851 |
| LevelxGroup | 2 | 2.054 | .486 | .627 |
| LxGxS | 2 | 14.521 | 3.434 | .066 |
| (Error 2) | | | | |
| TxL + TxGxL | 12 | 4.228 | | |

Table 4

Replicated Latin Squares Split-Plot ANOVA Results for Recall of Medium Structural Importance (SI) Information.

| SOURCE | df | MS | F | p |
|---|---|---|---|---|
| Session | 1 | 3.089 | 2.025 | .228 |
| Group | 2 | 93.908 | 61.564 | .001 |
| Teacher | 2 | 16.889 | 11.073 | .023 |
| Hour:Session | 4 | 1.691 | 1.108 | .462 |
| SessionxGroup | 2 | 1.970 | 1.292 | .369 |
| SessionxTeacher | 2 | 10.047 | 6.587 | .054 |
| (Error 1) | | | | |
| TxGxH:Session | 4 | 1.525 | | |
| Level | 1 | 416.116 | 150.068 | .000 |
| LevelxSession | 1 | .004 | .002 | .970 |
| LevelxGroup | 2 | 2.685 | .968 | .408 |
| LxGxS | 2 | .172 | .062 | .940 |
| (Error 2) | | | | |
| TxL + TxGxL | 12 | 2.773 | | |

Table 5

Replicated Latin Squares Split-Plot ANOVA Results for Recall of Low Structural Importance (SI) Information.

| SOURCE | df | MS | F | p |
|---|---|---|---|---|
| Session | 1 | 7.647 | 3.393 | .139 |
| Group | 2 | 21.331 | 9.465 | .030 |
| Teacher | 2 | 1.116 | .495 | .642 |
| Hour:Session | 4 | .964 | .220 | .914 |
| SessionxGroup | 2 | .993 | .441 | .671 |
| SessionxTeacher | 2 | 2.163 | .960 | .456 |
| (Error 1) | | | | |
| TxGxH:Session | 4 | 2.253 | | |
| Level | 1 | 152.707 | 116.841 | .000 |
| LevelxSession | 1 | .005 | .004 | .951 |
| LevelxGroup | 2 | 8.493 | 6.499 | .012 |
| LxGxS | 2 | .665 | .509 | .614 |
| (Error 2) | | | | |
| TxL + TxGxL | 12 | 1.307 | | |

Table 6

Mean Number of Passage Units Noted and Number of Units Noted by Level of Structural Importance (SI) for Study Method and Reading Level.

| Group | | Total Notes | | High SI Notes | | Medium SI Notes | | Low SI Notes | |
|---|---|---|---|---|---|---|---|---|---|
| | n* | M | SD | M | SD | M | SD | M | SD** |
| Traditional Notetaking | 12 | 16.53 | 6.29 | 9.29 | 3.49 | 4.96 | 1.85 | 2.24 | 1.32 |
| Below Average Readers | 6 | 10.85 | 1.48 | 6.35 | .82 | 3.50 | .90 | 1.00 | .25 |
| Above Average Readers | 6 | 22.44 | 1.54 | 12.36 | 1.70 | 6.48 | .88 | 3.52 | .63 |
| Episodic Mapping | 12 | 19.19 | 6.40 | 9.85 | 3.06 | 6.39 | 2.35 | 2.94 | 1.36 |
| Below Average Readers | 6 | 13.32 | 1.68 | 7.24 | .72 | 4.44 | 1.26 | 1.64 | .84 |
| Above Average Readers | 6 | 25.56 | 1.87 | 12.70 | 1.22 | 8.52 | .93 | 4.35 | .42 |

* Number of Means (Group mean = experimental unit)

** Standard Deviation of the Group Means (experimental units)

Table 7

Split-Plot ANOVA Results for Total Number of Passage Units Noted.

| SOURCE | df | MS | F | p |
|---|---|---|---|---|
| Group | 1 | 113.886 | .340 | .618 |
| Teacher | 2 | 46.361 | .140 | .878 |
| (Error 1) | | | | |
| GroupxTeacher | 2 | 333.896 | | |
| Level | 1 | 1064.823 | 1.428 | .298 |
| LevelxGroup | 1 | 1684.620 | 2.260 | .207 |
| (Error 2) | | | | |
| TxL + TxGxL | 4 | 745.455 | | |

Table 8

Split-Plot ANOVA Results for the number of High Structural Importance (SI) Passage Units Noted

| SOURCE | df | MS | F | p |
|---|---|---|---|---|
| Group | 1 | 4.905 | .185 | .709 |
| Teacher | 2 | 8.123 | .307 | .765 |
| (Error 1) | | | | |
| GroupxTeacher | 2 | 26.482 | | |
| Level | 1 | 449.810 | 4.068 | .114 |
| LevelxGroup | 1 | 455.797 | 4.122 | .112 |
| (Error 2) | | | | |
| TxL + TxGxL | 4 | 110.572 | | |

Table 9

Split-Plot ANOVA Results for the number of Medium Structural Importance (SI) Passage Units Noted

| SOURCE | df | MS | F | p |
|---|---|---|---|---|
| Group | 1 | 4.909 | 3.644 | .196 |
| Teacher | 2 | 6.690 | 4.967 | .165 |
| (Error 1) | | | | |
| GroupxTeacher | 2 | 1.347 | | |
| Level | 1 | 8.848 | .674 | .458 |
| LevelxGroup | 1 | 71.106 | 5.413 | .081 |
| (Error 2) | | | | |
| TxL + TxGxL | 4 | 13.135 | | |

Table 10

Split-Plot ANOVA Results for the number of Low Structural Importance (SI) Passage Units Noted

| SOURCE | df | MS | F | p |
|---|---|---|---|---|
| Group | 1 | 1.160 | .050 | .844 |
| Teacher | 2 | 4.860 | .209 | .827 |
| (Error 1) | | | | |
| GroupxTeacher | 2 | 23.222 | | |
| Level | 1 | 1.851 | .060 | .818 |
| LevelxGroup | 1 | 33.553 | 1.090 | .355 |
| (Error 2) | | | | |
| TxL + TxGxL | 4 | 30.780 | | |

Table 11

Mean Total Notes Recalled and Proportion of Total Recall Due to Notes Recalled for Study Method and Reading Level.

| Group | | Total Notes Recalled | | Proportion of Total Recall Due to Notes Recalled | |
|---|---|---|---|---|---|
| | n* | M | SD | M | SD** |
| Traditional Notetaking | 12 | 11.86 | 5.63 | .71 | .09 |
| Below Average Readers | 6 | 7.19 | 1.79 | .66 | .10 |
| Above Average Readers | 6 | 16.72 | 2.62 | .75 | .07 |
| Episodic Mapping | 12 | 13.21 | 4.95 | .69 | .11 |
| Below Average Readers | 6 | 8.76 | 1.53 | .66 | .13 |
| Above Average Readers | 6 | 18.04 | 1.58 | .73 | .08 |

* Number of Means (Group mean = experimental unit)

** Standard Deviation of the Group Means (experimental units)

Table 12

Split-Plot ANOVA Results for Total Number of Notes Recalled.

| SOURCE | df | MS | F | p |
|---|---|---|---|---|
| Group | 1 | 47.220 | 18.797 | .049 |
| Teacher | 2 | 5.059 | 2.014 | .332 |
| (Error 1) | | | | |
| GroupxTeacher | 2 | 2.512 | | |
| Level | 1 | 2186.727 | 129.041 | .000 |
| LevelxGroup | 1 | 1.135 | .067 | .808 |
| (Error 2) | | | | |
| TxL + TxGxL | 4 | 16.946 | | |

Table 13

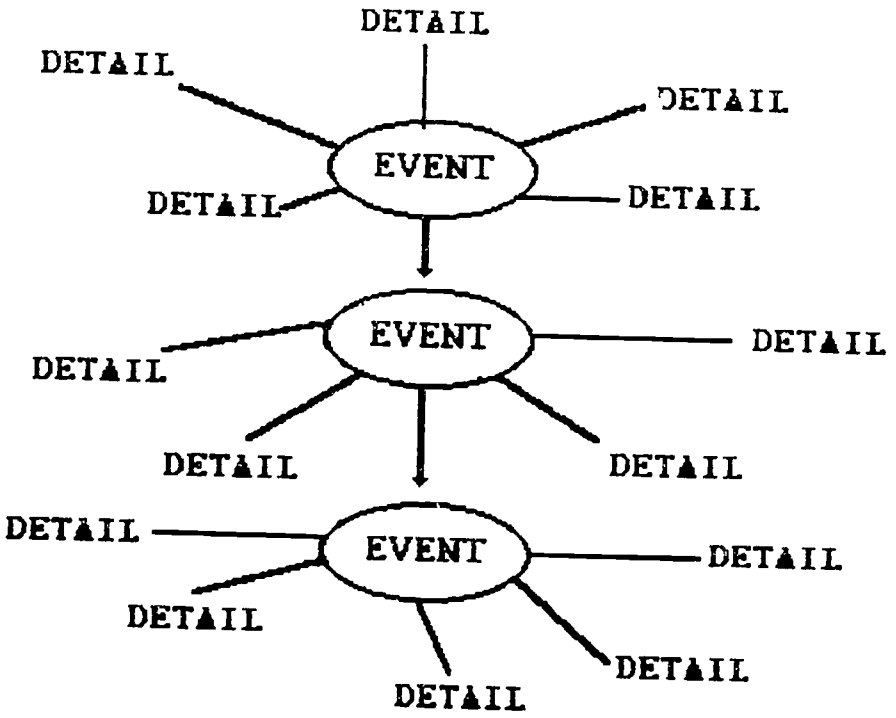
Split-Plot ANOVA Results for the Proportion of Total Recall Due to Notes Recalled.

| SOURCE | df | MS | F | p |
|---|---|---|---|---|
| Group | 1 | .014 | .400 | .594 |
| Teacher | 2 | .027 | .771 | .567 |
| (Error 1) | | | | |
| GroupxTeacher | 2 | .035 | | |
| Level | 1 | .173 | 1.730 | .260 |
| LevelxGroup | 1 | .004 | .040 | .855 |
| (Error 2) | | | | |
| TxL + TxGxL | 4 | .100 | | |

## Figure Captions

Figure 1. Structure of an Episodic Map.

Figure 2. Interaction for Recall of Low Structural Importance (SI) Passage Units by Study Method and Reading Ability Level.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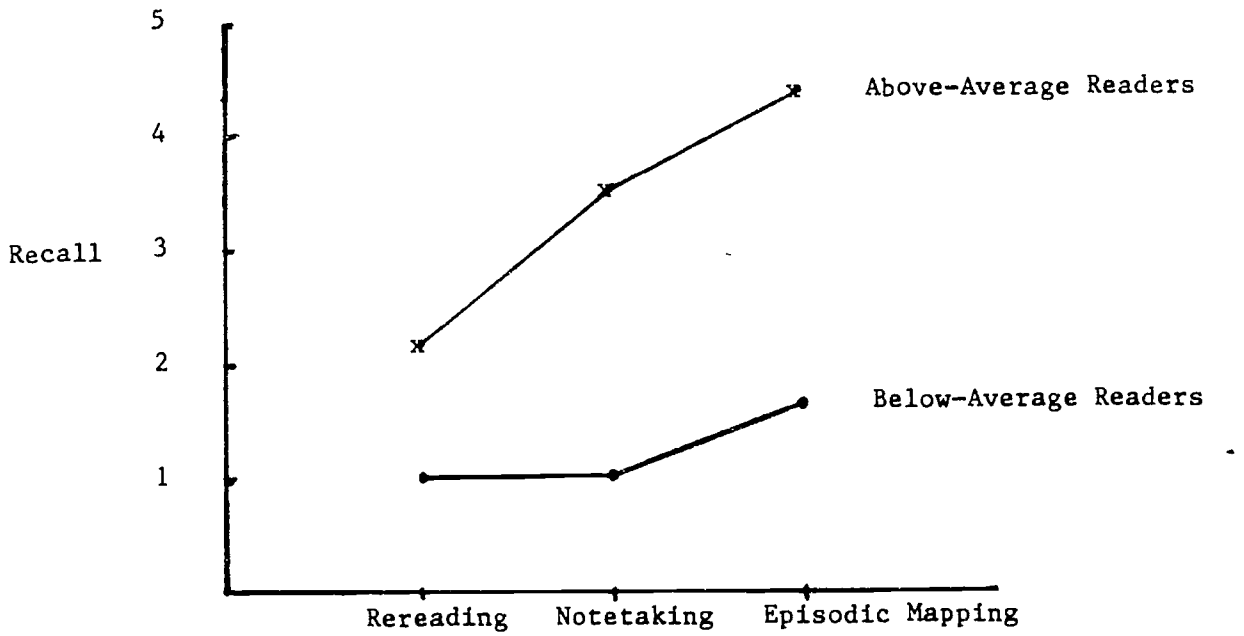
5
4
3
2
1
Recall
Above-Average Readers
Below-Average Readers
Rereading
Notetaking
Episodic Mapping