

Elaborative Verbal Rehearsals and College Students' Cognitive Performance

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Two experiments were conducted to determine the potential of elaborative verbal rehearsal (EVR) as a learning strategy for high-risk college students. In Experiment 1, a correlational inquiry was used to explore the relation between Ss' EVRs and their overall test performance. Sixty-four Ss studied an extended text, prepared an EVR, and then took the test. There were significant correlations between the quality of Ss' EVRs and their overall test performance. In Experiment 2, 50 Ss were trained to produce either EVRs or verbatim rehearsals and then took the same test in immediate and delayed conditions. The EVR Ss performed significantly better on almost every variable. EVRs appear to be a powerful learning strategy for high-risk students.

College freshmen often enter universities unprepared for the academic tasks that they will encounter in their courses. One reason for this lack of preparation is that these students do not have a repertoire of effective learning strategies (King, 1992; Weinstein, Zimmerman, & Palmer, 1988). Rather than using strategies that encourage them to elaborate on ideas, many college freshmen rely on the rote strategies that they used in high school (Christopoulos, Rohwer, & Thomas, 1987; Simpson & Nist, 1990). Hence, even though their college-level tasks may require synthesis or analysis, they reread and memorize their textbook assignments and lecture notes on a superficial level.

In an attempt to address these problems, many universities have designed programs or courses in which freshmen are taught more efficient and effective learning strategies (Wyatt, 1992). These strategies typically require the students to produce some observable written artifact such as a map, chart, or diagram. These are also the strategies that are typically researched (e.g., Diekhoff, Brown, & Dansereau, 1982). Fewer researchers however, have investigated the efficacy of strategies that produce no artifacts and that capitalize on verbal productions. One such strategy that requires no artifact is verbal rehearsal; this is the focus of the present experiments.

The research that has investigated verbal rehearsal is limited in many ways. Perhaps the primary limitation to the extant literature is that verbal rehearsal has been operationalized as an activity in which processes are emphasized such as repeating selected statements, identifying and reading topic sentences and details from the text, or combining one

sentence with another sentence to construct a paraphrase or oral summary. As Wittrock (1990) pointed out, activities such as these do not fully engage learners in the generative processes of transformation, reorganization, and elaboration.

In contrast to verbal rehearsals that emphasize such simple verbatim processes is elaborative verbal rehearsal. When learners elaborate, they add information that is not explicit in the text that they are reading and studying (Gagne, Weidemann, Bell, & Anders, 1984). Thus, in elaborative verbal rehearsals, learners are involved in constructing generalizations, thinking of personal examples and applications, and responding to text on personal levels. This type of postreading verbal rehearsal has not been researched. Given the importance of elaborative processing to individuals' understanding and remembering of text (Wittrock, 1990) and the finding that adults do not spontaneously elaborate when they read and study (Mayer, 1987; Pressley et al., 1992), we considered this limitation of the extant research to be critical.

Another limitation of the research is that there are very few studies in which verbal rehearsals have been investigated as a strategy for learning from naturally occurring text. In most of the studies in which verbal rehearsal has been investigated serial recall tasks have been used (Asarnow & Meichenbaum, 1979; Craik & Watkins, 1973; Flavell, Beach, & Chinsky, 1966; Ornstein & Naus, 1978). These basic research studies have generally concluded that verbal rehearsal (a) can improve retention of material, (b) is a developmental skill that improves with age, and (c) must match the processing demands of the criterion task to be effective.

In a few studies verbal rehearsal has been investigated as a postreading strategy for brief (i.e., fewer than 500 words) narrative selections (Gambrell, Koskinen, & Kapinus, 1985; Gambrell, Pfeiffer, & Wilson, 1985; Kapinus, Gambrell, & Koskinen, 1987). In these studies elementary school-age children retold all the important ideas from the story they had read. Their retellings were then scored using a text-based outline for scoring the quantity and type of story structure units. In these three studies it was found that the

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children who conducted retellings (i.e., verbal rehearsals) performed significantly better on the cued- and free-recall measures than did the control groups that either produced illustrations or answered questions about the stories.

We decided to address these research limitations by investigating the potential of elaborative verbal rehearsal as an independent learning strategy for high-risk college students who were assigned to study a lengthy expository text selection. In Experiment 1, we investigated whether there were any relations between students' elaborative verbal rehearsals and their cognitive performance on a recognition and recall examination. In Experiment 2, we sought to determine whether the verbal rehearsal itself or the type of processing involved in the rehearsal would make a difference in students' cognitive performance. Unlike in Experiment 1, in Experiment 2 we systematically manipulated the students' level of processing and provided intensive training.

Experiment 1

Experiment 1 was a correlational inquiry designed to investigate the relation between subjects' elaborative verbal rehearsals and their overall examination performance and to determine which components of elaborative verbal rehearsal were most predictive of performance. In addition, in Experiment 1 we also sought to determine whether subjects' time on task or their efficiency in the use of time had a stronger relation with examination performance than did the quality of their elaborative verbal rehearsal. The subjects' efficiency was defined as the quality of elaborative verbal rehearsal divided by the time they spent in constructing and practicing their elaborative verbal rehearsal.

Method

Participants. The participants were 64 high-risk college freshmen (34 men and 30 women) enrolled in several different sections of an elective learning strategies course. To meet a requirement of the course, we provided all students with five options for outside projects. The 64 students in this study volunteered to participate as their outside project. Verbal Scholastic Aptitude Test (SAT-V; Educational Testing Service, 1989) scores were available for all the participants. The average SAT-V score was 421.30 with a standard deviation of 52.08, which is based on a mean of 500 and standard deviation of 100; this represents the 21st percentile.

Materials. The text selected for elaborative verbal rehearsal and subsequent examination was an excerpt from a college-level linguistics textbook (Brooks & Emmert, 1980). The expository excerpt, *The Nature of Meaning in Words*, was approximately 3,870 words and was theoretical in nature. This text was selected for two reasons. First, we determined from previous work (e.g., Nist, Simpson, Olejnik, & Mealey, 1991) that college freshmen had little or no prior knowledge of the theories discussed in the text. The text was also selected because it required strategic learning from the students rather than rote learning so that they could comprehend and remember the information (Pressley, Ghatala, Woloshyn, & Pirie, 1990).

To assess the students' learning of the text excerpt, we administered a 40-point recognition and essay exam. The recognition

items were 10 multiple-choice questions and 10 true-false questions, 5 of each were higher level thinking questions requiring students to synthesize information across the text, to apply information to new situations, to generalize, or to recognize new examples of the theories and concepts. The other 10 recognition items (i.e., 5 multiple-choice questions and 5 true-false questions) were memory-level questions in which the subjects were asked to recognize definitions, theories, and characteristics of the theories (see Appendix A for sample items).

Over 2 years, three professors developed and refined these questions, making sure there was a consensus on which items were memory level and which were higher level. Pilot testing of the 20 questions with similar subjects provided a Kuder-Richardson (K-R 20) reliability estimate of .79. In addition to the recognition items, there were two essay questions, each worth 10 points, in which the students were asked to discuss the theories and their implications for communication.

Procedure. Each student individually completed two phases. In Phase 1, which consisted of one laboratory session, students (a) read and studied the excerpt, (b) read a packet describing the rationale, characteristics, advantages, and steps in creating elaborative verbal rehearsals, and (c) listened to the researcher giving audiotaped, quality models of elaborative verbal rehearsals from psychology and history textbook excerpts.

Phase 2 occurred 2 days later when each student met with the researcher for a 90-min individual session. In preparation for this session the students were required to construct one elaborative verbal rehearsal for the textbook excerpt *The Nature of Meaning in Words* and to record the total time they spent working on the task. They were also informed that they would be administered a multiple-choice, true-false, and essay exam covering the content of the textbook excerpt and that the elaborative verbal rehearsal would be their only means of study during Phase 2.

Students began Phase 2 by spending 15 min in a room practicing their elaborative verbal rehearsal on the tape recorder. During practice the students also reported the time they had spent in developing and practicing their elaborative verbal rehearsal. After practice each student's elaborative verbal rehearsal was taped so that it could eventually be scored. Once the taping was completed, each student was assigned a 10-min interpolated task that contained rapid-reading exercises for numbers and letters. Phase 2 ended with each student being administered the recognition and essay exam over the text excerpt.

Scoring procedures. Recognition and essay scores, taped elaborative verbal rehearsals, and self-reported time on task were collected during Phase 2. The recognition items were machine scored. The two essay questions were independently scored by two trained raters using a scoring rubric (see Appendix B) in which points were assigned for various predetermined responses. This rubric listed the ideas (i.e., a template) needed to answer each essay question in a minimally correct fashion. There was agreement of greater than 90% on this initial scoring for all 64 essays. Any essays with differences in the point totals were then reread so that consensus was possible.

To determine the quality of each student's taped elaborative verbal rehearsal, we modified Irwin and Mitchell's (1983) Richness of Retelling Scale. Overall, the modified scale stressed the students' "active construction of relations among parts of texts, and between the text and knowledge and experiences" (Wittrock, 1990, p. 349). More specifically, the scale included several elaborative processes that learners should use when studying text: (a) summarizing by using their own words and organization, (b) relating past experiences to text, (c) generating examples and

applications, and (d) seeking interrelations among ideas and across text (Wittrock, 1983, 1990).

As revealed in Figure 1, a quality elaborative verbal rehearsal was described as one that contained six components. Each of the six components was scored on a 5-point Likert-type scale ranging from poor (1) to excellent (5). Hence, an elaborative verbal rehearsal that met each of the components in a superior fashion received a score of 30.

To operationalize these six components, we devised and used an elaborative verbal rehearsal scoring rubric (see Appendix C). Each rater independently scored 32 verbal rehearsals; 30% of the verbal rehearsals were randomly selected to check for interrater reliability in scoring. A Pearson product-moment correlation revealed an interrater reliability of .92 for this scoring.

Students' efficiency index was computed by dividing their score on the elaborative verbal rehearsal by their self-reported time on task. For example, if a student received a score of 27 out of 30 on the elaborative verbal rehearsal and reported a time on task of 10 min, then the student's efficiency index would be 2.7.

Data analysis. The distributions of the scores for all variables were found to be, and to remain, skewed after a log transformation was made. Therefore, correlations and multiple regression analyses were performed using rank transformations of the original data, as suggested by Conover and Iman (1981). All hypotheses were tested at the .05 level of significance.

Results

Table 1 summarizes the descriptive statistics and correlations of the variables investigated. There was a significant and strong rank correlation of .96 ($p < .0001$) between the quality of the students' elaborative verbal rehearsals and their overall exam performance. The correlation between the students' time on task and their overall exam perfor-

mance ($r = .17$) was small and not statistically significant ($p = .19$). When the students' quality of elaborative verbal rehearsals adjusted for time spent was considered in an index of efficiency, the relation with overall exam performance was much lower ($r = .32$) than the unadjusted elaborative verbal rehearsal quality correlation but still statistically significant ($p = .011$).

Recognition and essay performance. The same pattern of correlations was found when the students' performance on the recognition and essay measures was analyzed separately. Quality of elaborative verbal rehearsals was strongly and significantly related to the students' performance on the recognition items ($r = .76$, $p < .0001$). On the essay questions this correlation was .92 ($p < .0001$). A t test for dependent correlations (Glass & Hopkins, 1984, pp. 310–311) revealed that there was a significant difference between these two correlations, $t(61) = 4.76$, $p < .001$, indicating that the relation between students' elaborative verbal rehearsals and their essay performance was stronger than the relation between students' verbal rehearsals and their recognition performance.

The correlations between students' recognition and essay performance and their time on task or efficiency were not as strong as those in which the quality of the students' elaborative verbal rehearsal was examined (see Table 1). Neither correlation involving time was statistically significant (both $ps > .15$). The correlations between students' efficiency index and the performance on the recognition and essay tasks were .28 ($p = .023$) and .28 ($p = .024$), respectively. Thus, these data suggest that the quality of students' elaborative verbal rehearsals correlated strongly with their overall exam performance; efficiency correlated weakly, and the amount of time students spent developing and practicing their elaborative verbal rehearsals did not correlate at all.

Predictive power of time and verbal rehearsal quality. Regression analyses were conducted to determine whether quality and time were jointly predictive of students' overall exam performance. When the students' score on the elaborative verbal rehearsals and reported total time on task were entered as predictors in a regression analysis, the squared multiple correlation equaled .93. The model was statistically significant, $F(2, 61) = 379.46$, $p < .0001$. The squared semipartial correlation for verbal rehearsal equaled .90, which was statistically significant, $t(61) = 27.11$, $p < .0001$, whereas the squared semipartial correlation for time equaled .003 and was not statistically significant, $t(61) = -1.62$, $p > .10$. Thus, elaborative verbal rehearsal, when time was controlled, was predictive of overall exam performance, but time, when the elaborative verbal rehearsal was controlled, was not a significant predictor of overall exam performance.

Individual component analysis. To understand elaborative verbal rehearsal further, we analyzed the six components characterizing a quality rehearsal (see Figure 1) separately with additional correlational and regression analyses. Spearman rank correlations were calculated to determine which components were significantly related to the students' overall exam performance and which were related to each other. The correlation matrix and descriptive

Elaborative Verbal Rehearsal

	1	2	3	4	5
1. Elaborative verbal rehearsal includes generalizations based on the text.					
2. Elaborative verbal rehearsal includes creative or personal reactions to the key ideas in the text.					
3. Elaborative verbal rehearsal includes what is important to remember from the text (in the student's own words).					
4. Elaborative verbal rehearsal includes and explains appropriate facts, details, and examples for each of the key ideas.					
5. Elaborative verbal rehearsal includes and explains appropriate personal examples.					
6. Elaborative verbal rehearsal is organized, complete and makes sense.					
TOTAL					

Figure 1. The components of elaborative verbal rehearsal.

Table 1
Experiment 1: Summary Statistics and Correlation Matrix

Measure	1	2	3	4	5	6	Mdn
1. Overall exam performance	—	.77*	.97*	.96*	.17	.32*	24.00
2. Recognition performance		—	.63*	.76*	.09	.28*	17.00
3. Essay performance			—	.92*	.17	.28*	7.50
4. Elaborative verbal rehearsal				—	.23	.28*	14.00
5. Reported time on task					—	-.76*	10.00
6. Efficiency index						—	1.25
Mdn							—

Note. For overall exam performance, maximum = 40; for recognition performance, maximum = 20; for essay performance, maximum = 20; for elaborative verbal rehearsal, maximum = 30; efficiency index = elaborative verbal rehearsal divided by time.

* $p < .05$.

data are reported in Table 2. As indicated in Table 2, all six components describing the elaborative verbal rehearsal were significantly related to the subjects' overall exam performance and to each other. Those correlations ranged from .75 for the correlation between the subjects' overall performance and their score on the key ideas component to .91 for the correlation between the subjects' overall performance and their score on the personal examples and applications component. The intercorrelations among the components ranged from .62 for the relations between the generalization component and the key ideas component to .85 for the relation between the creative response component and the personal example or application component. All correlations were statistically significant.

To examine the predictability of performance from the components, we conducted a multiple regression analysis that was based on ranked data. Mean ranks were assigned to ties. Before interpreting the full model, we examined the residuals for influential data points using the Cook distance statistics. None of the values exceeded .163, and we concluded that there were no unusual data points in the distribution. Because the components were correlated, we checked multicollinearity to determine whether it was a problem. None of the variance inflation factors values exceeded 5.9. Hence, we concluded that collinearity did not seriously affect the regression analysis interpretation. The

results of the regression analyses indicated that, as a set, the six components predicted overall performance, $R^2 = .91$, $F(6, 57) = 94.63$, $p < .0001$.

To find a subset or subsets of components that would predict almost as well as all six components, we computed squared multiple correlations for all possible regressions. The overall completeness and organization component was the single best predictor, explaining 82.1% of the total variance in overall exam performance. Among the two-variable models, any one of four components (generalizations, creative responses, text examples, or personal examples) combined with the completeness and organization component explained between 86% and 87% of the variance in overall exam performance. Beyond these two-component models, the three-, four-, and five-component models explained additional variance that we considered trivial.

Discussion

The data from Experiment 1 suggested a strong and significant relation between the quality of the students' elaborative verbal rehearsals and their recognition, essay, and overall exam performance. The relation between the students' elaborative verbal rehearsal and their subsequent essay performance was stronger than the one between their rehearsal and recognition performance.

Table 2
Experiment 2: Summary and Intercorrelations for Six Components of Elaborative Verbal Rehearsal

Component ^a	1	2	3	4	5	6	Overall performance	Mdn
1. Generalization	—	.76 ^b	.62	.69	.80	.76	.83	2.00
2. Creative response		—	.76	.80	.85	.83	.88	1.00
3. Key ideas			—	.82	.73	.75	.75	3.85
4. Text examples and details				—	.84	.83	.86	3.00
5. Personal examples					—	.83	.91	2.00
6. Completeness and organization						—	.89	3.00
Overall performance							—	—
Mdn								—

Note. ^a All components have a maximum score of 5. ^b All correlations are significant at the .001 level.

The correlations between the subjects' exam performance and time on task were small and nonsignificant. When time and quality were both considered using an efficiency index, the correlations were significant but were only of medium strength (Cohen, 1988, p. 81). Stated in another way, less than 10% of the variance in the students' exam performance could be attributed to their efficiency index. Together, these data suggest that the total time students invested in developing and practicing the verbal rehearsal was not as important as the quality of the final product.

An analysis of the six individual components of the elaborative verbal rehearsal indicated that the sixth component, overall organization and completeness, was the single best predictor of the students' overall exam performance, accounting for 82% of the total variance. With this component, elaborative verbal rehearsals are judged on whether the subjects have merely reproduced the targeted text or have interacted with the text by using their own words and organization to explain ideas in a coherent manner (see Appendix C). If students' elaborative verbal rehearsals were complete and organized and included either creative responses, generalizations, text examples and details, or personal examples, an additional 4 to 5% of the variation on overall examination performance could be explained. Hence, it appears that these five components of the elaborative verbal rehearsal were important processes to these high-risk students who do not routinely elaborate when they read and study expository text.

It is difficult to compare the findings of Experiment 1 to other research studies because verbal rehearsal and the dependent measures used to determine the impact of rehearsal have been defined in such diverse ways. However, the research in which the relation between simple verbal rehearsals and recall is examined suggests similar trends (i.e., Muth, Glynn, Britton, & Graves, 1988).

Some individual components of the elaborative verbal rehearsal (i.e., generalizing and creating personal examples) emphasize processes similar to Pressley, McDaniel, Turnure, Wood, and Ahmad's (1987) elaborative interrogation strategy. Thus, comparisons and contrasts with this research seem to be warranted. For example, in their study of elaborative interrogation, Kaspar and Wood (1993) found a strong and significant correlation between high school students' generated elaborations (i.e., creating and answering "why" questions) and their subsequent recall. However, it should be noted that this strong and significant relation was for all students across different levels of academic achievement. Unlike in Experiment 1, in which there was a strong relation between elaborative rehearsal and performance for high-risk college students, Kaspar and Wood did not find a significant correlation for the low-achieving students in their study. One possible explanation for the difference in findings with low-achieving or high-risk students might originate from the nature of the two strategies and their elaborative processing options. Kaspar and Wood's students could only create and answer "why" questions, whereas the students in Experiment 1 could develop generalizations, creative reactions to the text, and personal examples and applications. These various options may have increased the

quality of the students' elaborative verbal rehearsals in Experiment 1.

Because the relations between the subjects' elaborative verbal rehearsals and recognition and essay performance were so strong and predictive of success, we conducted a more carefully controlled experiment to examine the impact of the processes involved in verbal rehearsal.

Experiment 2

We designed Experiment 2 to investigate whether the act of verbal rehearsal or the type of processing involved in the rehearsal affects subjects' exam performance. For the purposes of this experiment, two types of rehearsals were defined. As in Experiment 1, elaborative verbal rehearsals emphasized generalizations, creative reactions to text, personal examples and applications, key ideas, text examples, and details pertinent to the key ideas. In contrast, simple verbatim verbal rehearsals emphasized only key ideas and details stated verbatim from the text. Students were then trained to produce either a simple verbatim rehearsal or an elaborative verbal rehearsal. As in Experiment 1, an immediate recognition and essay exam was administered to determine whether there were any differences in performance between the students in the simple verbatim rehearsal condition and those in the elaborative verbal rehearsal condition.

In addition to an immediate posttest, an unannounced delayed posttest was also included because so few research studies have investigated the impact of learning strategies on long-term delayed measures (Lysynchuk, Pressley, d'Ailly, Smith, & Cake, 1989). We also wished to determine whether there would be a difference between the students in the simple verbatim rehearsal condition and those in the elaborative verbal rehearsal condition in the amount of forgetting that occurred between the immediate and the delayed posttests.

Method

Participants. The participants of this study were 50 high-risk college freshmen (23 men and 27 women) enrolled in several different sections of a learning strategies course. As in Experiment 1, all students were given a list of five options for an outside project. Fifty students chose to participate in this research study. The 50 subjects' average SAT-V score was 444, representing the 29th percentile.

All 50 students attended one hour of training across three consecutive weeks for a total of three hours of instruction. The students were randomly assigned to receiving either the elaborative verbal rehearsal condition or the simple verbatim condition and were also randomly assigned to a specific training time. There were 25 E students and 25 V subjects in each condition. Six different training times were held on two different days and were controlled so that the elaborative verbal rehearsal and simple verbatim condition training sessions were matched as closely as possible for time of day and day of week. Between seven and nine students were in each training session.

Before Experiment 2 began all students developed an initial elaborative verbal rehearsal that was scored with the procedures

from Experiment 1. The elaborative verbal rehearsal students' mean score was 11.76 out of 30 ($SD = 4.09$), whereas the simple verbatim rehearsal students' mean score was 13.56 ($SD = 3.56$). There was no significant difference between students in the two conditions on the initial criterion verbal rehearsal, $F(1, 48) = 2.69$, $p = .108$. This initial verbal rehearsal served as a covariate in the analyses.

Materials. The criterion text and exam for Experiment 2 were the same as those used Experiment 1. However, because this was a training study in which the students were involved in 3 hr of individual instruction during a scheduled session, we developed self-directed packets of materials for the elaborative verbal and simple verbatim students. Although the materials differed in the processes emphasized, they were otherwise similar for the elaborative verbal and simple verbatim students in that they included the following: (a) explanations and rationales for the elaborative verbal or simple verbatim rehearsal, (b) taped examples, (c) directions on how to construct either an elaborative verbal or simple verbatim rehearsal, (d) activities, and (e) process checks and quizzes.

The elaborative verbal and simple verbatim students also read and studied the same psychology chapter that served as the vehicle for the practice rehearsals and for subsequent quizzes. The chapter, *Remembering and Forgetting* (Wortman & Loftus, 1981), was one that all the students were required to read in their learning strategies course. There were two versions for each of the three multiple-choice and true-false quizzes covering the chapter; the elaborative verbal rehearsal students had 10 questions, 5 of which were higher level questions, and the simple verbatim rehearsal students had 10 memory-level questions. As with the criterion exam, the determination of the level associated with each quiz question was made by three professors who had written and pilot tested a pool of test questions over 3 years.

Procedure. All students individually completed five phases. In Phase 1 all students produced, before training, an initial verbal rehearsal on an excerpt from the same chapter used for the criterion verbal rehearsal and exam.

In Phase 2 the elaborative verbal and simple verbatim students participated in 3 hr of training, 1 hr per week for 3 weeks. Two of the researchers conducted each training session for all students. Each 60-min training session was divided into five parts, and students completed each task on an individual basis. First, the students completed activities in their packets concerning elaborative verbal or simple verbatim rehearsals. Second, they were assigned to construct either a simple verbatim or an elaborative verbal rehearsal that was based on part of the chapter titled *Remembering and Forgetting*. Third, students were individually taken out of the room to present their verbal rehearsal to one of the two researchers who, in turn, provided specific process feedback. For example, elaborative verbal students who omitted generalizations were assisted in creating ones. On the other hand, simple verbatim students who had not included all the important supporting details were assisted in finding them. When appropriate, misconceptions about content were clarified for both elaborative verbal and simple verbatim students. Fourth, students returned to the training session room to complete a quiz covering the content (i.e., *Remembering and Forgetting* chapter) for which they had just produced a verbal rehearsal. Finally, students individually reviewed the quiz once it had been graded.

For Phase 3 the elaborative verbal and the simple verbatim students read and studied the criterion text excerpt and prepared either a criterion simple verbatim or an elaborative rehearsal, depending on their training. For Phase 4, which occurred 2 days after Phase 3, each student attended a 60-min individual session that was similar to the individual session in Experiment 1. This

session lasted 60 min because the students did not have to complete a questionnaire and an interview about their reactions to the rehearsal strategy as the students in Experiment 1 had done.

Motivation was controlled in two ways. First, students who participated in all phases received full credit for their outside project, which counted as 10% of their course grade. In addition, students were promised a packet of unfinished strategy examples (i.e., skeletal maps, time lines, and charts) for the final in their learning strategies course if they could demonstrate that they had (a) read and studied the chapter (i.e., text markings), (b) constructed an appropriate criterion verbal rehearsal (i.e., an index card with their notes about their verbal rehearsal that was returned to the instructor, and (c) performed satisfactorily on the exam (i.e., answered all questions). All the randomly assigned students in both the elaborative verbal and the simple verbatim treatment conditions received full credit for their participation and the packet.

This packet did not provide the participants any privileged information about the final examination. Rather, the packet provided additional examples of strategies that all students, volunteers and nonvolunteers, had been taught during the learning strategies course. In future studies, we will probably include debriefing sessions for the nonvolunteers so that they may also see the additional strategy examples before the final examination.

Phase 5, a delayed and unannounced testing, occurred 1 week after Phase 4. The delayed, unannounced posttest was identical to the immediate posttest. The exam was administered during the students' learning strategy class. Students who had not participated in the study met with their professor in another room.

Scoring of rehearsals and recognition and essay items. Data were collected during Phases 1, 4, and 5. We used the 5-point Likert-type scale from Experiment 1. Using this scale, we each scored half of the verbal rehearsals without knowledge of whether they were from elaborative verbal or simple verbatim students or whether they were initial or criterion measures. Then, we randomly selected 30% of the verbal rehearsals to check for consistency in scoring; a Pearson product-moment correlation revealed an interrater reliability of .90.

As in Experiment 1, the recognition items were machine scored as being either right or wrong. The essay items were scored by the same two trained raters who participated in Experiment 1, using the same scoring rubric. There was 89% agreement on the total scores for these essays. Any essays with differences in the point totals were reread so that consensus was possible.

Data analysis. In Experiment 2 we used a two-group pretest-posttest-delayed posttest design. The pretest was the initial verbal rehearsal, and the posttest and delayed posttest were the 20 recognition items and the 2 essay items. The posttest and the delayed posttest were the same. The data were analyzed using analysis of covariance; effect sizes were computed using Wolf's (1986) formula, which involves finding the difference between the two groups' adjusted means and then dividing the difference by the pooled, unadjusted standard deviation.

Because a major ice storm occurred the day of the unannounced delayed testing, 9 elaborative verbal and 9 simple verbatim students were unable to attend class. The testing could not be rescheduled because it was the end of the quarter. Hence, the number of students for the delayed testing was 32 (16 elaborative verbal and 16 simple verbatim) rather than 50. Statistical tests were conducted to determine whether the 32 students present for the delayed testing were similar to the 18 absent students. The analysis revealed that the 18 students not able to attend during the delayed testing were not significantly different from the 32 students present on the initial criterion verbal rehearsal and the SAT-V scores (both

$F_s < 1$). A second analysis indicated that the 16 present elaborative verbal students were not significantly different from the 16 present simple verbatim students on the initial criterion verbal rehearsal and SAT-V scores (both $F_s < 1$). The results reported next are based on the 16 elaborative verbal and the 16 simple verbatim students who completed both the posttest and delayed posttest.

Results

The two groups' regression slopes were tested for equality on each of the 12 initial posttest measures. With the exception of the creative response component, there was no evidence of an interaction between the initial verbal rehearsal and the treatment (all $F_s < 1$). For the creative response component outcome, the interaction was significant at the .10 level, $F(1, 28) = 3.21, p = .084$. Because this was only 1 of 12 tests conducted, we decided to attribute this result to chance and to proceed with the analysis of covariance.

Table 3 presents the adjusted posttest means for the elaborative verbal and the simple verbatim subjects, F statistics, p values, and effect sizes (d s) for the posttest measures. For these data, the criterion verbal rehearsal and its six components are discussed first; then the subjects' initial and delayed posttest performances are presented.

Criterion verbal rehearsal. A very large and statistically significant effect in favor of elaborative verbal students ($F = 96.04, p < .0001, d = 3.4$) was observed for the overall criterion verbal rehearsal measure. Four of the six components of the elaborative verbal rehearsal were also

statistically significant at the .05 level. The effect sizes for these four components ranged from 0.8 to 5.3. The only two components that were not statistically significant were key ideas and overall organization and completeness.

Initial posttest performance. All of the indicators of exam performance were statistically significant at the .05 level, with the elaborative verbal students receiving higher scores than the simple verbatim students on all measures. The effect sizes ranged from 1.5 for the overall exam performance measure to 0.9 for the ten memory-level recognition items.

Delayed posttest performance. Table 3 presents the results for the five delayed, unannounced exam performance measures. There was no evidence of an interaction between the initial verbal rehearsal measure and the treatment for any of the outcomes (all $F_s < 1$). In the analyses of covariance, the elaborative verbal students had significantly ($p < .05$) higher scores than did the simple verbatim students on all measures except for the memory-level recognition items. The final column reports the effect sizes, which ranged from 0.5 for the memory-level recognition items to 1.0 for higher level recognition items. These results indicate that the differences were not only statistically significant but also of practical importance.

Amount of forgetting. Finally, we conducted an analysis to compare the amount of forgetting between the immediate and delayed tests for the elaborative and simple verbatim rehearsal students. Change scores were computed for each group. Because the initial verbal rehearsal was unrelated to the change score ($F < 1$), the initial verbal rehearsal was not

Table 3
Experiment 2: Summary Statistics and Treatment Effects for the Initial and Delayed Posttest Measures

Measures	M_E (Adj)	M_V (Adj)	F	p	d
Criterion EVR ^a	22.6	14.3	96.04	.001	3.4
Generalization ^b	3.0	1.2	53.92	.001	4.7
Creative	2.7	1.0	36.55	.001	2.1
Key ideas	4.8	4.4	2.94	.097	0.5
Text examples	4.6	3.9	5.29	.029	0.8
Examples	4.4	1.1	214.15	.001	5.3
Completeness	3.0	2.7	2.54	.122	0.5
Initial Posttest					
Overall ^c	28.1	21.0	18.80	.002	1.5
Recognition	16.4	13.8	14.36	.007	1.4
Memory ^d	8.9	7.9	4.88	.035	0.9
Higher level	7.5	5.9	10.34	.003	1.2
Essay	11.6	7.0	13.87	.001	1.3
Delayed					
Overall	22.8	17.6	5.95	.021	0.9
Recognition	14.7	12.8	4.55	.042	0.8
Memory	7.9	7.2	1.64	.210	0.5
Higher level	6.8	5.4	7.54	.010	1.0
Essay	8.9	4.7	5.42	.044	0.7

Note. M_E (Adj) = adjusted mean for EVR (elaborative verbal rehearsal) students; M_V (Adj) = adjusted mean for simple verbatim students.

^a Maximum score of EVR is 30. ^b Maximum score of each EVR component is 5. ^c Maximum score of overall exam performance is 40; recognition performance is 20; essay performance is 20. ^d Maximum score of memory recognition items is 10; maximum score of higher level recognition items is 10.

used as a covariate in this analysis. The mean change for the elaborative verbal students equaled 5.3 and the mean change for the simple verbatim students equaled 3.3. Both mean changes were statistically significant, $t(15) = 3.79$, $p < .002$, and $t(15) = 4.96$, $p < .001$, respectively. However, the difference in forgetting was not statistically significant, $F(1, 30) = 1.71$, $p = .201$. Thus, there was insufficient evidence to indicate that subjects in one treatment condition forgot more than did subjects in the other condition.

Supplementary analysis of essays. We conducted a supplementary analysis to determine whether the three components differentiating the elaborative students' verbal rehearsals from the simple verbatim students' rehearsals (see Table 3) would reappear in the essay answers for the initial and delayed testings. Because the first scoring of the essays used a rubric (see Appendix B) that emphasized only the inclusion of key ideas and explanations, a second scoring was necessary. In the second scoring we analyzed each essay written by the elaborative verbal and simple verbatim students for the number of times they included generalizations, creative responses to text, and personal examples in their essay answers. An overall total that represented a summing of the three components was computed for each elaborative verbal and simple verbatim student. The mean total for the elaborative verbal students on the initial posttest was 4.5 ($SD = 2.48$), whereas the mean total for the simple verbatim students was 1.31 ($SD = 1.49$). On the delayed posttest, the means were 1.94 ($SD = 1.57$) and .75 ($SD = .86$) for the elaborative verbal and the simple verbatim students, respectively.

To determine whether the observed differences between the elaborative verbal and the simple verbatim students were statistically significant, we conducted a 2 (groups) \times 2 (tests) mixed analysis of variance. The analysis indicated that the elaborative verbal students included significantly more instances of elaborative thinking about the targeted text in their initial posttest essays, $F(1, 30) = 14.05$, $p < .001$, and delayed posttest essays, $F(1, 30) = 10.65$, $p < .005$, than did the simple verbatim students. The interaction between treatment groups and time of measure was also significant, $F(1, 30) = 5.65$, $p < .05$, thus indicating a greater drop from initial posttest to delayed posttest in the use of the three elaborative components by the elaborative verbal students. This interaction may well have resulted from a floor effect among the simple verbatim students at both time periods.

Discussion

In Experiment 2, we investigated whether students trained to construct and produce elaborative verbal rehearsals performed any differently on a recognition and essay exam from students trained in the traditional conception of a verbal rehearsal (i.e., the repetition of key ideas and details stated in a verbatim fashion).

Initial verbal rehearsal performance. The elaborative verbal and simple verbatim students received less than 50% of the total points possible on the initial verbal rehearsals that preceded their training. This finding is consistent with previous research that has suggested that postsecondary

students do not spontaneously elaborate as completely as they should when they read and study text (Pressley et al., 1992).

Criterion verbal rehearsal performance. After receiving training the elaborative verbal students' criterion verbal rehearsals were significantly higher than the simple verbatim students' rehearsals. More specifically, the elaborative verbal students' criterion verbal rehearsals included more generalizations, creative responses to the text, text examples and details, and personal examples. The effect sizes for the elaborative components emphasizing generalizations, personal examples, and creative responses to text were especially strong.

These differences between the elaborative verbal and the simple verbatim students' verbal rehearsals should not be surprising because the training materials for the elaborative verbal students emphasized such elaborative processes, whereas the simple verbatim students' training materials emphasized only the importance of identifying and stating the key ideas and details of a text in a precise and complete manner. During the training, the simple verbatim students were not encouraged to restate, paraphrase, or transform the text's ideas into their own words. Hence, these findings reconfirm previous research studies that have emphasized the importance of intensive training as a means of facilitating strategic behavior in high-risk college students (Nist, Simpson, Olejnik, & Mealey, 1991; Simpson, Hayes, Stahl, Connor, & Weaver, 1988).

Recognition and essay performance. When the elaborative verbal and simple verbatim students' performance on the recognition items was compared, the elaborative verbal students outperformed the simple verbatim students on all outcomes that we examined. That is, the elaborative verbal students scored significantly higher on the recognition items and on the two essay questions on both the initial and the unannounced, delayed posttests. When the recognition items were analyzed as either memory-level or higher level questions, the 16 elaborative verbal students performed significantly better than did the simple verbatim students on the 10 higher level items on both test administrations. This effect, however, did not hold for the 10 memory-level items. Even though the elaborative verbal students scored significantly better on the memory-level items for the initial posttest, the associated effect size was smaller than all others. Moreover, there were no significant differences between the elaborative verbal and the simple verbatim students' performance on the memory-level items for the delayed testing.

Given the nature of the simple verbatim students' training, the foregoing makes sense. Because the simple verbatim students received training that focused on the importance of including key ideas and all supporting details in their verbal rehearsal, it is natural to assume that they would perform as well as the elaborative verbal students on exam items tapping memory for factual items. The simple verbatim students' scores on their criterion verbal rehearsal support this analysis in that there was no significant difference between the elaborative verbal and the simple verbatim students on the key ideas component.

The elaborative verbal students also outperformed the

simple verbatim students on the initial and delayed posttest essays. The elaborative verbal rehearsal students' significantly higher scores occurred when the essays were evaluated with a scoring rubric that emphasized the inclusion of pertinent key ideas and supporting details that answered the specified essay questions. Moreover, when the essays were scored a second time for the inclusion of generalizations, personal examples, and creative responses to the ideas contained in the targeted text excerpt, the elaborative verbal students again outperformed the simple verbatim students.

Overall, these findings are consistent with research in which simple verbatim verbal rehearsal was investigated with younger children who read short narrative selections (e.g., Gambrell, Koskinen, & Kapinus, 1985; Gambrell, Pfeiffer, & Wilson, 1985; Kapinus et al., 1987). The findings from Experiment 2 are also consistent with what Pressley et al. found in their research with elaborative interrogation. Generally, their research on elaborative interrogation with postsecondary students produced effect sizes similar to those obtained in Experiment 2 (Pressley et al., 1992).

Though the research findings on elaborative interrogation and elaborative verbal rehearsal are similar, two differences should be noted. First, no differences have been found between the elaborative interrogation strategy and rehearsal (i.e., repeating of the text) when the topics studied were unfamiliar (Kaspar & Wood, 1993). The topics in Experiments 1 and 2 originated from difficult expository text and were not familiar to the students. Second, the research findings on elaborative interrogation have been based primarily on cued-recall measures. In contrast, in Experiments 1 and 2 we used essay and recognition measures similar to those that the students would receive in a college testing situation.

The amount of forgetting. The results indicated that both the elaborative verbal and the simple verbatim students scored lower on the delayed posttest measures than they did on the immediate posttest measures. Moreover, there was insufficient evidence to indicate that the elaborative verbal students forgot more than did the simple verbatim students. It is difficult to compare this finding on forgetting with those of other studies on verbal rehearsal or elaboration because most designs have not included delayed testing, especially unannounced delayed testing. Gambrell, Pfeiffer, and Wilson (1985) investigated simple verbatim rehearsals (called retellings) and included delayed testing. In that study, the fourth graders who retold the important parts of a story did not experience significant forgetting on the 2-day delayed-recall testing. In contrast, the students participating in the alternative treatment (i.e., illustrating the story's important parts) did experience significant forgetting between testings. It is quite possible that retelling or simple verbatim rehearsal is a more potent strategy under these conditions, especially when compared with the strategy of drawing pictures.

In summary, the findings from Experiment 2 suggest that students trained to construct and include elaborations in their verbal rehearsals perform significantly better than similar students trained only to include verbatim text-based statements. It seems that the processing involved in the

elaborative verbal students' rehearsals makes a difference on recognition and essay tasks like those considered in this experiment.

General Discussion

Although these two experiments were exploratory in nature, one point seems certain: The high-risk college students from Experiments 1 and 2 who produced elaborative verbal rehearsals were the ones who performed in a superior fashion on the recognition and essay questions. In Experiment 1 the correlations between the quality of the students' elaborative verbal rehearsals and their exam performance were strong and statistically significant. In Experiment 2 almost every comparison favored the elaborative verbal rehearsal students, thus providing large effect sizes. The one comparison that did not favor the students trained to produce elaborative verbal rehearsals occurred on the delayed posttest's 10 memory-level recognition questions. On these 10 items the elaborative verbal rehearsal and the simple verbatim rehearsal students performed in a similar manner.

Wittrock's (1990) generative model of comprehension offers a plausible explanation as to why elaborative verbal rehearsals had the impact they did on students' cognitive performance. According to Wittrock, "generation is the fundamental cognitive process in comprehension" (pp. 348-349), which can result in assimilative learning or schema fitting and accommodative learning or the building of new schemata. Generation, one of four components in Wittrock's model, involves learners in actively building relations among the parts of the text and their own knowledge and experience. To become expert independent learners, students must reconstruct the text in familiar terms and relate personal examples and experiences to the text's message. Students trained to conduct elaborative verbal rehearsals in Experiment 2 were involved in generation when they constructed generalizations, personal examples, and creative responses to the theories presented in the targeted expository text.

Because these two experiments were the first to investigate elaborative verbal rehearsals, there appears to be a clear need for additional research on this independent learning strategy. In future studies researchers should examine the impact of elaborative verbal rehearsals on students' metacognitive processing. Interview data suggest that high-risk students see elaborative verbal rehearsals as advantageous because the strategy "helps you know when you know and know when you are lost." In addition, researchers might examine whether a reduced number of elaborative components, such as personal examples and generalizations, have the potency to influence students' recognition and essay performance. Finally, researchers might include a default treatment condition such as asking students to reread the text repeatedly. With such a proposed study, rereading could be compared with simple verbatim and elaborative verbal rehearsal, thus allowing a full assessment of the relative merits of rehearsal.

When designing any of these studies, researchers might also consider investigating the impact of elaborative verbal rehearsal on familiar and unfamiliar topics and different text

types (i.e., factual vs. theoretical). For these two experiments we chose to use ecologically valid text that was unfamiliar and theoretical. Pressley and his colleagues examined the issue of topic familiarity with their elaborative interrogation strategy, but the targeted texts have generally been constructed by the researchers. It is quite possible that simple verbatim verbal rehearsal is advantageous for high-risk students when studying familiar topics or when the content area lends itself to memory-level tasks.

Wittrock (1990), Pressley et al. (1990, 1992), and others consistently stressed the importance of developing and researching strategies that encourage students to use more elaborative processing. That need has yet to be fully addressed. However, these two experiments, which have investigated elaborative verbal rehearsal as an independent learning strategy, offer some promise for high-risk college students.

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Appendix A

Sample Recognition Questions Used in Experiments 1 and 2

Memory-Level Questions

3. What are the three components in the dimensions of meaning?
 - a. value, activity, evaluative
 - b. vocabulary, syntax, semantics
 - c. passivity, activity, vocabulary
 - d. evaluative, activity, potency*
12. The primary component of meaning in a word is evaluative. (False)

Higher Level Questions

4. An example of the reference process would be
 - a. seeing the word *alligator* and visualizing the object for that word.*
 - b. the ability to form associations for both concrete and abstract words.
 - c. stereotyping all dogs as friendly and all horses as mean.
 - d. using categories to abstract likenesses and differences.
13. Scientists usually rely on the denotative meaning of terms in their field of study. (True)

*Correct answer to the question.

Appendix B

Essay Scoring Rubric

Essay 1

Discuss the stimulus–response paradigm and the reference process as theories that attempt to explain how we learn the meaning of words. (Overall value is 10 points.)

- 3 points: Definition of stimulus–response paradigm and the components
- 1 point: Explanation that associations must occur over time
- 3 points: Definition of the reference process and components
- 1 point: Explanation that there is no connection between the referent and symbol
- 2 points: Explanation of the implications of these two theories that should include three of the following:
- a. These models are experienced based; hence, words can mean different things to different people
 - b. Time can change the meanings we associate with words
 - c. New experiences can also alter these meanings
 - d. It is easier to agree with other people on the meanings of concrete words

Essay 2

Discuss the dimensions of meaning and its relationship to the communication or the lack of communication among people. (Overall value is 10 points.)

- 4 points: Definition of the dimensions of meaning and the three components
- 1 point: One characteristic of these dimensions; any of the following would be appropriate:
- a. The evaluative component is the most predominant
 - b. These dimensions apply to words in all cultures
 - c. These dimensions are based on bipolar scales
- 2 points: Example and explanation of the dimensions of meaning
- 3 points: Implications for communication that should include three of the following:
- a. We should choose our words more carefully.
 - b. We need to be more sensitive to our audience if we wish to persuade them.
 - c. Our experiences determine our reactions to words, especially on the evaluative component.
 - d. If you wish to create positive reactions to your ideas, then choose words with positive evaluative components.

Appendix C

Elaborative Verbal Rehearsal Scoring Rubric

Generalization

- 1 = None
- 2 = Attempt, but more like a summary
- 3 = One (e.g., We learn the meaning of our words through experiences and associations, in which, in turn, give us dimensions to meanings.)
- 4 = Two
- 5 = Three or more

Personal Reaction or Opinion

- 1 = None
- 2 = Attempt, but is not explained (e.g., This stuff is ridiculous or very interesting.)
- 3 = One, and it is explained
- 4 = Two
- 5 = Three

(Appendix C continues on next page)

Key Ideas

(If ideas are stated in textbook's words, deduct 1 point.)

- 1 = One key idea explained
- 2 = Two key ideas explained
- 3 = Three key ideas explained
- 4 = Four key ideas explained
- 5 = Has five key ideas (meaning is arbitrary, meaning is learned by means of the stimulus-response, meaning is learning from the reference process, words have connotations and denotations, words have dimensions of meaning)

Supporting Facts, Details, Example

- 1 = Has textbook examples or details for only one key idea
- 2 = Has textbook examples or details for only two key ideas
- 3 = Has textbook examples or details for only three key ideas
- 4 = Has textbook examples or details for only four key ideas
- 5 = Has textbook examples or details for each of the five key ideas

Personal Example

- 1 = None
- 2 = Attempt, but is not explained or does not fit

- 3 = One example that fits and is explained
- 4 = Two examples
- 5 = Three examples

Organized, Complete, and Makes Sense

- 1 = Is text based, incomplete in key ideas and examples, occasionally makes no sense in explaining the theories, and usually is word for word from the book
- 2 = Is text based, incomplete, or occasionally makes no sense but not both of the last two
- 3 = Is text based, complete, and makes sense
- 4 = Text is reorganized by the learner, makes sense, and is complete
- 5 = A superior job—this is reserved for the talk through that has received 5s for three of these criteria (e.g., personal examples, generalizations)

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