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Effects of Repetition on Recall and Note-Taking: Strategies for Learning From Lectures

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Students tend to emphasize important information more than less important information in their notes and recall for a lecture. We investigated whether this strategy changes when the lecture is repeated. In Experiment 1, students viewed a lecture one, two, or three times and, without being allowed to review their notes, took a recall test. In Experiment 2, students took cumulative notes on a lecture that was presented one, two, or three times, and, following a review of their notes, took a recall test. In both experiments, the most important information was heavily represented in students' notes and did not increase greatly with additional presentations; less important information was not well represented in students' notes after one presentation but increased greatly on subsequent presentations. These results support the hypothesis that students actively assess and, if necessary, shift their learning strategy each time a lecture is repeated.

When students take notes on or recall a lecture, they tend to emphasize highly important information more than less important information. This "levels effect" in students' note-taking (Kiewra, 1985) and recall (Brown & Smiley, 1977; Meyer, 1975) suggests that students use a learning strategy of focusing their attention on the highest-level information in a lecture. What happens to this learning strategy when the lecture is repeated? What do students get out of extra exposures to a lecture? We address these questions in the present studies.

Mayer (1983) and Bromage and Mayer (1986) have identified two possible effects of repetition on learning from prose: quantitative and qualitative. The quantitative hypothesis predicts (a) that repetition allows the learner to add more information to memory while maintaining the same learning strategy across presentations and (b) that the number of times a lecture is presented is positively related to the overall amount of information a learner will recall and have in his or her notes, with equivalent increases for each level of information. The qualitative hypothesis predicts (a) that repetition allows the reader to adjust his or her learning strategy so that he or she can focus on different aspects of the lecture during each successive presentation and (b) that there will be evidence of shifts in learning strategies, namely, the pattern of recall and note-taking content will differ across presentations. In particular, students may focus on the highest-level information during the first presentation. If they have reached a ceiling on processing of the highest information, they may shift more attention to lower levels on subsequent presentations; however, if they have not reached a ceiling, they may continue to focus attention on the highest-level information during the next presentation.

Previous studies have provided evidence for the qualitative hypothesis (Bromage & Mayer, 1986; Mayer, 1983). We replicate and extend these results in the present studies by using a classroom setting rather than a laboratory setting and by including a note-taking measure in addition to a recall measure.

Experiment 1

In Experiment 1, students viewed the videotaped lecture one, two, or three times and either took notes or were forbidden from note-taking. These manipulations allowed us to see how repetition affects note-taking and how repetition and note-taking affect recall.

Method

Subjects and design. Twenty-four college undergraduates served in the one-presentation group, 24 served in the two-presentation group, and 23 served in the three-presentation group. Twelve subjects in each group were required to take notes, and the rest were not allowed to take notes.

Materials and apparatus. The materials consisted of an 8-min, 900-word videotaped lecture on how exposure meters work adapted from Bromage and Mayer (1986) and a recall sheet that asked students to write down "as much as you can from the lecture." The apparatus consisted of two 19-in. color television monitors and a videotape player in each classroom.

Procedure. On the basis of random assignment, students in classrooms viewed the videotape one, two, or three times, and were either required or not allowed to take notes. Students did not know in advance how many times the videotape would be presented, and students' notes were collected immediately after each presentation. Following the final presentation, students were given 8 min to complete the recall sheet.

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Results and Discussion

Scoring. The passage was decomposed into 9 Level 1 idea units that represented the superordinate information, 98 Level 2 idea units that modified the Level 1 idea units, and 24 Level 3 idea units that modified the Level 2 idea units. Following Bromage and Mayer (1986), we tallied the number of Level 1, Level 2, and Level 3 idea units in each recall protocol and each note-taking protocol for each student. Because note-taking did not affect recall performance, results have been collapsed across note-taking and non–note-taking treatments.

Quantitative and qualitative effects of repetition on recall. Figure 1 shows the proportion of Level 1, Level 2, and Level 3 idea units recalled by students who viewed the lecture one, two, or three times. As expected, there was a quantitative effect in which the number of presentations strongly affected the overall amount recalled, $F(2, 143) = 10.32$, $MS_e = 51.65$, $p < .001$. Consistent with previous research by Bromage and Mayer (1986), there was also evidence for a qualitative effect: There was a levels effect in which recall was strongly influenced by the level of the idea unit, $F(2, 292) = 267.88$, $MS_e = 107.95$, $p < .001$, and there was a Levels × Presentations interaction, $F(2, 292) = 2.82$, $MS_e = 107.95$, $p < .03$, in which the strength of the levels effect depended on the number of presentations with the strongest effect for three presentations. These results indicate that students did not master the highest-level information during the first presentation; instead, recall increased for all levels of information with additional presentations.

Quantitative and qualitative effects of repetition on notes. Figure 2 shows the proportion of Level 1, Level 2, and Level 3 idea units in the notes of note-taking students who viewed the lecture one, two, or three times. As expected, there was a quantitative effect in which the number of presentations strongly affected the overall amount of idea units in students' notes, $F(2, 68) = 4.38$, $MS_e = 165.04$, $p < .02$. There was only partial evidence for a qualitative effect: There was a levels effect in which the probability that an idea unit would be noted depended strongly on the level of the idea unit, $F(2, 134) = 315.32$, $MS_e = 144.79$, $p < .001$; however, the Levels × Number of Presentations interaction failed to reach significance, $F(4, 134) = 1.18$, $MS_e = 144.79$, *ns*. Although the interaction was not significant, one-way analyses of variance (ANOVAs) revealed that only the number of Level 2 idea units in notes was positively affected by the number of presentations, $F(2, 68) = 4.85$, $MS_e = 99.67$, $p < .02$. Presumably, students had reached a ceiling on noting Level 1 ideas, so additional presentations allowed students to focus on the next lowest level of information.

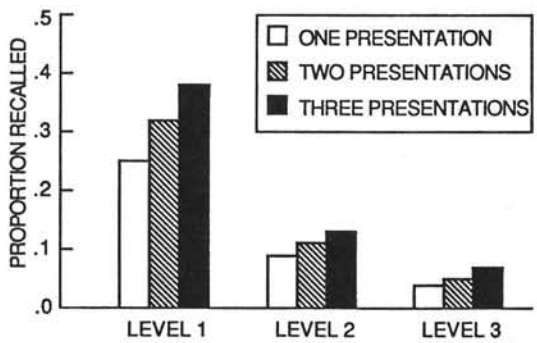

Figure 1. Proportions of Level 1, Level 2, and Level 3 idea units recalled after one, two, and three presentations: Experiment 1.

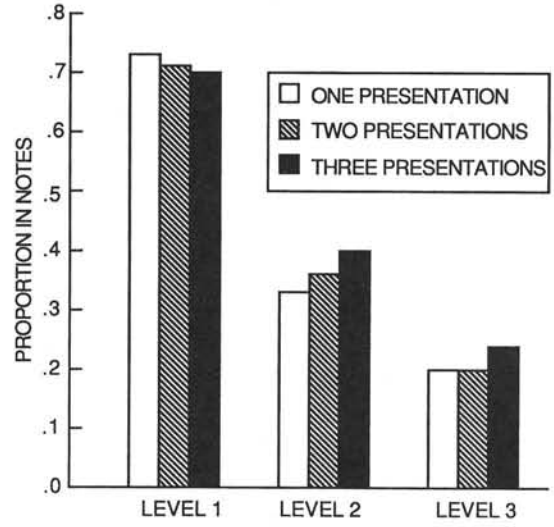

Figure 2. Proportions of Level 1, Level 2, and Level 3 idea units in students' notes after one, two, and three presentations: Experiment 1.

Experiment 2

In Experiment 1, students generally did not master the highest-level information during the first presentation. To help students in Experiment 2 to master the highest-level information with one presentation, they were permitted to review their notes and told so in advance of note-taking. Anticipation of a review period was expected to increase note-taking; reviewing notes was expected to improve recall (Kiewra, 1985). In order to facilitate the process of note-taking—particularly for lower-level information—students viewing the lecture more than once were asked to record cumulative notes rather than begin a new set of notes upon each presentation.

Method

Subjects and design. Twenty college undergraduates from the same subject pool as Experiment 1 served in the one-presentation group, 21 served in the two-presentation group, and 19 served in the three-presentation group.

Materials and apparatus. The materials and apparatus were identical to those used in Experiment 1.

Procedure. The procedure was identical to Experiment 1, except all students were required to take notes. Students added to their existing notes with a different colored pen for each presentation rather than taking unique notes on each presentation. Students were told in advance how many times the videotape would be presented and were given 15 min to review their notes prior to the recall test.

Results and Discussion

Scoring. Recall tests and notes were scored in the identical manner used in Experiment 1.

Quantitative and qualitative effects of repetition on recall. Figure 3 shows the proportion of Level 1, Level 2, and Level 3 idea units recalled by students who viewed the lecture one, two, or three times. In contrast to Experiment 1, there was no evidence of a quantitative effect: The number of presentations did not positively affect the overall amount recalled, $F(2, 57) = 1.15$, $MS_e = .02$, *ns*. Also in contrast to Experiment 1, there was only partial evidence for a qualitative effect: There was a levels effect in which recall was strongly influenced by the level of the idea unit, $F(2, 114) = 398.74$, $MS_e = 3.13$, $p < .001$, however, there was not a Levels × Presentations interaction in which the strength of the levels effect depended on the number of presentations, $F(4, 114) = .66$, $MS_e = .01$, *ns*. One-way ANOVAs, however, revealed that recall of Level 2 idea units, $F(2, 57) = 2.52$, $MS_e = 46.32$, $p < .090$, and Level 3 idea units, $F(2, 57) = 6.02$, $MS_e = 1.52$, $p < .005$, was positively affected by the number of presentations. Apparently, students reached a recall ceiling for Level 1 idea units after one presentation, so additional presentations mainly affected the next lower levels.

Quantitative and qualitative effects of repetition on notes. Figure 4 shows the proportion of Level 1, Level 2, and Level 3 idea units in the notes of students who viewed the lecture one, two, or three times. As expected, there was a quantitative effect in which the number of presentations strongly affected the overall amount of idea units in students' notes, $F(2, 57) = 12.01$, $MS_e = .38$, $p < .001$. There was also evidence for a qualitative effect: There was a levels effect in which the probability that an idea unit would be noted depended strongly on the level of the idea unit, $F(2, 114) = 322.78$, $MS_e = 3.97$, $p < .001$, and there was a Levels × Presentations interaction, $F(4, 114) = 2.90$, $MS_e = .04$, $p < .026$, in which the strength of the levels effect depended on the number of presentations with the strongest effects for one presentation. As in Experiment 1, students had reached a ceiling on noting Level 1 ideas, so additional presentations allowed students to focus on the next lowest levels of information.

Supplemental Study

A supplemental study was conducted to assess the idea that students who are given free access to viewing the lecture would use extra study time to fill in deficiencies at progressively lower levels of information.

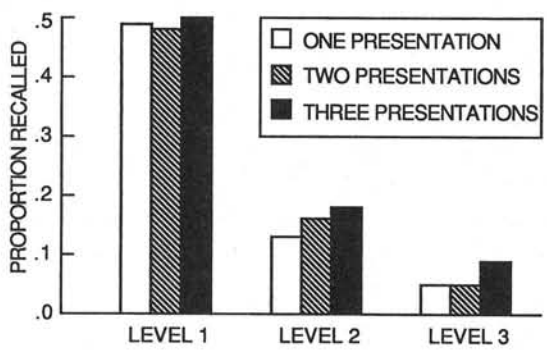

Figure 3. Proportions of Level 1, Level 2, and Level 3 idea units recalled after one, two, and three presentations: Experiment 2.

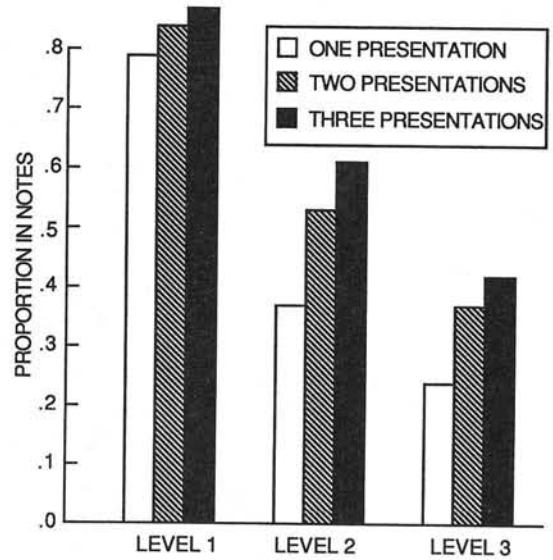

Figure 4. Proportions of Level 1, Level 2, and Level 3 idea units in students' notes after one, two, and three presentations: Experiment 2.

Method

Subjects and design. The subjects were 18 college students from the same subject pool as Experiments 1 and 2.

Materials and apparatus. Materials and apparatus were identical to those used in Experiments 1 and 2.

Procedure. Subjects participated individually in a small laboratory room with a television monitor and videotape player. After instruction and practice in using the remote control to stop, rewind, and fast forward the videotape, students were told they could watch the lecture videotape in any manner and for however long they desired. Like the subjects in Experiment 2, they were instructed to take notes and were allowed to review their notes for 15 min prior to the recall test.

Results and Discussion

Scoring was identical to Experiments 1 and 2. The mean study time of 43 min was significantly longer than the 24 min allowed for the three-presentation group in Experiment 2, $t(35) = 4.91$, $p < .05$; however, the mean time spent viewing the videotape (25 min) did not differ significantly from the 24 min allowed for the three-presentation group in Experiment 2, $t(35) = 0.69$, *ns*. The proportions of Level 1, Level 2, and Level 3 idea units recalled were .49, .20, and .07, respectively. This pattern did not differ significantly from that obtained for the three-presentation group in Experiment 2, $F(2, 70) = 0.28$, $MS_e = .004$, *ns*. The proportions of Level 1, Level 2, and Level 3 idea units in students' notes were .85, .65, and .56, respectively. This pattern did differ significantly from that of the three-presentation group in Experiment 2, $F(2, 70) = 4.00$, $MS_e = .065$, $p < .023$. Those viewing the lecture on their own recorded a similar number of Level 1 and Level 2 idea units in notes but recorded more Level 3

Table 1
Slope of Linear Regression Line for Each Level of Idea Unit

Data source	Level of idea unit		
	Level 1	Level 2	Level 3
Experiment 1			
Recall	6.5[a]	2.0	2.0
Notes	−1.5	3.5[a]	2.5
Experiment 2			
Recall	0.5	2.5[a]	2.5[a]
Notes	4.0	12.0[a]	8.5

[a] Greatest slope.

ideas than those viewing the lecture three times. These results reveal that free viewing did not lead to greater recall but did increase both study time and the recording of subordinate idea units in notes. We interpret these results to mean that subjects free to learn on their own are both strategic and motivated. They continue to work with the material until they capture a relatively high percentage of detailed information in their notes. We expect that allowing students an unlimited amount of time to then review their notes would particularly benefit those who view the lecture freely.

Conclusion

Consistent with the qualitative hypothesis, these results portray our students as strategic learners who reassess their processing strategy on each successive presentation of the lecture. Their strategy can best be described as *successive differentiation*: First, they focus on the top-level information; then, when a ceiling is reached, they shift attention to the next level of information, and so on. In our studies, the ceiling seems to be about 50% for recall and 70% to 80% for note-taking; that is, when a student can recall about 50% or has taken notes on about 70% to 80% of the Level 1 information, the student can shift attention to lower-level information on successive presentations of the lecture.

In order to investigate the successive differentiation strategy in more detail, we fit individual regression lines to the recall and note-taking data by idea unit for one, two, and three presentations. Table 1 summarizes the slope of regression lines. In Experiment 1 the greatest growth in recall across presentations was for Level 1 information, whereas in Experiment 2 the greatest recall growth was in Level 2 and Level 3 information. This pattern is consistent with the premise that Level 1 information did not reach its ceiling in Experiment 1, whereas a ceiling was reached for Level 1 information after one presentation in Experiment 2. Apparently, a recall ceiling of about 50% for Level 1 information represents a limit in which the marginal utility of additional presentations disappears.

In both Experiments 1 and 2, the greatest growth in note-taking across presentations was for Level 2 information. This pattern is consistent with the premise that Level 1 information reached its ceiling after one presentation in Experiments 1 and 2, so that additional presentations allowed students to shift their additional note-taking to the next lowest level of information. Because students could review their notes prior to taking the recall test in Experiment 2, their increasingly detailed notes allowed students in Experiment 2 who received multiple presentations to show improvements in recall of Level 2 and Level 3 information. Apparently, students continue to shift their additional note-taking to the next lowest level of information, as evidenced by the increase of Level 3 idea units in the notes of free-viewing subjects. The benefits of such detailed note-taking, however, may not be fully realized unless students receive sufficient time or training for review.

These findings extend previous results (Bromage & Mayer, 1986; Mayer, 1983) by suggesting that students can shift their learning strategies on each successive presentation of a lecture. This orderly progression is consistent with the idea that students are active learners who have some metacognitive control over their learning strategies. These findings extend the qualitative hypothesis to include the idea that repetition enables reassessment and, if necessary, shifts in students' selective attention to lecture information.

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