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Improving Students' Study Habits by Demonstrating the Mnemonic Benefits of Semantic Processing

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This article describes an in-class exercise that illustrates the advantage of semantic over nonsemantic study habits. The exercise includes a survey of students' current study strategies, followed by the presentation of an abbreviated version of Craik and Tulving's (1975) classic levels-of-processing experiment. We observed significant benefits of semantic processing over nonsemantic processing, and this result motivated an in-depth discussion regarding the limitations of students' intuitions about effective study strategies and methods for improving current strategies. The brief exercise changed students' intended strategies for future studying and helped students learn the concept of semantic processing.

Students often have misconceptions about the best strategies for committing information to memory. Informal surveys in our courses show that students try to memorize facts by repeating them over and over again and learn textbook information by reading the text multiple times. The memory literature shows that rote repetition is not particularly effective, however, especially relative to strategies that involve semantic or elaborative processing of information (Callender & McDaniel, 2007a; Craik & Watkins, 1973). The mnemonic benefit of semantic processing is, perhaps, one of the most widely held notions to come out of the memory literature. Nonetheless, students frequently persist in using a rote repetition strategy.

This exercise illustrates the robust mnemonic advantage of semantic over nonsemantic processing and encourages students to consider the implications of this advantage for their study habits. We based the exercise on an abbreviated form of Craik and Tulving's (1975) classic levels-of-processing experiment demonstrating the benefit of semantic processing, presented in the context of an interactive discussion of students' study habits. During the exercise, students reveal their beliefs that rote repetition is an effective study method, only to have that intuition challenged by subsequent demonstration and discussion.

Although similar exercises appear in textbooks (e.g., Francis, Neath, Mackewn, & Goldthwaithe, 2004; Neath, 1998) and in this journal (Chaffin & Herrmann, 1983), our exercise is more extensive in providing a framework for the levels-of-processing experiment, surveying students about their study habits, providing data to support key arguments, offering discussion questions, and encouraging students to consider the implications for their studying.

Method

Participants and Procedure

Undergraduates in an experimental methods course ($n = 51$) participated in the exercise. We modeled the exercise after Craik and Tulving's (1975) classic depth-of-processing experiment and presented it using

Microsoft PowerPoint. Students viewed 18 words on an overhead screen one at a time for 2 sec each. Prior to the presentation of each word, an orienting question appeared, encouraging students to process particular characteristics of the word. For six words, we presented an orthographic orienting question (e.g., "Is it typed in capital letters?"); for six words, a phonological orienting question (e.g., "Does it rhyme with 'shock'?"); and for six words, a semantic orienting question (e.g., "Does it fit in the sentence 'The ___ was building a nest'?"). We randomly intermixed the orienting questions and presented them for 3 sec each. Students answered each question by writing "yes" or "no" on an answer sheet numbered 1 to 18. We did not inform students that we would give them a memory test for the words.

After the instructor presented the words, she asked students to describe the different types of questions given and consider why they were included. This short discussion (2–3 min) served as an intervening activity. On the subsequent surprise free recall test, the instructor gave students 60 sec to recall the words on an answer sheet. Students subsequently scored their recall responses for each type of orienting question. The collection and scoring of data took approximately 7 min.

The instructor then asked students to reveal the pattern of results in their data by raising their hand to indicate which of the three conditions produced the highest and lowest levels of recall. Students readily determined the relative order of recall performance with the semantic processing condition leading to better recall than either the phonological or orthographic processing conditions.[1] Next, the instructor led the class in the discussion and interpretation of the results. The instructor highlighted the findings of Craik and Watkins (1973) and Craik and Tulving (1975) showing that successful remembering is better achieved through the use of semantic study strategies rather than phonologically based or rote repetition strategies. Students then considered the implications of the exercise, discussing study strategies suggested by the research literature and the in-class exercise. Students proposed ideas such as relating information to existing knowledge, making material personally relevant, and thinking more deeply about a topic by generating examples and applications.

Table 1. Sample Multiple-Choice Question

Rhonda just received a new banking card with a PIN number that she needs to remember to access her checking account. She is trying to devise a strategy for remembering the PIN number. Which of the following would you recommend?

a. Try to remember the way the numbers look, like whether they are more circular (like a 0) or more straight edged (like a 4)
b. Make up a rhyme that includes the numbers and try to recall the rhyme when you are at the ATM
c. Relate the numbers to something of personal relevance like the jersey numbers of your favorite sports stars
d. I would recommend any of the above because they are equally likely to help her remember the PIN number

Before and after the exercise, students used a 5-point Likert scale ranging from 1 (*not at all effective*) to 5 (*very effective*) to rate the effectiveness of two study strategies: reading and rereading information versus relating information to oneself. Before the exercise, students reported the strategy they used to study for the previous exam in the course. After the exercise, students indicated the strategy they intended to use in preparing for the next exam. Options included repeating the material over and over again, reading and rereading the material, thinking about the meaning of the material, and applying the information to one's personal experiences. We permitted students to describe a strategy that was not one of the aforementioned choices, and we classified the provided strategies as semantic or nonsemantic (e.g., rote repetition). If a student indicated use of both types, we classified the strategy as semantic. Finally, to assess students' ability to apply semantic processing to real-world learning and memory situations, we administered the same four multiple-choice questions before and after the exercise (see Table 1).

Results and Discussion

We conducted a 2 × 2 repeated measures ANOVA for the effectiveness ratings with type of study strategy (reading and rereading vs. relating to oneself) and time (pre- vs. postexercise) as factors. Most critically, the two-way interaction was significant, $F(1, 50) = 42.31$, $p < .001$, partial $\eta^2 = .46$. Prior to the exercise, students rated reading and rereading information ($M = 3.88$) to be as effective as relating information to oneself ($M = 3.76$) as a study strategy. After the

[1]The recall advantage for semantic over nonsemantic processing is readily observed in students' show of hands. Thus, a formal statistical analysis of students' recall performance is not necessary during the exercise. For completeness, however, we note that the one-way ANOVA revealed significantly better recall for semantic than phonological or orthographic processing, $F(2, 100) = 88.44$, $p < .001$.

exercise, students rated relating information to oneself ($M = 4.31$) as significantly more effective than reading and rereading information ($M = 3.25$), $t(50) = -4.79$, $p < .001$, $d = 1.05$. Before the exercise, only 14% of students reported using a semantic study strategy in preparing for their most recent exam. Following the exercise, 68% said they would use a semantic strategy for the next exam. Finally, students answered significantly more multiple-choice questions correctly after the exercise ($M = 82\%$) than before the exercise ($M = 49\%$), $t(50) = -7.75$, $p < .001$, $d = 1.27$.

These results converge on the conclusion that the exercise improved students' understanding of components yielding effective memory and study strategies. Moreover, the exercise was effective in changing students' reports of their intentions for future studying. If students' actual behaviors followed these intentions, then the exercise could enhance the effectiveness of students' study activities. Students report rereading as a preferred study method in this study (see also Karpicke, 2007), yet such a strategy appears to be minimally effective for improving retention and learning (Callender & McDaniel, 2007b). The vehicle for changing studying intentions included a discussion of the shortcomings of commonly used learning and memory strategies, as well as alternative strategies students might use to take advantage of depth-of-processing effects. This discussion was motivated by students' participation in an abbreviated levels-of-processing study replicating Craik and Tulving's (1975) finding of better memory for semantic than nonsemantic processing and completion of a class survey regarding study strategies.

One limitation is that we assessed students' learning and intentions immediately following the exercise, and we did not assess actual changes in strategy use. Nonetheless, the data do show that the brief and easily implemented exercise was effective for informing students about useful study strategies, convincing students of the need to improve their study habits, and for the initial learning of fundamental concepts from the memory literature.

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Notes

1. The file for the abbreviated levels-of-processing experiment is available on the Internet at http://lamar.colostate.edu/~delosh/downloads.htm. This file was designed for use with Microsoft PowerPoint, versions 97 and later, on either Windows or Macintosh platforms. You can also present this experiment using Microsoft's free PowerPoint Viewer, which is available at the same location or from Microsoft's Web page (http:/www.microsoft.com).
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