

Using the Four-Questions Technique to Enhance Learning

Beth Dietz-Uhler
Miami University

Jason R. Lanter
Kutztown University

To assess the effect of a 4-question reflective learning technique on quiz performance, students engaged in an interactive activity, responded to 4 questions to encourage analyzing (i.e., what was learned), reflecting (i.e., why it is important), relating (i.e., how the material related to their personal lives), and generating (i.e., what questions they now have about the material), and took a quiz on the studied material. Quiz performance was better for students who responded to the 4 questions prior to the quiz than for those who did so after the quiz. Students also perceived the 4-question technique to be enjoyable and successful in meeting its objectives. We discuss how this simple technique effectively promotes students' understanding and memory.

Active learning is effective in improving students' learning (e.g., Angelo & Cross, 1993; Bonwell & Eison, 1991; Yoder & Hochevar, 2005) because it encourages students to think more deeply about the material. There are a number of ways to promote deeper thinking. One such way is reflection, wherein students spend time thinking about the material. Cognitive psychologists have shown, for example, that more meaningful processing of information results in better memory of that information (e.g., Craik & Lockhart, 1972). Processing information in an elaborative manner leads to better memory than processing information at a superficial level (DeRosa, 1988; Hyde & Jenkins, 1969; Kolers, 1979). Another way to promote deeper thinking is by relating the material to one's personal life, which requires students to process information more deeply. When students apply course material to their

own lives, they tend to remember the information better (e.g., Roediger, Gallo, & Geraci, 2002). A third way to promote deeper thinking is questioning, whereby students generate a question they still have about the material, thus encouraging deeper processing of the material. Carroll (2001) found that students reported favorable attitudes toward having to generate questions about course content. In a review of the cognitive psychology literature, Anderson (1978) found strong support for the role of question generation in improving memory.

Whereas prior research has shown that various forms of active learning promote retention, we did not find a single technique that incorporated multiple forms of active learning. To fill this gap, we designed a four-questions technique that encourages students to analyze, reflect, relate, and question the material they are studying. We designed a form for students to complete about the studied material. The form included four questions (see Method section for exact questions) that required students to analyze the material, reflect on it, relate it to some aspect of their personal lives, and generate at least one question about it that was unanswered by the activity. This four-questions technique is generic and can be adapted to many topics. The purpose of this study was to assess the effectiveness of the four-questions technique. Based on prior research, we hypothesized that responding to the four questions would lead to better learning (as defined by performance on multiple-choice comprehension questions) than would simply engaging in the learning activity alone.

Method

Participants

Participants were 107 students (37 men, 70 women) in an introductory psychology course who completed the experiment for research participation credit. Most (53%) of the participants were first-year students; 11% were second year, 34% were third year, and 2% were fourth year. The mean age was 19.16 ($SD = 2.86$).

Procedure

The design of the study was a 2 (order: four questions before quiz, four questions after quiz) \times 2 (activity topic: self-enhancement bias, prisoner's dilemma) between-participant design. We randomly assigned participants to one of the four conditions: questions first/self-enhancement ($n = 27$); questions first/prisoner's dilemma ($n = 23$); quiz first/self-enhancement ($n = 28$); or quiz first/prisoner's dilemma condition ($n = 29$). The study was online.

Participants completed a Web-based, interactive activity about either the prisoner's dilemma or the self-enhancement bias. The prisoner's dilemma activity involved a scenario in which participants and their partners were arrested for a robbery. Participants, without knowing what their partners would say, decided whether to cooperate (make the same choice as their partners) or defect (make a different choice than their partners). Participants received feedback about the outcome of their decisions. In the self-enhancement bias activity, participants indicated their level of concern relative to other people on such issues as environmental awareness and animal protection. Participants received feedback about their stated level of concern relative to other participants, typically showing that people exaggerated their own level of concern. Both topics are typically covered at the end of introductory psychology courses, so students would most likely be unfamiliar with them. We used two topics rather than one to test whether the four-questions activity would be equally effective in promoting learning across multiple topics. After completing the interactive activity, half of the participants took a quiz about the topic and then responded to four questions about it, whereas the other half responded to four questions about the activity and then took a quiz.

The quiz for the self-enhancement bias activity included four multiple-choice questions (e.g., The activity infers that people tend to rate themselves _____ on

abilities, beliefs, values, and attitudes: (a) below average, (b) average, (c) above average, (d) none of the above), each designed to test whether participants understood the self-enhancement bias. The quiz for the prisoner's dilemma activity included three multiple-choice questions (e.g., This activity indicates that the key to success in the game is: (a) competition, (b) cooperation, (c) addressing physiological needs, (d) self-actualization) designed to test participants' understanding of the prisoner's dilemma. Students were able to review the activities and feedback provided by the activity before completing the quiz. We standardized scores on the quiz by computing the percentage of correct responses.

For the four-questions technique, the first question (Identify one important concept, research finding, theory, or idea in psychology that you learned while completing this activity) encouraged analysis of the material. The second question (Why do you believe that this concept, research finding, theory, or idea in psychology is important?) encouraged students to reflect on the activity. The third question (Apply what you have learned from this activity to some aspect of your life) encouraged students to relate the material to their personal lives. We requested responses of at least 100 words for these three questions.¹ The fourth question (What question(s) has the activity raised for you? What are you still wondering about?) encouraged students to question the knowledge they gained as a result of the activity. We instructed students not to state that they did not have any questions.

After completing the interactive activity, the four questions, and the quiz, students responded to items relating to perceptions of the four-questions technique, learning, and memory. First, they indicated whether the four-questions activity was successful in meeting the goals of thinking more deeply about the material, encouraging reflection on the psychological concept illustrated in the activity, encouraging relating the material to one's personal life, and encouraging questions about the material, using a 7-point scale ranging from 1 (*not very successful*) to 7 (*very successful*). We combined these items to create an overall score for meeting goals ($\alpha = .78$). Second, students provided perceptions of learning by indicating their level of agreement with five statements that focused on whether they learned a lot from having to respond to the four questions

¹The actual mean word count for Questions 1, 2, and 3 ranged from 52 to 80 words, with an overall $M = 65.12$ ($SD = 35.93$). Although the average word count was less than what we asked of participants, we did not discard any data.

(stating what they learned, indicating why what they learned was important, thinking about how the material related to their personal lives, and thinking about a question they still had about the activity), using a scale of 1 (*strongly disagree*) to 7 (*strongly agree*). These items were combined to create an overall score for perceptions of learning ($\alpha = .90$). Third, students indicated their level of agreement with items about the effectiveness of the activity in helping them remember the material, understanding the material better, enjoyment of the activity, and desire to respond to the four questions in the future, using a scale of 1 (*strongly disagree*) to 7 (*strongly agree*). These items were combined to create an overall score for memory and enjoyment ($\alpha = .82$). Finally, participants indicated their gender, year in school, and age. All participants received information about the purpose of the study, where to find information about active learning, and how to contact the experimenters.

Results

To test our primary hypothesis that students who completed the four questions prior to the quiz would perform better on the quiz than students who took the quiz before answering the four questions, we conducted a 2 (topic: prisoner's dilemma or self-enhancement) \times 2 (order: four questions before quiz or after quiz) ANOVA with quiz scores as the dependent variable. Results showed that when participants answered the four questions before the quiz, their quiz scores ($M = 74.00\%$, $SD = 25.48\%$) were significantly higher than when they answered the four questions after the quiz ($M = 59.18\%$, $SD = 29.69\%$), $F(1, 102) = 7.42$, $p < .01$, partial eta-squared = .086. These results suggest that the four-questions technique enhances learning. Further, the moderate effect size suggests that this result is reasonably robust. The main effect of topic and the interaction effect were not significant, $ps > .05$.

To examine whether the four-questions activity met its goals, was considered to be a valuable learning tool, and improved memory for the material, we conducted a 2 (topic: prisoner's dilemma or self-enhancement) \times 2 (order: four questions before quiz or after quiz) MANOVA with each of the scores as dependent variables. The main effects of topic and order and the interaction effect were not significant, $ps > .05$. Therefore, we collapsed across order and topic and conducted one-sample t tests using the midpoint (4.0) of the scale as the test statistic. Results showed that participants

perceived the activity to be successful in meeting its goals ($M = 4.65$, $SD = 1.06$), $t(97) = 6.03$, $p < .01$, $d = 1.22$, and in improving memory and enjoyment ($M = 4.29$, $SD = 1.67$), $t(104) = 2.54$, $p < .05$, $d = .50$. The effect sizes for these analyses indicate a large effect for success in meeting its goal and a moderate effect for improving memory and enjoyment. The mean for perceptions of learning ($M = 4.20$, $SD = 1.28$) was not significantly higher than the scale's midpoint.

Discussion

The purpose of this study was to test the hypothesis that a technique that incorporated analyzing, reflecting, relating, and questioning material would promote learning. Results showed that when students completed the four questions prior to the quiz, their performance on the quiz was significantly better than when students completed the four questions after the quiz. Results suggest that when students spend time thinking and elaborating on the material in multiple ways, their performance on comprehension tests improves, consistent with prior research (e.g., Anderson, 1978; Carroll, 2001; DeRosa, 1988; Hyde & Jenkins, 1969; Kolers, 1979; Roediger et al., 2002). Moreover, students perceived that the four-questions technique successfully met its objectives and they enjoyed responding to the questions. Of course, because of the positive wording of the perception questions, it is possible that these results reflect an agreement bias.

The advantage of a tool such as the four-questions technique is its applicability to diverse learning situations, including those that are typically passive, such as listening to a lecture, watching an instructional video, or reading a text. In essence, this technique can make any type of activity an active one. It would be interesting to compare the effect of the four-questions technique on the effectiveness of active and passive learning. Ideally, the technique would encourage students to engage with the material at a high cognitive level and enhance learning, regardless of how instructors present material.

References

- Anderson, T. H. (1978). *Another look at the self-questioning study technique* (Tech. Education Rep. No. 6). Champaign: University of Illinois, Center for the Study of Reading.

- Angelo, T. A., & Cross, K. P. (1993). *Classroom assessment techniques: A handbook for college teachers* (2nd ed.). San Francisco: Jossey-Bass.
- Bonwell, C. C., & Eison, J. A. (1991). *Active learning: Creating excitement in the classroom* (ASHE ERIC Higher Education Rep. No. 1). Washington, DC: The George Washington University, School of Education and Human Development.
- Carroll, D. W. (2001). Using ignorance questions to promote thinking skills. *Teaching of Psychology*, 28, 98–100.
- Craik, F. I. M., & Lockhart, R. S. (1972). Levels of processing: A framework for memory research. *Journal of Verbal Learning and Verbal Behavior*, 11, 671–684.
- DeRosa, D. V. (1988). How to study actively. In V. P. Makosky, L. G. Whittemore, & A. M. Rogers (Eds.), *Activities handbook for the teaching of psychology* (Vol. 2, pp. 72–74). Washington, DC: American Psychological Association.
- Hyde, T. S., & Jenkins, J. J. (1969). Differential effects of incidental tasks on the organization of recall of a list of highly associated words. *Journal of Experimental Psychology*, 82, 472–481.
- Kolers, P. A. (1979). A pattern analyzing basis of recognition. In L. S. Cermak & F. I. M. Craik (Eds.), *Levels of processing in human memory* (pp. 363–384). Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.
- Roediger, H. L., III, Gallo, D. A., & Geraci, L. (2002). Processing approaches to cognition: The impetus from the levels-of-processing framework. *Memory*, 10, 319–332.
- Yoder, J. D., & Hochevar, C. M. (2005). Encouraging active learning can improve students' performance on examinations. *Teaching of Psychology*, 32, 91–95.

Notes

1. We collected these data while the second author was at Miami University.
2. Send correspondence to Beth Dietz-Uhler, Department of Psychology, Miami University, Middletown, OH, 45042; e-mail: uhlerbd@muohio.edu.

Copyright of Teaching of Psychology is the property of Lawrence Erlbaum Associates and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.