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Russell G. Coulter-Kern
Manchester College

Kelly L. Fogle
Manchester College

Harrison M. Sibert
Manchester College

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*The Effect of Online Quizzing on Understanding of
Key Concepts in an Introduction to Psychology Course**

RUSSELL G. COULTER-KERN
Manchester College

KELLY L. FOGLE
Manchester College

HARRISON M. SIBERT
Manchester College

ABSTRACT

Students enrolled in Introduction to Psychology were required to complete online chapter-review quizzes as part of their course. Using a within-subjects experimental design, we compared the students' understanding of key concepts during a week when they were required to take an online review quiz to their understanding of key concepts during a week when an online review quiz was not offered. Results suggest that online quizzing improves understanding of key chapter concepts.

KEY WORDS Online quizzing; College students; Computer-assisted instruction; Psychology instruction

One challenge facing college faculty is the encounter with the question, How do I increase student learning in the classroom without taking too much additional time to review information? Frequently, the answer to this question focuses on the use of technology. Recent research points to online quizzing as an easy and effective way to help students retain important course concepts for later multiple-choice assessments (DeSouza and Fleming 2003; Grimstad and Grabe 2004; Johnson and Kiviniemi 2009); however, there is a lack of research on whether online quizzing is also effective in helping students recall information for other types of assessments. The current literature does not address whether multiple-choice online quizzing would have

* Correspondence concerning this article should be addressed to Russell G. Coulter-Kern, Department of Psychology, Manchester College, North Manchester, IN 46962. Email: rgcoulter-kern@manchester.edu.

similar effects on students when they are not provided with the visual cues available in a recognition task.

Research also indicates that paper-and-pencil pretesting is an effective way to help students focus their attention on in-class lectures and improve performance on exams (Nevid and Mahon 2009). Nevid and Mahon required students to complete a prelecture quiz at the beginning of class and a postlecture quiz at the end of the class period. They found that using paper-and-pencil mastery quizzes at the beginning and end of a class period encouraged students to stay alert and attentive during the lecture and enhanced student performance on exams, especially on questions that were signaled on the mastery quizzes. Roediger and Karpicke (2006) also found significant benefits related to pretesting. They noted that students who studied a passage once and were tested over it three times recalled more about it than students who studied the passage three times and were tested over it once.

Although in-class paper-and-pencil testing proves to be beneficial, it takes a significant amount of time on the part of the professor. When compared with in-class quizzing, online quizzing is attractive to instructors because it can be graded and recorded automatically, providing instant feedback for students and allowing more time for planning and grading (Cluskey, Hodges, and Smith 2006). Although some researchers suggest that online quizzing may “distract students from other, more traditional study strategies,” recent research tends to support online quizzing as a useful supplemental study tool for students that does not consume valuable class time (Brothen and Wambach 2001:293).

Other studies have demonstrated that online review affects student performance on exams (DeSouza and Fleming 2003; Grimstad and Grabe 2004; Johnson and Kiviniemi 2009). DeSouza and Fleming (2003) noted that students who completed online quizzes performed significantly better on exams than students who completed paper-and-pencil quizzes in class. Johnson and Kiviniemi (2009) found that students performed significantly better on multiple-choice reading questions covered in a required online quiz than on those that were not covered in online review. The same study showed that the more online quizzes students completed, the higher their exam scores and overall course grades were. Grimstad and Grabe (2004) also found that online review affects exam scores positively. They focused on voluntary use of online study questions and found that students who completed at least 50 review questions performed consistently better on exams than students who did not use the online review questions (Grimstad and Grabe 2004).

Online review also opens up opportunities for discussion and other activities in class. In two recent studies, students reported that online quizzing motivated them to read prior to class and prepared them for class discussion (Urtel et al. 2006; Marcell 2008). In addition, Cluskey et al. (2006) found that students who complete online quizzes prior to class participate more in class than students who do not complete online quizzes. Results from Marcell (2008) indicate that classes who were required to complete online review quizzes asked more reading-related questions and made more reading-related comments during class. Additionally, students' questions and comments focused on clarification and application of reading material. This gives instructors the opportunity to cover course material in more depth and to discuss the practical applications of concepts because students already understand the concepts themselves.

Students who review online also tend to perform better in the course overall (Cluskey et al. 2006; Johnson and Kiviniemi 2009). In Urtel et al. (2006), students reported that online quizzing helped them learn course material better. Cluskey et al. (2006) and Johnson and Kiviniemi (2009) found that students who complete online quizzes are not as likely to procrastinate and cram before exams because they must review course material over time. In

addition, students who complete online quizzes also report that they feel more prepared for exams, they are more satisfied with their performance, and they earn higher overall grades in the class than students who do not complete online quizzes (Cluskey et al. 2006).

In the present study, all students completed required online review quizzes prior to class. We expected that when asked to explain concepts on an unannounced recall task, students would remember and explain concepts they reviewed online better than they would remember concepts they had not reviewed online. Although previous studies indicate that online quizzing is related to increased student-perceived preparation for exams and in-class discussions, better performance on objective assessments, and higher overall course grades, the current literature does not address whether the benefits of online quizzing extend to a better recall of concepts on a recall task of understanding, as opposed to simple recognition-based types of assessment. To address this gap in the literature, we designed the current study to examine whether online quizzing is also effective in increasing overall understanding of concepts on a recall task of understanding. In addition, we were testing their recall when they were not expecting a posttest recall task.

METHOD

Overview

We used a within-subjects experimental design to assess whether taking online chapter-review quizzes resulted in better overall understanding of key course concepts on a recall task. We compared students' scores on a recall task completed after they had taken an online review quiz to their scores on a recall task when an online review quiz was not offered.

Prior to the beginning of the study, the course professor selected 24 course concepts he thought were moderately difficult for college students to understand. He chose a moderate level of difficulty for the recall task to eliminate potential floor or ceiling effects. Two student researchers (the second and third authors) selected six of the concepts for the first recall task and six of the concepts for the second recall task. The professor was unaware which items were selected for recall for either task. In this way, we hoped to control for level of difficulty between conditions and eliminate any bias in the difficulty level of concepts or bias in how concepts were reviewed by the professor in class.

Participants

All participants were undergraduate students recruited through two Introduction to Psychology classes at a small Midwestern college. All students were required to complete online review quizzes as part of the course; however, participation in the study was voluntary and students were offered extra credit for participating. Participants included 17 male and 29 female students, and all participants were between the ages of 18 and 23. Twenty-seven of the participants were classified as first-year college students, 10 were sophomores, 6 were juniors, and 3 were seniors.

Procedure

In the two Introduction to Psychology classes, we briefly explained that we were conducting a study examining student learning. We gave the students an informed-consent form

and explained that by signing the form, they would be giving us permission to look at their in-class assessments. They were not informed until after the study was complete that the study was assessing online quizzing.

For the first week of the study, students were required to complete an online chapter-review quiz on the course Web site. This quiz was a mastery quiz that the students could retake several times to earn a better score. Later in the week, all participants completed an unannounced short-answer, in-class quiz over three key concepts from the chapter. The students were not told ahead of time that they were going to be evaluated on the concepts from the online quizzes, because we did not want their expectations about a posttest quiz to cause them to study for it. On the quiz, students were asked to explain and provide an example of each of three concepts listed in the left margin of a sheet of paper. The quizzes were graded by the professor, who was blind to condition and scored them on a 12-point scale. Partial credit was given for answers if the student demonstrated an understanding of the concept but failed to give an appropriate example, or if the student gave an appropriate example and failed to give a good definition of the concept.

The following week, students were not given access to an online mastery quiz. They were given a similar in-class recall quiz. This quiz also had 12 possible points and was graded by the professor, who was blind to condition. Scores for the two weeks were compared to determine whether online quizzing aided in overall understanding of key chapter concepts in a recall task.

RESULTS

From the sample of 46 students, we analyzed the results of the quizzes from Week 1 and Week 2 and compared the mean scores and standard deviations. We performed a paired-samples *t* test to determine whether the mean score for Week 1, when the online review was required ($M = 6.0$), was significantly different from the mean score for Week 2, when online review was not offered ($M = 4.4$). The *t* test confirmed that students recalled significantly more on the Week 1 quiz, when they were required to review the chapter concepts online, $t(45) = 3.61$, $p < .05$.

As suggested by Thalheimer and Cook (2002:2), we calculated an effect size to show “the relative magnitude of the experimental treatment,” regardless of the sample size. The effect size is a measure of the actual impact of the intervention—in this case, the impact of online quizzing on understanding of course concepts. Cohen (1992) suggested that effect sizes of .20 are small, .50 are medium, and .80 are large. The effect size for the present study is in the medium range ($d = .539$). Medium effect sizes, as defined by Cohen (1992:156), “represent an effect likely to be visible to the naked eye of a careful observer.” Because the effect size in the current study was in the medium range, this suggests that the intervention had a substantial effect on student learning.

DISCUSSION

Overall, the results of this study provide additional support for online quizzing as a learning tool, especially as it applies to recall of concepts. We found a significant difference between scores measuring understanding of target concepts on a recall task when students were required to take an online review quiz and students’ scores on the recall task when they were not given the opportunity to take a review quiz beforehand. The results of the paired-samples *t* test indicate that the mean scores when online review was required were significantly different than the mean scores on the in-class quiz when online review was not offered.

It is important to note that students recalled significantly more after taking online quizzes even though they had no idea that their recall would be tested. If students had been informed ahead of time that there would be a recall task later, they might have prepared for it. We wanted to see the impact of an online quiz in a typical class; thus, even though students' recall following an online quiz was worth only six points out of twelve, their recall was not cued by a recognition task and they were not prompted to study for the posttest.

Further evidence of the efficacy of online quizzing was found from the effect size calculation. We calculated an effect size to determine "the relative magnitude of the experimental treatment," regardless of sample size (Thalheimer and Cook 2002:2). The effect size was in the medium range, which suggests that online quizzing has a substantial effect on understanding of key concepts on a recall task.

The results of the present study support the findings of similar studies on the positive effect of online quizzing on student learning; however, past studies generally measured positive effect on student learning using objective, multiple-choice exams. Results of the current study both support and strengthen past research findings, because we found that online quizzing also increases overall understanding of course concepts during a recall task. Thus, even when the posttest test was short essay instead of multiple choice, we also found evidence of the value of multiple-choice online quizzes.

One limitation of our study was that it took place over two weeks, so not all variables could be controlled. Students may have experienced significant life events that would affect performance, such as tests and papers due in other classes. In addition, because this study was conducted at the end of a semester, we were not able to replicate it. In the future, it would be useful to replicate this study with a larger sample size to see if similar results are obtained. It could also be repeated several times during a semester. This would provide several opportunities to observe the effect of the online quizzes on understanding target concepts.

Based on our results, it appears that online quizzing may be an inexpensive learning tool in terms of time and resources and is highly beneficial as a method of improving student learning. In the future, it may be useful to examine the impact of online quizzing several weeks after students take an online quiz. We may notice an even stronger effect, because it is unlikely that course material that was not reviewed in a quiz would be recalled as well as material covered in an online quiz. We suspect that the mere presence of information on an online quiz may cue students that the information is important and may increase the likelihood that they will pay attention to it and be able to demonstrate understanding of the concept on a later recall task. Although not a panacea for student learning, online quizzing may prove to be an important component of college classrooms and provide incremental learning without a significant investment of time and financial resources on the part of faculty.

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