

DAILY ONLINE EXTRA CREDIT QUIZZES AND EXAM PERFORMANCE

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ABSTRACT. This investigation explored the effect of daily online extra credit quizzes on exam performance in a large sample across 10 semesters. Students (N=843) in five semesters of a family development course were offered daily online extra credit quizzes and students in another five semesters were not. The number of quizzes completed was significantly correlated with average exam score in the course, but comparisons between semesters revealed no improvement in average exam scores. These results suggest that daily online extra credit quizzes may not enhance student learning or retention. Rather, students who are otherwise motivated to do well in the course appear more likely to take advantage of extra credit opportunities.

The literature on the scholarship of teaching and learning has multiple investigations exploring the effectiveness of frequent quizzes, extra credit, and online/web-based methodologies in promoting student learning. Frequent quizzes have been linked to student learning as assessed by exam performance (Leeming, 2002; Narloch, Garbin, & Turnage, 2006; Padilla-Walker, 2006; Tuckman, 1996), as has extra credit (Henley & Savage, 1994; Junn, 1995), and web-based methodologies (Bliwise, 2005; Fletcher-Flynn & Gravatt, 1995). However, to date no investigation has simultaneously explored an operationalization integrating all three components.

Frequent quizzes, as assessed in the literature, are typically a required component of the course conducted during class time (Geiger & Bostow, 1976; Leeming, 2002; Narloch et al., 2006; Tuckman, 1996). Although the frequency of the quizzes varies across investigations, most are daily/every class period (Leeming, 2002; Padilla-Walker, 2006). This frequency of administration is consistent with the findings of a “testing effect” reported in the literature that demonstrates a linear relationship between frequency of assessment and student learning and

KEY WORDS. Extra credit, Daily quizzes, Web-based learning

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retention (Karpicke & Roediger, 2007; Roediger & Karpicke, 2006; Townsend & Wheatley, 1975), as well as the recommendations of leading educational psychologists (Glenn, 2007).

Rarely are frequent quizzes used for extra credit (Padilla-Walker, 2006) or offered online (Bliwise, 2005), as they are typically used to encourage frequent class attendance or keeping up with assigned readings (Geiger & Bostow, 1976; Leeming, 2002; Narloch et al., 2006; Wilder, Flood, & Stromsnes, 2001). Similarly, the majority of extra credit opportunities offered to students take forms other than daily quizzes or online opportunities (Hardy, 2002; Henley & Savage, 1994; Hill, Palladino, & Eison, 1993; Junn, 1995). Interestingly, although web-based methodologies have been shown to enhance student learning (Fletcher-Flynn & Gravatt, 1995), are thought by faculty to have high educational value (Hill et al., 1993), and are perceived by students to be a positive influence on study habits and learning (Ogilvie, Trusk, & Blue, 1999), they have rarely been used, especially to offer frequent quizzes or extra credit (Bliwise, 2005).

Further, prior evaluations of frequent quizzes have had methodological limitations that question the validity of their findings. It is not uncommon, for example, for quizzes and exams to have completely different formats, such as quizzes that are fill in the blank but exams that are multiple choice (Tuckman, 1996). This is a serious limitation because the degree of overlap between quizzes and exams is a critical factor in determining the effectiveness of the quizzes (Burns & Vinchur, 1992) and their utility in addressing other concerns, such as illustrating the types of questions that will appear on exams and providing students constructive feedback on their level of mastery of the material (Thorne, 2000).

Additionally, frequent quizzes, like many methods of assessing student learning, operate under a competency-contingent incentive framework (Bandura, 1986). This framework posits that because incentives are made available as a direct result of demonstrating competency (e.g.,

correct answers on a quiz), individuals' motivation to acquire the incentive will drive them to learn to demonstrate competency. However, the incentive of avoiding a zero on a required quiz (and thus endangering one's grade in the course) is not necessarily equal to the incentive of earning extra credit on an optional quiz, particularly as the prior incentive is more coercive and punishes failure as much as it rewards success. To the extent that taking an optional extra credit quiz is more voluntary, one would expect it to be more reflective of a voluntary choice to study the course material beyond what is required and more likely to predict mastery on other forms of assessment. It is for this reason that it is especially important to investigate *extra credit* daily quizzes.

By offering the quizzes online through course management software such as WebCT, it is also possible to remove numerous logistical barriers to using frequent quizzes. Frequent quizzes require class time, frequent student attendance, and substantial grading time or even more class time for grading (especially if students need to be provided with the correct answers for any questions they miss), and typically do not provide "second chances" to retake the quizzes until complete mastery is demonstrated (Wilder et al., 2001). Automated online quizzes can eliminate all of these problems by making quizzes available outside of class time, automatically and immediately grading student responses and providing feedback, and allowing students multiple opportunities to retake quizzes.

Web-based quizzes can also minimize the presence or impact of the three greatest disadvantages to offering extra credit. First, the most frequent disadvantage to offering extra credit as reported by faculty is that it encourages a lax or irresponsible attitude towards the course (Norcross, Horrocks, & Stevenson, 1989). By making the quizzes available only for a limited window of time, these assignments actually encourage responsibility and time

management. Second, when time windows are not restricted, less than 10% of students will access online materials immediately or shortly after the relevant class period, usually waiting until 48 hours before an exam (Bliwise, 2005). By making online quizzes available only for a limited window of time, students are further encouraged to use them as a learning tool to reinforce class material rather than a last minute effort to improve their grade. Third, the most frequent suggestion by faculty for when extra credit is appropriate is when it is offered to the entire class as part of the course structure (Norcross, Dooley, & Stevenson, 1993). By offering online extra credit quizzes, it is possible to ensure equal access and opportunity for all students, not just those in attendance on a given day.

It is for these reasons that I developed an online extra credit daily quiz system for one of my courses. Consistent with prior research on both extra credit and frequent quizzes, I hypothesized that there would be a direct positive linear relationship between the number of extra credit quizzes completed and average exam scores.

However, I was mindful of Hardy's (2002) findings that students who complete extra credit are typically the students who would perform better on course exams anyway. That is, the relationship between the two variables may indeed be causal, but in the opposite direction of what is hypothesized. To guard against this possibility, I compared data from five semesters where I offered the quizzes [experimental group] against five semesters where I did not [control group]. I hypothesized that if the relationship were causal in the direction suggested by the first hypothesis, then average exam scores should be significantly higher in the extra credit semesters (as students should have learned more from studying for and taking the quizzes). Conversely, if I observed no difference in exam averages in comparing the two groups, that would suggest

further support for Hardy's (2002) interpretation that the students who score higher on exams are more likely to use extra credit.

Method

Participants

Participants were 863 undergraduates enrolled in one of 10 semesters of an introductory family development course at a Southeastern university. Although demographic data were not collected, approximately 95% of the students were female, 75% were white, 25% were African-American, and nearly all were traditional college students.

I taught this course ten times across the fall, spring, and summer semesters from August 2003 through December 2006. The course typically met twice a week for 75 minutes in the fall and spring and five times a week for 100 minutes in the summer. Students completed daily textbook readings and readings of journal and popular press articles. The course was a combined lecture/discussion format with an average enrollment of 86.

Procedures

After IRB approval, I used existing records of students' exam averages and extra credit scores. The first five times I taught the class, I did not offer extra credit quizzes. The students in these five sections comprise the control group. The last five times I taught the class, students were offered 20 extra credit quizzes via WebCT. The students in these five sections comprise the experimental group.

One extra credit quiz was offered for each lecture topic. The quiz would open on WebCT immediately after the end of class on the day of the topic and would remain open until the starting time for the next class period. For fall and spring semesters, quizzes were open either two or five days; for summer semesters, quizzes were open either one or three days, as

appropriate for the schedule. After the quiz had closed, students could no longer attempt it. I informed all students of the opportunity to take the quizzes on the first day of class, and additional instructions were provided in the syllabus. The value of all 20 quizzes was equivalent to approximately 5% of the points in the course or one-half letter grade.

Measures

Exam scores. I calculated students' average exam scores as the sum of their scores on all course exams divided by the number of exams. All exams were 50 multiple choice item exams, with each item worth two percentage points. The number of exams varied from two to four, as the structure of the course dictated, but the questions were all from a common test bank I created for the course.

Extra credit quizzes. I created 20 extra credit quizzes for the course, one for each lecture topic based on the material I covered in class for that topic. Each quiz contained five multiple choice items similar to those that appeared on exams. Correctly answering all five items earned one point of extra credit. Students only received extra credit if they correctly answered all five items (i.e., scores were rounded down). After completing the quiz, students received immediate automated feedback informing them which items they had answered correctly. For items they missed, they received no indication as to which of the other answers was the correct one. Students could retake a quiz as many times as they wanted while it was open in order to correctly answer all five items, but they had to retake the entire quiz (all five items). In order to discourage guessing, the placement of the correct answer was randomized each time the quiz was attempted. For example, if the correct answer was "gender," the first time a student took the quiz, "gender" could be answer "c" whereas the second time it could be answer "a."

Results

For the combined sample of 863, the mean exam average was 74.42 with a standard deviation of 9.08. Using the procedure recommended by Tukey (1970), I calculated the interquartile range [IQR] as the difference between the 75th and 25th percentiles (81.33-68.00) and multiplied the result by 1.50 to identify potential outliers ($1.50 \times \text{IQR} = 20.00$). This resulted in the elimination of 20 cases with exam scores below 54.42 or above 94.42 (2.32% of the sample), leaving 843 cases. This left a final sample with a mean of 74.86 and a standard deviation of 8.49.

Within the experimental group, 95% completed at least one extra credit quiz, with over 50% completing 16 or more, and the greatest number, 19%, completing all 20. The mean number of completed quizzes was 14.00 with a standard deviation of 6.22.

As hypothesized, the correlation between extra credit scores and exam averages was significant, $r = .23, p < .001$, with extra credit scores explaining over 5% of the variance in exam averages.

To more fully explore the potential causal relationship between extra credit scores and exam averages, I calculated an independent samples *t*-test comparing the experimental and control groups. The experimental ($M = 74.87, SD = 8.48$) and control ($M = 74.85, SD = 8.52$) groups had virtually identical exam averages, $t(841) = -.04, ns$.

Discussion

This investigation explored the effect of daily online extra credit quizzes on exam performance in a large sample across 10 semesters. As hypothesized, there was a direct positive linear relationship between the number of quizzes students completed and their exam averages. The more extra credit quizzes students completed, the higher their exam averages. However, subsequent analyses comparing students in semesters where extra credit was offered with students in semesters where it was not revealed no difference in average exam scores, even

though the vast majority of students in the extra credit semesters took advantage of at least some of the extra credit opportunities.

These results suggest further support for Hardy's (2002) interpretation that students who voluntarily choose to complete extra credit assignments are more likely to score well on exams to begin with. That is, rather than the quizzes resulting in greater learning and retention of the material, which is then demonstrated on exams, the most parsimonious interpretation of the correlation is that students who score well on exams are more conscientious (e.g., more likely to study, care about their grades, etc.) and as a product of that attitudinal difference, are more likely to take advantage of extra credit opportunities.

Although the results reported here seem to suggest a limited utility of extra credit, particularly as extra credit quizzes do not seem to improve exam performance, I urge caution in totally dismissing daily online extra credit quizzes. First, the design of this investigation was not fully experimental. For ethical reasons, I could not randomly assign students to extra credit or no extra credit groups (Norcross et al., 1993), so it remains possible that the students in the first five semesters were different from the students in the last five semesters in a way that confounded the comparison between the groups. Second, because I was using existing data, I was only able to investigate the relationship between the quizzes and exam averages. I was unable to explore the potential impact of the quizzes on a host of other important variables such as class attendance, course satisfaction, and student ratings of instruction, and I was unable to control for other potential confounds such as time spent studying, GPA, and standardized test scores (Padilla-Walker, 2006). Further, multiple choice quizzes may not have been the most effective method of assessing student learning for all students and they may have failed to capture variation due to differences between students in learning styles.

Indeed, my experience in using the quizzes suggests they may have numerous other benefits that I was unable to assess in this investigation. For example, in the semesters when I offered the quizzes, I noticed a sharp decrease in the number of students making last minute pleas for extra credit in an attempt to raise their grade, consistent with the findings of other extra credit investigations (Hardy, 2002). I also noticed that the quizzes sparked increasing discussions between me and my students, for example, if there were errors or inconsistencies on the quizzes. This interaction made it easier to spark class discussion on the assigned topics during the class both because it created a less formal atmosphere where students felt more comfortable to speak up and because I could call on many students by name (something that is otherwise difficult in classes of 80 or more).

Further, students frequently commented, both in person and on course evaluations, that they appreciated the quizzes because it allowed them to test themselves on the material every day and provided them an objective measure of feedback on how well they were learning the course material. For example, on course evaluations students commented, "I loved... the extra quizzes. They helped."; "[What I liked best about the course was] the online quizzes to help our grades."; "I really liked the fact that he gave out extra credit quizzes. They helped for studying for the test and it made me review the material every day." Finally, because these quizzes were only open for a short time, I believe they encouraged students either to attend class or to find out what they missed from a classmate in a timely manner before the quiz closed. Future investigations could attempt to quantitatively investigate and document effects on these variables.

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