Effects of a Contingency for Quiz Accuracy on Exam Scores

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Published online: 27 February 2018

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Abstract

Completing frequent quizzes can improve exam scores; however, there is a lack of research on variables that influence quiz accuracy and whether there is an effect on exam scores. This study evaluated the effects of a contingency for quiz accuracy on quiz accuracy and exam performance. Eighty-one students enrolled in an introductory Learning course participated. For each class meeting and its related readings, the instructor assigned an online quiz due just before each class. During the no-contingency condition, the instructor assigned quizzes, but quiz accuracy did not result in points toward the final grade. During the accuracy-contingency condition, students earned points based on quiz accuracy. In a reversal design, the accuracy-contingency increased quiz accuracy and exam scores relative to no-contingency. Although many students benefited from the contingency, low-performing students were least likely to show a meaningful improvement in exam scores.

Keywords Web-based · Quizzes · Exams · Undergraduate students · Contingency

Instructors increasingly teach large lecture-based classes to meet the growing demand of college enrollment (Mulryan-Kyne, 2010). These classes rely heavily on students completing reading assignments between class meetings (Ventura & Onsman, 2009). Reading assignments may help facilitate self-instruction outside of class while simultaneously increasing engagement during class. Unfortunately, students read fewer and fewer reading assignments, which negatively affects learning and exam scores (Burchfield & Sappington, 2000), perhaps due to poor behavioral contingencies between student

behavior and grades. Additionally, infrequent testing leads to an apparent fixed-interval scallop in studying behavior, increasing the likelihood that students wait to complete all readings until just prior to exams. Unfortunately, controlling a student's study behavior outside of the classroom is difficult; however, instructors can arrange activities and contingencies for completing those activities to promote a wide range of academic behaviors (Michael, 1991; Skinner, 1968).

One strategy to increase student studying behavior and compliance with reading assignments is to provide frequent quizzes, which may direct students to pertinent information and quiz scores provide students feedback on learning. Several studies have demonstrated a positive relationship between frequent quizzes and cumulative exams scores (Azorlosa, 2011; Daniel & Broida, 2004; Geiger & Bostow, 1976; Graham, 1999; Johnson & Kiviniemi, 2009; Narloch, Garbin, & Turnage, 2006). These studies have compared frequent quizzes to no quizzes and found that frequent quizzes on course readings produce higher exam scores. While encouraging, many of these studies have small sample sizes (Geiger & Bostow, 1976) and highly motivated students in advanced undergraduate- and graduate-level courses (Narloch et al., 2006). Thus, it is unknown whether frequent quizzes would increase reading course materials and improve exam performance in large, introductory-level courses where students may be less motivated and may not have weak study skills (Burchfield & Sappington, 2000).

Only one study has examined the effectiveness of quizzes in a large, introductory undergraduate course (Johnson &

The original version of this article was revised: This article was updated with the correct version of Figure 1.

- Frequent quizzes improve student's exam scores
- Instructors can arrange accuracy-contingencies to increase student accuracy and completion of quizzes
- Contingencies are necessary to increase student accuracy and completion of quizzes
- Accuracy-contingencies on quizzes help all student but had the least effect with low-performing students

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Kiviniemi, 2009). The course was a traditional lecture format with 159 students. The researchers used a within-subject group design and assigned quizzes to a subset of the required chapter readings and scores on quizzes counted towards a student's final grade. A single exam contained questions from chapters with associated quizzes and from chapters with no-assigned quiz. Exam performance was better for questions on chapters with a quiz than those without, but there was no strong correlation between number of completed quizzes and exam scores. Unfortunately, very few students completed the quizzes. An average of only 64% (range 40–88%) of students completed any single quiz, which made it difficult to attribute the higher exam performance on questions with a corresponding quiz to taking quizzes. Further, the authors aggregated data across students and did not report effects on students who perform at different levels. It is unclear if these results were affected by the high-performing students who may have completed and performed the best on quizzes, thus accounting for the change in exam scores.

One reason for low quiz completion might be the contingencies associated with completion. Johnson and Kiviniemi (2009) assigned 6% of the total course grade to quiz accuracy which may have been insufficient to motivate students. Across multiple studies, 6–25% of one's final grade was tied to quiz performance (Geiger & Bostow, 1976; Graham, 1999; Narloch et al., 2006). Thus, it is unclear what contingency an instructor should implement to increase engagement with quizzes and whether a contingency is even required or if the availability of quizzes with no-contingency is enough to affect student performance. Research on contingencies for homework accuracy has demonstrated that having points contingent on the accuracy of homework assignments increases homework submission (Rehfeldt, Walker, Garcia, Lovett, & Filipiak, 2010; Ryan & Hemmes, 2005), suggesting that a contingency is needed to increase quiz accuracy to improve exam performance.

Much remains to be understood about the effects of assigned readings, quizzes on those assigned readings, and their effects on exam performance. Currently, there are two important unaddressed questions. First, does a contingency for quiz accuracy increase quiz accuracy and corresponding exam performances or would offering quizzes not linked to points be sufficient to improve exam scores? Second, are the increased-exam-score effects of frequent quizzing observed with all students, or do different students differentially benefit from such a contingency? Thus, this study evaluated the effects of a contingency for Web-based quiz accuracy in a large, introductory Psychology class, in which the instructor provided Web-based quizzes related to each assigned readings. During the first and third quarters of the semester, the instructor assigned a quiz for each chapter, but no points were available for quiz accuracy. During the second and fourth quarters, the instructor continued assigning quizzes and awarded points based on quiz accuracy. The dependent variables were quiz

accuracy and exam grades. We analyzed the effects of this intervention on high-, mid-, and low-performing students. It was hypothesized that when a point contingency was in place for quiz accuracy, students would score higher on those quizzes and corresponding exams than when no such contingency was in place for quiz accuracy. We also explored those effects across students who performed at a high, mid, or low level on the first exam grade toward understanding with whom this contingency worked best.

Method

Participants

Eighty-one students enrolled in an Introduction to Learning course participated. One hundred six students were enrolled in the course on the first day. The experimenters removed students who withdrew from the course ($N = 6$) or did not complete all four class examinations ($N = 19$) from the analysis. Of the 19 who missed an exam, eight completed a makeup exam that was substantially different than the original; the remaining students did not request a makeup exam. The experimenters divided the students into three groups based on their first exam scores because (a) previous studies had not evaluated the effects of contingencies across high-, medium-, and low-performing students; and (b) this group assignment should be based on data that were not affected by quiz accuracy-contingency intervention.

The participants were students in an ethnically and economically diverse college. The college's student body was 32% Caucasian, 28% Hispanic, 25% Asian, and 8% African American. Thirty-nine percent of students receive Pell Grants due to income-based needs (U.S. DOE, 2017).

Setting

Individual lectures and the course exams took place in a large lecture hall that seated 110 students. In the front of the classroom the instructor (first author) lectured from behind a large table with a podium, computer, and a combined blackboard/whiteboard and displayed PowerPoint® slideshows on the whiteboard. Each student completed online quizzes outside of classes at his or her choice of time and location. The course met for 1.5 h two times a week across a 16-week semester. There were 25 lectures, the first of which reviewed the syllabus and had no assigned readings.

Materials

The textbook was *Learning and behavior* (7th ed. or 6th ed., Chance, 2008; 2013).

Quizzes The instructor created 24 quizzes, each consisting of five multiple-choice, five true/false, and five fill-in-the-blank questions each based on assigned reading materials due for the following class. Each chapter assignment was between 10 and 22 pages of text. Students could access their notes and textbook materials while they took the quizzes as the quizzes were completed outside of class and online. The instructor posted quizzes on Blackboard® and students accessed quizzes on a PC computer via the Internet. Quizzes could not be accessed on Apple® computers, smart phones, or tablets. Blackboard® introduced each no-contingency quiz with a note saying “This is quiz (#). It will NOT count towards your final grade. Once you begin you must complete it. It is not timed. Feedback will be provided on all submitted answers. Quiz is due (date). Good luck!” Blackboard® introduced each quiz with an accuracy-contingency with a note saying “This is quiz (#). It will count towards your final grade. Once you begin you must complete it. It is not timed. Feedback will be provided on all submitted answers. Quiz is due (date). Good luck!” After a student completed and submitted a quiz, regardless of whether the quiz had a contingency, Blackboard® generated notes stating “correct!” for correct answers, and “sorry, the correct answer was (answer)” for an incorrect answer.

Exams The experimenter administered four 50-question, multiple-choice exams on standard paper; the first exam covered four chapters and the remaining three each covered three chapters. Students took the exams in class and could not access their notes or textbook materials while taking the exams. Quiz and exam questions were unique, and there were no repeated quiz questions on exams, although both quizzes and exams covered the same textbook and lecture content. For each exam, the instructor created three versions with identical questions, but in different orders. Students recorded their exam answers on Scantron® sheets.

Response Measurement and Reliability

There were two dependent variables. The first was the percentage correct score on each quiz. Blackboard® calculated scores automatically for multiple choice and true/false questions and the experimenter manually coded fill-in-the-blank questions. When a student did not complete a quiz by the due date, defined as not clicking “submit” at the end of each quiz, the student received 0% correct for that quiz. The second dependent variable was the percentage correct on each of four 50-question exams scored on a Scantron® machine.

The experimenter and another data collector conducted interobserver agreement (IOA) for 30% of the fill-in-the-blank questions. The experimenter printed each student’s responses, de-identified the data, and assigned each student an identifying code. Then, they marked each response correct or

incorrect. Agreements were instances of both observers recording the same score for an item. The experimenter calculated IOA by dividing the number of agreements by the total number of questions and multiplying by 100. IOA was 98%.

Experimental Design

We used an ABAB design to evaluate the effects of an accuracy-contingency for quizzes on exam scores. A represented assigned quizzes with no-contingency, and B represented the contingency for quiz accuracy. Each phase was implemented during one quarter of the semester and ended with one of four exams.

Procedure

During the first class, the experimenter outlined the course and explained the Blackboard® quiz system. Each quiz tested the acquisition of information in the assigned reading. The instructor posted each quiz immediately after the preceding class to ensure students had time to complete the quiz. The instructor told students that quizzes were due 15 min before the beginning of the next class (9:00 AM). Regardless of condition, when a student completed a quiz, she received a total score and feedback on all questions, regardless of accuracy. For each exam, the instructor posted exam grades to Blackboard® on the same day.

No-Contingency Condition During the first class, the experimenter introduced the course, explained the Blackboard® quiz system, and stated that all quizzes until exam 1 would not count toward a student’s final grade. The initial no-contingency condition consisted of eight quizzes over 5 weeks and exam 1. A second no-contingency condition was conducted after exam 2, and this consisted of five quizzes over 4 weeks and exam 3. When students completed a quiz, they were given a score (range 0–15 points). Although students obtained scores based on their performance, the scores did not count towards their final grade. While there were no points available for completing no-contingency quizzes, there may have been other un-programmed consequences, such as students being more prepared for exams, scoring higher on exams, or automatic reinforcement from completing the quizzes.

Quiz Accuracy-Contingency Condition After exam 1, the experimenter stated that all quizzes until exam 2 would count toward one’s final grade. The instructor told the students that they could earn up to 1.82% of their final grade for each quiz depending on the accuracy of their quiz answers. The quiz accuracy-contingency condition consisted of six quizzes over 3 weeks. A second contingency condition was conducted after exam 3 and consisted of five quizzes over 3 weeks and exam

4. Students who did not attempt the quiz, did not complete the quiz, or completed the quiz after the deadline received a score of 0% for that quiz.

Quiz Integrity

An independent observer examined all 24 quizzes on Blackboard® to observe if the procedural steps were implemented as-planned. The steps were as follows: (1) the experimenter posted the quiz on Blackboard®, and students could access the quiz; (2) there was a note that stated whether the quiz counted toward their final grade or not, respectively; (3) the note stated the time and date of when the quiz was due; and (4) the note stated that students would receive feedback on all of his or her answers. Quiz integrity was 100% across all conditions.

Social Acceptability

Ten minutes before exam 4 was distributed, students completed a nine-question satisfaction survey that assessed study goals, appropriateness of procedures, and acceptability of outcomes (see Table 1). For each question, students rated the statement on a five-point Likert scale where 1 represented “strongly disagree” and a 5 “strongly agree.” Students had up to 10 min to complete the questionnaire and returned the questionnaire along with the completed final exam.

Results

We categorized 30 students as high performing (defined as students who received an A or B on exam 1), 20 students as mid performing (defined as students who received a C on their exam 1), and 31 students as low performing (defined as

students who received a D or F on exam 1). This categorization was used to evaluate the effects of the contingency across different performance groups of students.

Quiz Completion A larger percentage of students completed the quizzes during the accuracy-contingency than in the no-contingency condition. During the initial no-contingency phase, student completed 13.7% (SD = 20.1) of available quizzes. When the accuracy-contingency was put in place, students completed an average of 86.8% (SD = 21.0) of the available quizzes. Similar outcomes were found during the second half of the class when students completed 6.4% (SD = 20.2) of the no-contingency quizzes and 80.2% (SD = 30.1) of the accuracy-contingency quizzes. High-performing students completed an average of 13.3% (SD = 20.4) of the quizzes associated with no-contingency, mid-performing students completed an average of 7.7% (SD = 13.9) of these quizzes, and low-performing students completed an average of 10.7% (SD = 13.9) of these quizzes. Results indicated very low quiz completion and comparable completion between performance groups during the no-contingency condition ($p = .50$, one-way ANOVA). We did, however, observe differentiation between groups when the accuracy-contingency was in place. High-performing students completed an average of 92.3% (SD = 13.8) of the quizzes associated with an accuracy-contingency, mid-performing students completed an average of 92.3% (SD = 10.0) of these quizzes, and low-performing students completed an average of 76.7% (SD = 24.0) of these quizzes. The authors conducted a one-way ANOVA to analyze differences in quiz completion between the three different groups during the contingency condition. There was a significant difference in quiz completion between groups ($F [2, 78] = 7.392, p = .001$). Post hoc comparisons found that high- ($p = .003$) and mid-performing ($p = .008$) students completed significantly

Table 1 Social acceptability

Question	Distribution of ratings 1-2-3-4-5	<i>M</i>
1 It is important for students to read course material prior to each class	1-4-9-42-30	4.12
2 Students in an introduction to learning course should understand basic learning concepts	0-1-15-33-37	4.24
3 It is important for students to get good scores on cumulative exams	2-2-9-35-38	4.25
4 Completing graded online quizzes on course material is an acceptable way to help prepare for cumulative exams	2-8-13-28-34	4
5 Completing graded online quizzes helped me understand the material	1-8-16-33-28	3.91
6 Graded online quizzes are an appropriate way to encourage students to complete reading assignments	1-9-9-32-35	4.07
7 Graded online quizzes helped me read course material prior to each class.	1-8-13-30-32	3.99
8 The graded online quizzes were successful in increasing my overall cumulative exam grades	3-10-30-22-21	3.56
9 The graded online quizzes will help me remember the basic concepts from this course	4-7-30-25-20	3.58

Students rated agreement with each item on a scale from 1 (strongly disagree) to 5 (strongly agree)

more quizzes than low-performing students. There was no statistical difference in quiz completion between high- and mid-performing students during the accuracy-contingency condition ($p = 1.00$).

Quiz Accuracy

Due to the low completion rates during the no-contingency condition, many students received a score of “0” per each incomplete quiz. This grade, while not counting toward the student’s final grade, represents what the student would have received had the quiz scores counted towards the student’s final grade. During the initial no-contingency phase, students scored an average of 7.8% (SD = 13.5) correct on the quizzes. When the accuracy-contingency was put in place, students scored an average of 68.5% (SD = 19.9) correct on the quizzes. Similar outcomes were found during the second half of class when students scored an average of 4.4% (SD = 14.5) correct on the quizzes in the no-contingency condition and an average of 68.9% (SD = 27.8) correct on the quizzes in the accuracy-contingency condition. Thus, the accuracy contingency produced substantially higher accuracy (see Fig. 1). Students in the high-performing group scored an average of 8.6% (SD = 15.2) correct when there was no-contingency and an average of 79.7% (SD = 15.9) correct when there was an accuracy-contingency. Students in the mid-performing group received an average score of 4.3% (SD = 8.6) correct when there was no-contingency and an average score of 72.5% (SD = 13.3) correct when there was an accuracy-contingency. Students in the low-performing group received an average score of 5.8% (SD = 8.6) correct when there was no-contingency and an average score of 55.6% (SD = 23.5) correct when there was an accuracy-contingency. As with quiz completion, there was no difference between performance-level groups when no contingency was in place ($p = .39$), but the groups differed in accuracy when the contingency was in place ($F [2, 78] = 13.189, p < .001$), with the high- and mid-

performing groups having comparable accuracy ($p = .39$) and both higher accuracy than the low-performing group ($p < .001, p = .006$, respectively).

Collateral Effects on Exam Performance

Students averaged 71.7% (SD = 15.8) correct on exam 1, 75.8% (SD = 14.7) correct on exam 2, 72.7% (SD = 14.5) correct on exam 3, and 76.8% (SD = 17.2) correct on exam 4. A repeated measures ANOVA was conducted and found significant difference ($F [3240] = 7.566, p = .0001$; eta squared = .086, small effect size). A one-tailed pairwise comparisons post hoc test found that performance on exam 2 was significantly higher than exam 1 ($p = .001$) and exam 3 ($p = .003$) and performance on exam 4 was significantly higher than exam 1 ($p = .001$) and exam 3 ($p = .001$). No significant difference was found between exams from the no-contingency conditions (exams 1 and 3, $p > .397$) or between exams from the quiz accuracy-contingency conditions (exams 2 and 4, $p > .442$). Students performed significantly higher on the exams associated with quiz accuracy-contingencies. Further, there were more students who received an “A” on exams during the quiz accuracy-contingency conditions while there were more students who received an “F” on exams during the no-contingency conditions (see Fig. 2). The number of students who received an “A” on the exam doubled from 9 to 18 when the quiz-accuracy-contingency was in place.

The authors analyzed both the differences in scores on exams and grade differences on exams between the two contingency conditions. The first analysis examined whether there was any change in exam scores between the two contingency conditions, including a change of just 1 percentage point. We found that 33.3% of the high-performing students, 30.0% of the mid-performing students, and 29.0% of the low-performing students improved their exam scores when there were quiz accuracy-contingencies for associated quizzes, indicating a similar effect of the contingency across all three

Fig. 1 The graph displays average percentage correct performance on quizzes per performance group (high, mid, and low). The condition labels specify the quiz contingency

Fig. 2 The graph displays the number of student who received grades of As and Fs on the four classroom exams. The condition labels specify the quiz contingency

groups. The second analysis examined whether there was a socially significant change in exam performance, which was defined as having a score that was a letter grade higher on exams associated with a quiz accuracy-contingency. We found that 33.3% of the high-performing, 30.0% of the mid-performing, and 19.4% of the low-performing students experienced socially significant grade change. These data suggest that socially significant grade change occurred more often for high- and mid- than the low-performing students.

Social Acceptability

Table 1 displays the distribution and mean social validity ratings for each item. On average, students marked 4.2 (out of 5) regarding the goals of the quiz accuracy-contingency (question numbers 1, 2, and 3), 3.99 regarding the quiz accuracy-contingency procedures (question numbers 4, 5, and 6), and 3.7 regarding the effects of having a quiz accuracy-contingency (question numbers 7, 8, and 9). Overall, the students enrolled in this large, introductory course endorsed the goals, procedures, and effects of a quiz accuracy-contingency.

Discussion

Similar to observations made by Rehfeldt et al. (2010) and Ryan and Hemmes (2005), contingencies for quiz accuracy increased quiz completion and accuracy, and increased the mean exam grade by approximately 4%. Approximately a third of high- and medium-performing students and one fifth of low-performing students made large improvements in their exam grades. Overall, the intervention was deemed as socially acceptable by the students. This study contributed to the literature in three distinct ways. First, this study demonstrated that having an accuracy-contingency is necessary to promote students engaging in frequent quiz taking. Students scored significantly higher on quizzes that had an accuracy-contingency due mainly to the fact that a large percentage of students did

not attempt quizzes during the no-contingency conditions. Second, when students took quizzes frequently due to the accuracy-contingency, they experienced positive collateral effects on their exam performance. Students scored significantly higher on exams that had associated quizzes with an accuracy-contingency, thus replicating Johnson and Kiviniemi (2009) and Ryan and Hemmes (2005). Third, this study examined the effects of the quiz accuracy-contingency by differing levels of student performance. While the quiz accuracy-contingency was functionally related to increased quiz and exam performance, socially significant exam results were more common in mid- and high-performing students; fewer low-performing students benefited from the contingency and were more likely to continue receiving Ds and Fs on exams. These results conflict with Graham (1999) who found that frequent quizzes aided mid-range students (who received a C as their final grade) the most; however, Graham differed from this study in that the quizzes were unannounced and were delivered in class. Further, Graham (1999) compared quiz and no quiz conditions, whereas in the current study, quizzes were available during all conditions and only the contingency for quiz accuracy changed. The reasons why the benefits of quiz accuracy-contingencies did not extend to low performing students to the same degree warrants further research. Low-performing students were less likely to complete quizzes and performed with less accuracy on those quizzes perhaps because (a) they did not have the skill set to understand the course material and do well on quizzes; (b) they did not have an adequate learning history to acquire the self-management repertoire to engage in quiz completion consistently; (c) the reinforcer magnitude (i.e., available points) was too small for those students; and (d) reinforcement for other concurrent behavior, such as work, leisure, or family activities, was much greater than for academic behavior.

This study leads to important findings for instructors managing higher-education classrooms. Simply developing quizzes or other study material is insufficient to change student grades positively. Instructors interested in increasing overall

exam scores through frequent quizzes would need to implement a salient contingency for quiz accuracy to see the desired effects on exam scores. Furthermore, while a contingency for quiz accuracy is necessary for significant positive effects, this does not guarantee that those students who are at risk for failing the course will benefit in the form of passing the exams. It appears that low-performing students need additional resources and contingencies to improve their scores enough to pass the exams. Instructors interested in utilizing behavioral procedures to improve classroom practices should consider using a contingency for quiz accuracy to ensure that students complete the quizzes and receive higher scores on those quizzes, but should be cautious if the expectations is to improve both quiz and exam scores across all students who perform at varying levels.

A positive aspect to this study was the high level of social acceptability: students believed that reading the course material prior to each class was important, getting good grades was valuable, the graded online quizzes helped them understand material, encouraged them to complete reading assignments, and students reported higher overall exam grades when there was a contingency for quiz accuracy. Most interestingly, students reported that the graded quizzes helped them remember concepts from the course more than when the quizzes were available and not subject to an accuracy-contingency. These results, combined with other results, indicate that the contingency was unobtrusive and benefitted the majority of the class. This study has great implications for practice, as it was an efficient and effective addition to the classroom to improve exam scores within a wide range of students and was easy to implement for the professor despite the large class size. The professor also noted that the quizzes were easy to post online and grade.

There were several limitations to this study. We did not conduct any analysis of the internal consistency of responses to the exam items or normalization of exam items to make the exams equivalent in difficulty across the different phases. There was also no means of control for cheating on the online quizzes. Students were divided into performance groups based on the first exam grade, before the quiz accuracy-contingency; thus, student groups may have been slightly skewed because students tend to perform worse on the first exam. We should note that as an internal exercise, we conducted the same analyses based on groupings made based on final grades and the results were nearly identical, suggesting that the two methods were nearly equivalent. Neither of these methods, however, included broader measures, such as GPA scores, and such measures should be considered in future research.

Future research should address quiz accuracy-contingencies and completion in low-performing students, as there has yet to be any definitive research on promoting quiz taking behavior in low-performing students. Future research should also investigate the different reasons for students failing to take quizzes.

The different reasons for failure to take quizzes might have implications for which solution might be most effective for everyone. For example, some low-performing students may lack motivation or have many competing contingencies but have the skills. These students might benefit most from increasing reinforcer magnitude and reducing response cost. Other students might lack key skills. These students might benefit from training on study and time management skills but may not benefit from motivational interventions since they may be unable to respond. Perhaps there are more effective ways to target increasing exam grades in low-performing students that do not involve out of class quizzes, such as alternative teaching methods like interteaching (Boyce & Hinline, 2002; Sturmey, Dalfen, & Fienup, 2015), manipulating the quiz accuracy-contingency to make points more valuable to these students, and manipulating response effort or magnitude.

Acknowledgments This research was conducted by the first author in partial fulfillment of a Ph.D. in Psychology (behavior analysis concentration) through the Graduate Center, CUNY.

A portion of Dr. Fienup's work was completed while affiliated with Queens College and The Graduate Center, CUNY.

Compliance with Ethical Standards

The research was determined to be exempt by the institutional review board of the affiliated university.

Conflict of Interest The authors declare that they have no conflict of interest.

References

- Azorlosa, J. L. (2011). The effect of announced quizzes on exam performance: II. *Journal of Instructional Psychology*, 38, 3–7.
- Boyce, T. E., & Hinline, P. N. (2002). Interteaching: a strategy for enhancing the user friendliness of behavioral arrangements in the college classroom. *The Behavior Analyst*, 25, 215–226.
- Burchfield, C. M., & Sappington, J. (2000). Compliance with required reading assignments. *Teaching of Psychology*, 27, 58–60.
- Daniel, D. B., & Broida, J. (2004). Using web-based quizzing to improve exam performance: Lessons learned. *Teaching of Psychology*, 31, 207–208.
- Geiger, O. G., & Bostow, D. E. (1976). Contingency-managed college instruction: Effects of weekly quizzes on performance on examination. *Psychological Reports*, 39, 707–710.
- Graham, R. B. (1999). Unannounced quizzes raise test scores selectively for mid-range students. *Teaching of Psychology*, 26, 271–273.
- Johnson, B. C., & Kiviniemi, M. T. (2009). The effect of online chapter quizzes on exam performance in an undergraduate social psychology course. *Teaching of Psychology*, 36, 33–37.
- Michael, J. (1991). A behavioral perspective on college teaching. *The Behavior Analyst*, 14, 229–239.
- Mulryan-Kyne, C. (2010). Teaching large classes at college and university level: challenges and opportunities. *Teaching in Higher Education*, 15, 175–185.
- Narloch, R., Garbin, C. P., & Turnage, K. D. (2006). Benefits of prelecture quizzes. *Teaching of Psychology*, 33, 109–112.

- Rehfeldt, R. A., Walker, B., Garcia, Y., Lovett, S., & Filipiak, S. (2010). A point contingency for homework submission in the graduate school classroom. *Journal of Applied Behavior Analysis*, 43, 499–502.
- Ryan, C. S., & Hemmes, N. S. (2005). Effects of the contingency for homework submission on homework submission and quiz performance in a college course. *Journal of Applied Behavior Analysis*, 38, 79–88.
- Skinner, B. F. (1968). *The technology of teaching*. Massachusetts: Copley Publishing Group.
- Sturmey, P., Dalfen, S., & Fienup, D. M. (2015). Inter-teaching: a systematic review. *European Journal of Behavior Analysis*, 16, 121–130.
- U.S. Department of Education (2017). *College Scorecard: CUNY Queens College*. Retrieved from: <https://collegescorecard.ed.gov/school/?190664-CUNY-Queens-College>
- Ventura, S., & Onsmann, A. (2009). The use of popular movies during lectures to aid the teaching and learning of undergraduate pharmacology. *Medical Teacher*, 31, 662–664.