

On-line Quizzes: Putting Technology to Work to Aid Student Performance

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Abstract

In a large class, quizzes can be difficult to manage. In-class quizzes require graders or extra time outside of class on the part of the instructor and require valuable class time to complete. In addition, feedback on the quizzes can be slow because of the additional time needed for grading (Bradford, Brown, & Cocking, 2000). On-line quizzes eliminate these problems. They can be given over a longer period of time to meet the outside demands on students, they can introduce new material, grade feedback is instantaneous, and no time is required for grading. It is well documented that students taking quizzes in class do better on exams than those that do not take quizzes (Clump, Bauer, & Whiteleather, 2003).

This study examined whether on-line quizzes enhanced overall course grades and therefore were a benefit to students in a manner similar to in-class quizzes. Several self-reported variables were used to determine the relationship between exam scores and the average number of hours students worked per week, their attendance in class, and the average number of hours they studied for each exam and for on-line quizzes. Results revealed a moderately positive relationship between students' scores on-line quizzes and course grades.

Keywords: on-line quizzes, student performance, classroom technology

Introduction

Students benefit from a variety of teaching aids. While many aids are available such as class notes, keywords from the textbook, chapter summaries, and practice tests, quizzes, especially on-line quizzes, are beneficial to improving student performance. Gurung (2003) studied the benefits to students of a variety of pedagogical aids on exam performance and found that on-line quizzes were only exceeded as an aid to students by boldface and italic terms in the textbook and practice test questions. Many instructors using the on-line quiz method receive as a secondary benefit to their schools a reduction in the use of paper and untold hours of grading that paper quizzes require (Galley, 2003). This newly available time can enhance efficiency and course management (Davis, 2001). Other benefits include instantaneous feedback that not

only lets the students know their standing, it also allows for more continuity when teachers track student grades. When it takes several days or even weeks to grade quizzes instructors find it difficult to know if students are falling behind within quiz related content areas. One basic assumption for classroom assessment is that students require feedback “early and often” (Angelo & Cross, 1998, p. 9). On-line quizzes, when used as a formative weekly assessment, provide continuous feedback to students (Bradford, Brown, & Cocking, 2000).

The course evaluated in this study is an introductory overview of leisure that also meets the social science campus curriculum requirement. Typically, the profile of the course has been recreation majors. In recent years due to the demand for courses meeting a social science requirement, the course has nearly doubled in enrollment with a disproportionate number of non-majors.

Literature Review

The Internet and World Wide Web are an integral part of the lives of today’s students. The Internet is deeply woven into the fabric of just about everything students do. They are comfortable with technology, they embrace its capabilities and they see it as a useable resource both in and out of the classroom (Bonk, Cummings, Hara, Fischler, & Lee, 2000).

Student grades can be influenced by a variety of outside, non-academic obligations. Astin’s (1993) seminal work on college impact using similar variables as this study, showed that attendance, time spent studying and use of technology have the greatest influence on student outcomes, while working has a negative correlation.

The most time consuming influence is work. For many students, work is a necessity. With the income needed to pay for school or to supplement their student financial aid, work may take priority over academics. According to the United States Department of Education, National Center of Education Statistics (1999-2000) the number of students working at least one hour per week was 72.8% for full-time students and the average number of hours worked for full-time students was 22.4 hours.

The 2003 National Survey on Student Engagement (NSSE) identified through surveying first-year and senior students that, “Only about 13% of full-time students spent more than 25 hours per week preparing for class, the appropriate number that faculty members say is needed to do well in college” (NSSE, 2003, p. 7). Almost 40% of those surveyed spend five hours per week on-line doing academic work (NSSE, 2003). Lundberg (2002) discovered that students working over 20 hours per week tended to interact less with faculty and peers than their non-working peers.

The association between the need to work and attendance involves several factors. The increased cost of tuition, limited financial aid, and financial commitments beyond academics all suggest a need to work. Students also have a choice of work-

ing on-campus or off-campus, which can impact time needed to attend classes (Perozzi, Rainey, & Wahlquist, 2003). Considerable research in the area of student employment, attendance and academic achievement exists, but is contradictory in nature (St. Clair, 1999). Canabal (1998) noted that participation in work positively related with GPA while Ford and Bosworth (1995) suggested academic efforts are negatively impacted by employment. Perkins, Pitter, Howat and Whitfield (1999) found GPA's drop proportionally to the amount of money earned while employed which inferred students work more and attend class less to earn more money. Gump (2005) found fewer absences resulted in better overall grades, but they also suggested that attendance was only one of several contributing variables impacting overall course performance.

Technology-based learning opportunities are important when integrated into curriculum, but no improvements or benefits will occur merely on their own (Bradford, et al., 2000). When properly integrated, however, web-based activities can promote higher order learning, reasoning and engagement. Quizzes, when used as a web-based activity, have similar results regarding their influence on a student's overall performance in a course. In a similar study, Clump, et al., (2003) examined the influence quizzes had on student exam scores. They concluded that the more quizzes a student took prior to an exam the better he or she did on the exam that followed. While their main interest was determining if attendance influenced grades, they also discovered that when using participation in quizzes as an indicator of attendance, those present and taking the quizzes scored better on exams.

This study contributes to classroom teaching improvement by offering information that can potentially enhance students' overall course grades. Prior studies on the benefit of technology to overall course performance have been limited due to recent new opportunities provided by software such as WebCT. Information in this study may encourage further use of on-line course quizzes in support of other classroom teaching techniques and may ultimately enhance student outcomes.

The purpose of this paper was to investigate if on-line quizzes improve student grades. In previous studies, outside factors such as class attendance, hours of employment per week, and hours spent studying for each exam influenced overall course performance. While similar studies have been completed in regard to work, attendance, and study, none specifically compared course performance in the context of new on-line technologies. The results of this study may improve classroom-teaching methods that in turn provide meaningful benefits to students.

Methods

Participants

Of the 177 students taking the final exam (185 enrolled in the course) and providing self-reported data, 109 (61.6%) were male and 68 (38.4%) were female. Class

level frequencies showed 55 (30.9%) of the students were freshman, 51 (28.7%) were sophomores, 32 (18.0%) were juniors, 38 (21.3%) were seniors and 1 (.6%) student was registered as a graduate student. Nine students did not provide complete information so they were not used in data analysis. The sample consisted of students enrolled in an introductory leisure studies course at a major university. The course met three days per week for 50 minutes each session. As an introductory recreation core course within the offering department, student enrollment was disproportionately weighted with non-majors. In the fall semester this study was conducted 95% of those enrolled were not recreation majors.

Description of Course and Quizzes

This course is a requirement for recreation majors and an elective for non-majors. The course was taught in a large class format through lectures, class discussions, weekly on-line quizzes, and four in-class examinations. Student final grades were determined by averaging the top ten quiz average out of thirteen possible plus their exam scores for an overall final score. Extra credit was provided for scoring a perfect 100% on ten quizzes, scoring an average of 90% or better for all thirteen quizzes and scoring a perfect 100% on one pre-final exam quiz. In total, 20 extra credit points were possible. Within the course 19% of the students received all 20 extra credit points, 8% received 15 points, 13% received 10 points, 14% received 5 points and 47% did not receive any extra credit points. Grades were assigned using normal distribution with 75% being a "C". A plus/minus grading system was also used.

On-line quizzes were available to students from Tuesday at noon to Sunday at midnight. All quizzes were open book and open note. A maximum of two hours was provided for each quiz and students could take each quiz twice, however, only the highest score was recorded. Students were not provided with the correct answer when they missed questions, but they did know which questions they answered correctly. In total there were 13 quizzes available throughout the 16-week semester. Students did not have to take quizzes in the first week of class, during spring break and the last week of class. Quiz content included a review of readings identified in the syllabus for the following week. The intent of the on-line quizzes was to expose students to new material that would be discussed in class the following week. Quiz formats included true and false, multiple-choice and matching.

Many web-based classroom software packages are available, however, only WebCT is supported by the institution where this study was conducted. On-line quizzes are an integral part of the course curriculum in that they provide an opportunity to actively learn material that may or may not be introduced in the classroom. As an example, when the content area on outdoor recreation is to be delivered within the next week's lesson, questions can be provided in the preceding week to initiate discussions in the following week. The following is an example of a matching question:

“Please match the federal agency with the appropriate statement.”

<u>AGENCY</u>	<u>STATEMENT</u>
National Park Service	Overcrowding, Frozen budgets
U.S. Fish and Wildlife Service	Mechanized travel
U.S. Forest Service	Irrigation and Hydro power
Bureau of Land Management	Most acres in Alaska
Tennessee Valley Authority	Land Between the Lakes

This type of question allows a student to easily find the information in their textbooks and input the correct responses. An example requiring higher order thinking is:

“The smallest national park became a memorial in what year? Hint, look it up on the Internet.”

January 1, 1971

December 19, 1967

November 21, 1980

October 21, 1972

This requires the student to access information beyond the textbook including the Internet, library resources and the instructor. In addition, students may explore the web links and gain new information beyond the original question. The quizzes mirrored the format of the exams. In some cases questions appearing in the quizzes were repeated on exams.

Prior to the beginning of the semester, the instructor selected eight attendance days for use in assigning attendance points. Days used for attendance included three Monday classes, three Wednesday classes and two Friday classes spread through out the semester. Students could miss three class periods during the semester.

Data Collection

Profile data were collected using a Scantron scoring sheet typically used in testing. Students designated their gender and year in school on the scoring sheet. An eight-column section referred to as “Special Codes” allowed for collection of this data. Prior to the final exam the instructor used PowerPoint to explain how to complete this section of the scoring sheet. Questions included percent of attendance,

average number of hours worked per week, average number of hours spent studying for exams and the average number of hours spent completing on-line quizzes. Overall, students had two hours for the final exam, of which they used about five minutes to complete the Scantron sheet.

Data Analysis

Cross tabulations (Table 1) were computed using gender and rank in school for all variables. Final course scores were divided into quintiles of 20% each. When overall course percentage was cross tabulated with gender it revealed males scored lower in relation to females in the lower three quintiles especially centered near the median quantile. Student rank in school when cross-tabulated with attendance showed freshman and sophomores self-reported a higher percentage of attendance than upper classmembers, but overall they did not do as well in the course.

TABLE 1

Frequency of gender and overall percentage in course

Overall Percentage in Course	Male		Female	
	Frequency	Percentage	Frequency	Percentage
0-20%	4	2.4	1	.6
21-40%	13	7.7	3	1.8
41-60%	38	22.6	20	11.9
61-80%	34	20.2	27	16.1
81-100%	15	8.9	13	46.6
Total	104	61.9	64	38.1

Results

Students worked an average of 11.5 hours per week and attended 89.7 percent of the classes (Table 2). Average hours of work per week (SD = 11.95) and attendance (SD = 11.34) had the largest variation. Average hours of work ranged from zero to 45 hours and attendance ranged from 25 to 100 percent. To better gauge the accuracy of student self-reported data, the instructor compared actual attendance taken in class on eight pre-selected days and self-reported attendance. The mean for recorded attendance was 78.8 percent, lower than the self-reported information.

Students reported 3.5 hours as an average number of hours they studied for each of the four required exams. This variable had a low standard deviation (SD = 1.9) with a range of 1 to 12 hours spent studying for each exam. Because of the significant contribution quiz scores have to student overall grades, those that score high on

quizzes may study less for exams. They also reported that they spent 1.3 hours per week completing on-line quizzes. Time spent on on-line quizzes (SD = 0.54) revealed the lowest standard deviation with a range of zero to 3 hours per week. Student scores on all quizzes given throughout the semester had a mean of 93.4%. The overall exam mean was 80.5%.

TABLE 2

Descriptive Statistics for Variables

	N	M	SD
Quiz score average	168	93.4	8.44
Overall course percentage	168	80.5	9.48
Attendance percentage	168	89.7	11.34
Hours of study per exam	168	3.5	1.99
Average hours engaged in on-line quizzes	168	1.3	0.54
Average hours of work weekly	168	11.5	11.95

To determine which of the variables had the most influence on a student's final, correlations were run using SPSS (Table 3). In total, 168 students provided data that were useable for running correlations. Correlation indicating a moderate positive relationships occurred between overall quiz scores (M = 93.4) and their final course percentage (M = 80.5) in the class ($r(168) = .676, p < .01$). Three weak relationships occurred including attendance and final grade percentage ($r(168) = .389, p < .01$), attendance percentage (M = 89.69) and quiz scores ($r(168) = .227, p < .01$) and average hours of study (M = 3.51) and average hours (M=1.3) spent on on-line quizzes ($r(168) = .254, p < .01$). Also, a negative weak relationship was discovered between attendance and work ($r(168) = -.253, p < .01$).

Discussion

The use of on-line quizzes in and of themselves may not improve student performance on exams (Bradford, et al., 2000). Those who score poorly on the quizzes or those that do not complete the required quizzes tend to individually score poorly in the course. Overall, however, the results showed at least a moderate relationship between quiz scores and performance. Other variables only revealed weak relationships. This indicated that on-line quizzes could enhance a student's overall score in a course. Other factors may contribute to a student's success, but none as significant as the quizzes. These correlations suggest that on-line quizzes are related to a student's final grade percentage in this course.

TABLE 3

Correlations Between Independent Variables and Overall Score in Course

Variables	Quiz Score	Overall Attendance	Exam study	Online Quiz	Work	
	Students (n=168)					
Quiz score average	-	.676**	.227	.077	.072	-.114
Overall course percentage	.676**	-	.389	-.017	-.047	-.088
Attendance percentage	.227**	.389**	-	-.053	.017	-.253**
Hours of study per exam	.077	-.017	-.053	-	.254**	-.096
Average hours engaged in on-line quizzes	.072	-.047	-.017	.254**	-	-.068
Average hours of work weekly	-.114	-.088	-.253**	-.096	-.068	-

** $p < 0.01$

These data support previous research regarding in-class quizzes and go one step further by introducing on-line quizzes as an additional teaching method. First, students taking and scoring well on on-line quizzes score higher on exams and over the semester produce a higher average on exams. Second, students that attend class in conjunction with scoring well on quizzes produce higher exam scores. However, this is somewhat tempered by self-reported attendance being higher than actual attendance. Moore (2004) noted that, "On the average, students claimed they had attended more classes and help sessions than they actually had" (p. 16), which succinctly describes a common problem with self-reported data.

Finally, the more time students spend on on-line quizzes the better they do in the class. As with any self-reported data, limitations exist. Students were allowed two hours for each on-line quiz and were provided a second try to better their score. A casual observation of the data suggests students typically spent more time on their first attempt than on the second attempt. This most likely was due to students only having to research the correct answer for the questions they missed in the second quiz. The actual recorded time a student spent on quizzes was not reported.

This study also shows that the more a student works the less they attend class. This is substantiated in other studies showing students that miss class score lower on exams and in the course overall (Moore, 2004; Clump, et al., 2003).

On-line quiz technology, when used in the support of classroom instruction, can improve overall scores. Many other on-line resources are available and should be researched for their contribution to student performance. These include electronic provision of class notes and grades, chat rooms and mass emailing through electronic class rosters. Furthermore, studies that explore the relationship of attendance in class and the use of other on-line technology should be investigated. There may be a fine line between offering course material to students outside of class and their motivation to attend class.

On-line quizzes not only benefit students, but also result in instructors spending less time grading, which results in more time for instruction in the classroom. At a minimum, the benefits of less time grading, immediate feedback for students and easier access by students, should stimulate more interest in using this technology to enhance teaching. Shrinking budgets, larger class sizes and fewer teaching faculty should motivate faculty to explore the benefits realized through the use of on-line quizzes.

References

- Angelo, T. A., & Cross, K. P. (1998). *Classroom assessment techniques: A handbook for college teachers*. San Francisco: Jossey-Bass.
- Astin, A. (1993). *What matters in college? Four critical years revisited*. San Francisco: Jossey-Bass.
- Bonk, C. J., Cummings, J. A., Hara, N., Fischler, R. B., & Lee, S. M. (2000). A ten-level web integration continuum for higher education. In B. Abbey (Ed.), *Instructors and cognitive impacts of web-based education* (pp. 56–77). Hershey, PA: Idea Group Publishing.
- Bransford, J. D., Brown, A. L., & Cocking, R.R. (2000). *How people learn: Brain, mind, experience, and school*. Washington, DC: National Academy Press.
- Canabal, M. E. (1998, December) College student degree participation in the labor force: Determinants and relationship to school performance. *College Student Journal*, 32(4), 597-606.
- Clump, M. A., Bauer, H., & Whiteleather, A. (2003). To attend or not to attend: Is that a good question? *Journal of Instructional Psychology*, 30(3), 220-225.
- Davis, B. G. (2001) *Tools for teaching*. San Francisco: Jossey-Bass.
- Ford, J., & Bosworth, D. (1995, June). Part-time work and full-time education. *Studies in Higher Education*, 20(2), 454-470.
- Galley, M., (2003, May 8). The teacher's new test. *Education Week*, 22, 31-34.

Gump, S. E. (2005). The cost of cutting class. *College Teaching*, 53(1), 21-26.

Gurung, R. A. R. (2003). Pedagogical aids and student performance. *Teaching of Psychology*, 30(2), 92-95.

Lundberg, C. A. (2002, November). *Working and learning: The role of involvement for employed students*. Paper presented at the meeting of the Association for the Study of Higher Education, Sacramento, CA.

Moore, R. (2004). Helping students succeed in introductory science courses: How valid are student's claims about their course related behaviors. *Journal of College Science Teaching*, 33(4), 14-17.

National Center of Education Statistics (1999-2000). 1999-2000 National Postsecondary Student Aid Study. Retrieved July 12, 2004 from http://nces.ed.gov/das/library/tables_listings/show_nedrc.asp?rt=p&tableID=369.

National Survey on Student Engagement (NSSE), (2003). *National survey on student engagement, 2003 overview*. Retrieved July 12, 2004 from http://www.indiana.edu/~nsse/html/overview_2003.htm.

Perkins, G., Pitter, G., Wijesinghe, H., Howit, C., & Whitfield, D. (1999). *Relationship of financial aid, work and college performance*. Association for Institutional Research 1999 Annual Forum Paper.

Perozzi, B., Rainey A., & Wahlquist Z. (2003, September 1). A review of the effects of student employment on academic achievement. *The Online Bulletin: The monthly magazine of the Association of College Unions International*, 71(5). Retrieved July 12, 2004, from www.acui.org/Acui/resfiles/effectsreview.cfm.

St. Clair, K. L. (1999). A case against compulsory class attendance policies in higher education. *Innovative Higher Education*, 23(3), 171-180.