The Effects of Open Book Testing on Student Performance in Online Learning Environments*

Glenda C. Rakes
Professor
The University of Tennessee – Martin
College of Education and Behavioral Sciences
Department of Educational Studies
Gooch Hall 205F
Martin, Tennessee 38238

Phone: 731.881.7217
Fax: 731.881.1809
Email: grakes@utm.edu

* This research was sponsored by the Project RITE grant, The University of Tennessee, Office of Information Technology, Educational Technology Collaborative, 2005-2006.

The Effects of Open Book Testing on Student Performance

in Online Learning Environments

There is increasing evidence that online course and program offerings have penetrated the mainstream of colleges and universities across the country. To illustrate, Allen and Seaman (2005) report that:

- the overall percent of schools identifying online education as a critical, long term strategy grew from 49% in 2003 to 56% in 2005.
- sixty-five percent of higher education institutions report they are primarily using core faculty to teach their online courses.
- sixty-five percent of schools offering graduate face-to-face courses also offer graduate courses online.
- among all schools offering face-to-face Master's degree programs, 44% also offer Master's programs online.

With the proliferation of online courses as part of many college degree programs come many concerns about the quality of online courses. Concerns over the new role of faculty, establishing effective communication with students, motivating students, and assuring learning outcomes are growing (Yang & Cornelious, 2005). A continuing concern regarding learning outcomes is associated with assessment of student performance.

A variety of performance assessments, including examinations, should be employed to assure quality in online instruction (Yang & Cornelious, 2005). Academic integrity of the evaluation process is of particular concern in an online environment. According to Olt (2002), one way to help ensure academic integrity in online courses is through the use of open book examinations.

Open book testing may also promote more realistic learning opportunities that emphasize higher order thinking skills. Feller (1994) believed that closed book examinations test only what students can memorize, while open book examinations have the potential to measure higher level thinking skills that relate more closely to real-world work environments. He believed the open book examination was one method for incorporating such realistic, open-ended tasks into higher education.

In the work environment, individuals use multiple pieces of reference materials when they need to answer a question, prepare a report, or solve problems. Open book examinations can eliminate the need for total rote memorization of many pieces of information and allow the use of reference materials instead. This type of test has the potential to measure students' ability to organize and use or apply information rather than simply memorizing it.

Review of the Literature

Several researchers have studied whether the way in which objective tests are administered to students affect student achievement on tests in college and university courses. A wide range of results can be found in this literature regarding the effect of open book testing on student performance.

Some research findings demonstrate that students perform better on open book tests than traditional tests (Liu, 2005; diVesta, 1954). For example, Francis (1982) investigated the effect of using open book tests in a university English literature course. Results showed that students earned higher test scores than their peers who took a traditional examination.

Other researchers have reported that students perform equally well on open book examinations as they do on traditional examinations (Ioannidou, 1997; Jehu, Pincton, & Cher,

1970; Kalish, 1958; Krarup, Naeraa, & Olsen, 1974; Pauker, 1974; Weber, McBee, & Krebs, 1983). For example, Ioannidou (1997) studied 72 sophomores and juniors enrolled in a college education course and found no significant difference in overall examination scores between students who took an open book examination than those who took a traditional examination. Pauker (1974) studied student performance in an undergraduate child psychology course and found no significant differences in the average student test scores when comparing open book to closed book tests.

A few researchers found that at least some subgroups of students perform at lower levels on open book tests than those taking traditional, proctored examinations (Francis, 1982). For example, Pauker (1974) found that overall scores were not different between the two groups (traditional and open book examinations), but the below average students' scores were significantly lower on open book examinations. Boniface (1985) and Ioannidou (1997) both found that students who devoted more examination time to using notes and texts on an open book test obtained lower scores on the examination. diSibio (1983) found that not only did open book testing fail to promote higher order processing of information compared to a closed book examination, the expectation of receiving an open book test actually proved detrimental to such processing. Wellman and Marcinkiewicz (2004) studied 120 college pharmacy students and found that students provided with online, proctored assessment scored better than students who took online unproctored assessments.

These results may be attributed in part to the fact that, in general, students may not prepare adequately for open book tests (Boniface, 1985; Brightwell, Daniel, & Stewart, 2004; Theophilides & Koutselini, 2000; Weber et al., 1983). Students reported they did not invest as much study time or effort into preparation for open book examinations as compared to the

amount of time and effort invested in preparation for traditional, closed book, proctored examinations (Clift & Imrie, 1981; Crooks, 1988; diSibio, 1983; Weber, et al., 1983).

Open book examinations have been shown to reduce anxiety levels in students as they prepare for and complete tests (Feldhausen, 1961; Feller, 1994; Francis, 1982; Boniface, 1985; Ioannidou 1997; Liska & Simonson, 1991; Theophilides & Dionysiou, 1996), along with the tendency to "cram" at the last minute since the dependency on rote memorization is reduced. Some believe that open book tests result in more comprehensive student preparation and more consistent learning during a course (Theophilides & Dionysiou, 1996; Theophilides & Koutselini, 2000).

The Present Study

Research has demonstrated that a lack of preparation for open book tests exists on the part of some students (Boniface, 1985; Brightwell, et al., 2004; Theophilides & Koutselini, 2000; Weber, et al., 1983). This phenomenon may be related to the fact that anxiety is reduced when taking open book examinations —perhaps too much — to the point students believe little or no preparation is required in order to perform well on the test (Feldhausen, 1961; Feller, 1994; Francis, 1982; Boniface, 1985; Ioannidou 1997; Liska & Simonson, 1991; Theophilides & Dionysiou, 1996).

This behavior may also be due, in part, to students' lack of understanding concerning the differences between traditional, proctored tests and unproctored, open book tests. Students may not understand organizational and other skills and strategies needed to succeed on open book examinations. As a result, they spend too much time with books and notes during testing periods, which limits their ability to successfully complete the test, which, in turn, can result in lower test

scores (Boniface, 1985; Ioannidou, 1997).

This study investigated the differences in student performance on examinations taken in face-to-face, proctored testing environments and in online, open book, unproctored settings. This study also investigated the impact of training in open book test-taking skills on student performance in online, open book, unproctored test environments.

The first hypothesis for the present two-part study is that online students' performance on timed, unproctored, open book examinations will be significantly lower than traditional students' performance on timed, proctored, closed book examinations because students do not understand the requirements and preparation needed for successful performance on open book tests. The second hypothesis is that online students provided with training in open book testing skills will score significantly higher on online, unproctored, open book tests than online students who are not provided with the training.

This research was guided by two primary questions:

1) Is there a difference in mean test scores on midterm and final examinations between students in traditional, face-to-face classrooms in which students completed timed, proctored, closed book tests and students who took timed, unproctored, open book tests in an online environment?
2) Is there a difference in mean test scores on midterm and final examinations between online students taking timed, unproctored, open book tests who were provided Web-based training in open book testing skills and students who were not provided such training?

Methodology

The first part of this study compared the effects of open book testing in an online environment as opposed to closed book, proctored testing in a traditional classroom environment on student learning as measured by objective midterm and final examinations. All students were enrolled in an introductory graduate course in instructional technology from 2000-2005 taught by a single instructor. The structure and assignments for both traditional and online sections of the course were very similar, varying slightly with the edition of the text in use.

The first population consisted of 114 masters and doctoral level students enrolled in an NCATE accredited education program in two southern states. The experimental group contained 72 graduate students who participated in online instruction using the Blackboard learning system through which they took the examinations. The control group contained 42 graduate students who received traditional, face-to-face instruction who took the examinations in an in-class, proctored setting. The control group took HTML coded examinations online through the instructor's password protected university Web directory.

Participants in both groups completed multiple choice midterm and final examinations similar in length and content based on the standardized tests provided by the textbook publisher for each edition used in the period under investigation. All examinations contained approximately 100 points. All were administered using an imposed time limit of 90 minutes. The assessment used for this study consisted of a multiple choice midterm test and a multiple choice final examination based on the current version of *Instructional Media and Technologies for Learning* (Heinich, R., Molenda, M., Russell, J.D., & Smaldino, S.E., 1999; Heinich, R., Molenda, M., Russell, J.D., & Smaldino, S.E., 2002; Smaldino, S.E., Russell, J.D., Heinich, R., & Molenda, M., 2005). The assessments contained both recall and application-level questions.

The fact that the exams were similar but not exactly the same for all students because of the different text versions of the text is a limitation of the first part of the study.

The second part of this study investigated whether there was a difference in test performance between students taking online, unproctored, open book tests who were provided with training in open book test taking skills before the examinations and those who were not provided such training. Subjects for the second part of the study were 49 masters students enrolled in the same introductory instructional technology course in the fall and spring of 2005-2006 in an NCATE accredited education program at a southern university. The control group consisted of 23 students who took online, unproctored, open book examinations in Blackboard during the fall of 2005, but who did not receive training regarding open book test taking skills. The experimental group consisted of 26 students who took the same course during the following spring semester who were provided Web-based training regarding open book test taking skills.

A practice test was provided which allowed all students to experience the actual test environment before each examination. Students in both the control and experimental groups were required to complete the practice test before taking the midterm and final examinations. Web based training materials were developed based on the review of the literature and provided for the experimental group. These training materials can be located on the World Wide Web.

Information for the training materials was divided into three major categories in addition to an overview: 1) Organize Your Information, 2) Manage Your Time, and 3) Prepare the Environment. Students in the experimental group were required to review the open book testing tutorial prior to each examination and successfully complete a 21-question quiz over the material that was available in Blackboard. A score of 100% was required, with students provided the

opportunity to take the quiz as many times as necessary to achieve the required score. No student was allowed to take either the midterm or final examination until this requirement was fulfilled.

Results

Research Question 1: Is there a difference in mean test scores on midterm and final examinations between students in traditional, face-to-face classrooms in which students completed timed, proctored, closed book tests and students who took timed, unproctored, open book tests in an online environment?

The data were analyzed using Analysis of Variance. Results indicated that, on the midterm examination, those students from the traditional classes (n=42; M = 91.24; p<.001) had significantly higher midterm examination scores than those students from the online classes (n=72; $\overline{X}$ = 85.05). Results further indicated that, on the final examination, those students from the traditional classes (n=42; M = 89.55) had significantly higher final examination scores than those students from the online classes (n=72; $\overline{X}$ = 83.48; p<.001). ANOVA results are presented in Table 1 below.

Table 1. ANOVA Results

		Sum of Squares	df	Mean Square	F	Sig.
Midterm Exam	Between Groups	1015.173	1	1015.173	10.938	.001
	Within Groups	10395.360	112	92.816		
	Total	11410.533	113			
Final Exam	Between Groups	978.587	1	978.587	12.555	.001

Within Groups	8729.663	112	77.943
Total	9708.249	113	

Research Question 2: Is there a difference in mean test scores on midterm and final examinations between online students taking timed, open book tests who were provided Web-based training in open book testing skills and students who were not provided such training?

The data were analyzed using Analysis of Variance to determine if the mean scores from the midterm and final examinations were significantly different between the two groups. Results indicated that, on the midterm examination, those students from the experimental group (n=26; $\overline{X}$ = 87.58 had significantly higher midterm examination scores than students from the control group (n=23; $\overline{X}$ =81.61; p<.047). Results further indicated that, on the final examination, those students from the experimental group (n=26; $\overline{X}$ = 88.31) had significantly higher final examination scores than those students from the control group (n=23; $\overline{X}$ = 83.57; p<.021). ANOVA results are presented in Table 2 below.

Table 2. ANOVA Results

		Sum of Squares	df	Mean Square	F	Sig.
Midterm Exam	Between Groups	434.706	1	434.706	4.170	.047
	Within Groups	4899.824	47	104.252		
	Total	5334.531	48			

Final Exam	Between Groups	274.483	1	274.483	5.675	.021
	Within Groups	2273.191	47	48.366		
	Total	2547.673	48			

Discussion

With the increasing use of online learning by colleges and universities, faculty and administrators need to evaluate new roles of faculty and students and the effect of various online teaching practices on student achievement. Examination of a variety of assessment methods is an important part of the process. The availability of online testing environments such as provided through software such as Blackboard and WebCT, bring questions concerning the effect of these new testing opportunities on student performance.

In the first part of this study, results indicated that unproctored, open book tests were not necessarily easier for students than traditional tests. These results reinforce those of Brightwell, et al. (2004) who also concluded that open book tests were not easier than traditional examinations. Faculty preparing examinations for online students should consider open book examinations as a viable assessment alternative that can help quiet concerns regarding academic honesty (Olt, 2002) and provide an opportunity to assess higher order thinking skills (Feller, 1994).

The results from second part of this study indicated that student test performance may be adversely affected because they do not necessarily understand the differences in traditional, proctored, examinations and the requirements of unproctored, open book examinations. The findings of this study indicate that training may mitigate the inclination not to study for open book examinations (diSibio, 1983) by providing instruction concerning how to successfully

prepare for and complete open book tests. With preparation, students in this study performed significantly better than students who did not receive the training.

More research is needed to assess the possibilities for open book testing in the online learning environment using a larger subject base. Few studies that compare traditional and online assessments that are longitudinal in nature are available in the literature. Fewer studies regarding online learning and assessment have been conducted using graduate students. As online learning opportunities increase, the need for additional research into effective assessment possibilities also increases. The results of this study indicate that the use of open book testing may be a reasonable alternative or addition to traditional assessment methods.

References

Allen, I. E., & Seaman, J. (2005). Growing by degrees: Online education in the United States, 2005. Needham, MA: The Sloan Consortium Retrieved May 10, 2006, from http://www.sloan-c.org/resources/survey.asp

Boniface, D. (1985). Candidates' use of notes and textbooks during an open book examination. *Educational Research*, *27*(3), 201-209.

Brightwell, R., Daniel, J., & Stewart, A. (2004). Evaluation: Is an open book examination easier? *Bioscience Education E-Journal*, *3*. Retrieved May 10, 2006 from http://www.bioscience.heacademy.ac.uk/journal/vol3/Beej-3-3.htm

Clift, J. C., & Imrie, B.W. (1981). Assessing students, appraising teaching. New York: John Wiley and Sons.

Crooks, T. J. (1988). The impact of classroom evaluation practices on students. *Review of Educational Research*, *58*(4), 438-481.

diSibio, M.P. (1983). Open and closed book testing: Expectancy effects. *Dissertation Abstracts International*, *45*(06B),1939. (UMI No. 8413361)

diVesta, F.J. (1954). The effect of methods of presentation and examining conditions on student achievement in a correspondence course. *Journal of Applied Psychology*, *3*, 253-255.

Feldhausen, J.F. (1961). An evaluation of college students' reactions to open book examinations. *Educational and Psychological Measurement*, *21*, 637-646.

Feller, M. (1994). Open-book testing and education for the future. *Studies in Educational Evaluation*, *20*(2), 235-238.

Francis, J.C. (1982). A case for open-book examinations. *Educational Review*, *34*(1), 13-26.

Heinich, R., Molenda, M., Russell, J.D., & Smaldino, S.E. (1999). *Instructional media and technologies for learning* (6th ed.). Upper Saddle River, NJ: Merrill Prentice Hall.

Heinich, R., Molenda, M., Russell, J.D., & Smaldino, S.E. (2002). *Instructional media and technologies for learning* (7th ed.). Upper Saddle River, NJ: Merrill Prentice Hall.

Ioannidou, M.K. (1997). Testing and life-long learning: Open-book and closed-book examination in a university course, *Studies in Educational Evaluation*, *23*(2),131– 139.

Jehu, D., Pincton, C.J., & Cher, S. (1970). The use of notes in examinations. *British Journal of Educational Psychology*, *40*, 353–357.

Kalish, R.A. (1958). An experimental evaluation of the open-book examination. *Journal of Educational Psychology*, *49*, 220–240.

Krarup, N., Naeraa, N., & Olsen, C. (1974). Open-book tests in a university course. *Higher Education*, *3*(2), 157-164.

Liska, T., & Simonson, J. (1991). Open-text and open-note examinations. *Teaching Professor*, *5*(5), 1-2.

Liu, Y. (2005). Effects of online instruction vs. traditional Instruction on students' learning. *International Journal of Instructional Technology and Distance Learning*, *2*(3). Retrieved May 9, 2006 from http://www.itdl.org/Journal/Mar_05/article06.htm

Olt, M. (2002). Ethics and distance education: Strategies for minimizing academic dishonesty in online assessment. *Online Journal of Distance Learning Administration*, *5*(3). Retrieved April 20, 2006, from http://www.westga.edu/~distance/ojdla/fall53/olt53.html

Pauker, J.D. (1974). Effect of open book examinations on test performance in an undergraduate child psychology course. *Teaching of Psychology*, *1*(2), 71-73.

Smaldino, S.E., Russell, J.D., Heinich, R., & Molenda, M. (2005). *Instructional media and technologies for learning* (8th ed.). Upper Saddle River, NJ: Prentice Hall.

Theophilides, C. & Dionysiou, O. (1996). The major functions of the open book examination at the university level: A factor analytic study. *Studies in Educational Evaluation*, *22*(2), 157-170.

Theophilides, C., & Koutselini, M. (2000). Study behavior in the closed-book and the open-book examination: A comparative analysis. *Educational Research and Evaluation*, *6*(4), 379-393.

Weber, L.J., McBee, J.K., & Krebs, J.E. (1983). Take home tests: An experimental study. *Research in Higher Education*, *18*(4) 473-483.

Wellman, G.S., & Marcinkiewicz, H. (2004). Online learning and time-on-task: Impact of proctored vs. un-proctored testing. *Journal of Asynchronous Learning Networks, 8*(4). Retrieved May 11, 2006 from http://www.sloanc.org/publications/jaln/v8n4/v8n4_wellman.asp

Yang, Y., & Cornelious, L.F. (2005). Preparing instructors for quality online instruction. *Online Journal of Distance Learning Administration*, *8*(1). Retrieved May 10, 2006 from http://www.westga.edu/%7Edistance/ojdla/spring81/spring81.htm