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Ruth Lapsley

Brian Kulik

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J. B. (Ben) Arbaugh

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Is Identical Really Identical? An Investigation of Equivalency Theory and Online Learning

Ruth Lapsley, *Lewis-Clark State College*

Brian Kulik, *Central Washington University*

Rex Moody, *University of Colorado—Boulder*

J. B. (Ben) Arbaugh, *University of Wisconsin Oshkosh*

Abstract

This study investigates the validity of equivalency theory among 63 students by comparing two introductory upper-division human resource management courses: one taught online, the other in a traditional classroom. Commonalities included same term, same professor, and identical assignments/tests in the same order, thus allowing a direct comparison of course outcomes. MANCOVA results supported equivalency theory, and further suggest that the online learning pedagogy may be superior in its overall effect on student performance.

Introduction

While there is emerging research suggesting that courses delivered online produce at least comparable learning outcomes relative to traditional classroom-based courses when using similar instructional methods (Sitzmann, Kraiger, Stewart, and Wisher, 2006), the extent to which this conclusion can be reached based upon evidence varies substantially within the management discipline. While subjects such as management science (Dellana, Collins, and West, 2000; McLaren, 2004), management information systems (Clouse and Evans, 2003; Piccoli, Ahmad, and Ives, 2001; Webb, Gill, and Poe, 2005), organizational behavior (Friday, Friday-Stroud, Green, and Hill, 2006; Meisel and Marx, 1999), and strategy (Arbaugh, 2000; Friday et al., 2006) have been subjects of “online vs. classroom” comparison studies, courses in the human resources discipline have yet to be extensively considered in this body of research.

Another concern regarding comparison studies of online and classroom-based learning is the focus of the analysis. While some of these studies consider student characteristics such as gender (Arbaugh, 2000; Friday et al., 2006) or learning style (Clouse and Evans, 2003) in their designs, in measuring course design characteristics they tend to focus almost exclusively on exam performance. Such a perspective is particularly problematic for the management discipline since these courses often use a variety of approaches in addition to exams to assess student learning (Bailey, Sass, Swiercz, Seal, and Kayes, 2005; Fornaciari and Dean, 2005; Williams, Duray, and Eddy, 2006). This suggests that the design of online courses within the management discipline should be considered more comprehensively in comparison studies. Simonson, Schlosser and Hanson (1999) offered an "equivalency theory," stating that courses should provide equivalent learning experiences for all students, regardless of the method of delivery (traditional classroom, interactive telecommunication systems, or online). For this study, two sections of an undergraduate course were offered during the same quarter by one professor using identical syllabi and assessment instruments. The two courses differed only in the presentation format: one was a traditional classroom with limited online exercises and one was entirely online. These increased experimental controls allow for a more rigorous testing of equivalency theory than previous studies have provided.

Equivalency Theory and Online Learning

Simonson and colleagues (1999) developed equivalency theory as a means to integrate previous theories of distance education into a uniquely American perspective in light of recent advances in telecommunications technologies. The theory is intended to insure that distance education does not become an inferior form of education, and in fact may not even be a distinct field of education. Equivalency theory argues that the more equivalent the learning experiences of distance learners to that of local learners, the more equivalent the educational outcomes for all learners. Such an approach suggests that course designers create learning experiences of equivalent value for learners regardless of the course delivery medium, allowing that the experiences themselves could be different.

Recent discussions of equivalency theory have focused on how one establishes “equivalence.” Watkins and Schlosser (2000) argued that equivalence should be determined based upon demonstrated learner accomplishment rather than instructional time-based criteria. Such an approach suggests the need to evaluate learner performance on similar types of assessments using a broader range of assessments than final exam scores, which tends to be the measure of choice in many “online vs. classroom” studies (Weber and Lennon, 2007). While recent comparison studies in business education have begun to compare other outcomes such as participation patterns, class projects, and overall course grade (Arbaugh, 2000; Friday et al., 2006; Weber and Lennon, 2007), the range of activities considered in such studies to date remains relatively limited. Therefore, it is the intent of this study is to examine the question whether online teaching is less, as, or more effective than traditional classroom teaching across a variety of assessment methods. To this end, a methodology to test equivalency theory is developed, and results are discussed in terms of their potential support of equivalency theory. Implications of the findings toward the further pursuit of equivalency theory relevance and usefulness are considered.

Methodology

Research testing the support of equivalency theory needs to move in the direction of increased experimental controls using appropriate subjects. Interpreting the equivalency guidelines of

Simonson and colleagues (1999), we incorporate the following controls on undergraduate subjects: two equivalent courses were administered at the same time by the same professor, with virtually the only difference being different pedagogy (one course was conducted entirely online, the other course was held in a traditional classroom). Thus, by presenting the same course material in the same order, with identical assignments, quiz questions, and final reports, student outcomes in the traditional course can be more rigorously compared to the learning experienced by the online students. The course used in this study was “Management of Human Resources,” an introductory class designed to familiarize students with various aspects of the HR discipline. This junior-level course covers the basics of human resource management including definitions, current practices, and a review of HR laws.

The online course used in this study was developed to meet students' demands for a course with greater time flexibility at a branch campus approximately 100 miles from the main campus of a university located in the northwestern United States. Most of the online students were transfer students with an associate's degree from a community college where many of the courses are offered online. The professor who administered both the traditional and online courses had taught both types of courses numerous times, however, this was the first time the professor taught two sections of the same course, during the same quarter, using different delivery methods.

Prior to accepting the task of teaching the web-based course, the professor had chosen to modify the traditional course to accommodate a different textbook with more web resources for students and more exercises and problems at the end of each chapter. Therefore, a new online-savvy textbook was used for both the online and traditional classroom courses. The syllabi for the courses were essentially identical, except that the syllabus for the online course contained information on how to access the course management system, Blackboard™, and listed deadlines for completing each online quiz or problem. Both syllabi stated, for instance, that Chapters 1 and 2 would be covered in Week 1. While the traditional classroom students had to attend classes and participate in Chapter 1 and 2 discussions on Tuesday and Thursday, the online students were required to participate in an online asynchronous discussion involving Chapter 1 and 2 materials, responding no later than Sunday midnight. Three different types of instruments were used to

assess student learning in both sections of the junior-level, introductory human resource management course: chapter quizzes, online discussions, and written reports.

The traditional classroom pedagogy consisted of lectures and in-class discussions, with homework from the end-of-chapter exercises and problems. The online classroom pedagogy differed in that online students didn't hear lectures and in lieu of homework were required to participate in online threaded discussions centered on the same end-of-chapter exercises and problems as the classroom students. Students in both courses had access to Blackboard™ and were encouraged to take online practice quizzes (in Blackboard™) supplied by the textbook publisher. Practice quizzes were in the same multiple choice format as the graded quizzes for both classes. To familiarize the traditional classroom students with the Blackboard™ system, they were required to attend a seminar in a computer lab where they were guided through the software and then required to participate in a trial online threaded discussion. In contrast, the online students were required to have some familiarity with computers prior to registering for the class; therefore, no such lab training was offered them.

The 37 students enrolled in the classroom section of the course were mostly traditional, residential undergraduate college students at the main campus. The 26 students in the online course were geographically distant so never met the professor face-to-face; contact was limited to e-mail, online discussions, and occasional phone calls from students to the professor. These students were mostly non-traditional, with many of them working full-time and taking the course due to its time flexibility (as self-reported in their introductory online discussions). The course initially contained 28 students but one dropped due to personal time constraints, while one other dropped the course due to lack of computer skills.

The students from the two courses can be compared on a number of demographic variables to determine how the two samples differed. For each individual the variables included grade point average, credits earned to date, and age. All variables were measured at the start of the class. Other variables included number of credits taken during the same quarter as the test class, sex, and whether the student was a business major or not. Results from either t-tests or chi-square tests, depending on the level of data contained in the variable being tested, are shown in Tables 1

and 2. All data for these tests were collected from university student records. Based on the tests, a number of significant demographic differences exist between the two classes. The students in the online course, in general, had higher grade point averages, were older, took fewer credits during the same term, and were more likely to be business majors. There were no significant differences in the students from the two classes in terms of credits earned to date and sex.

TABLE 1: Comparison of Ratio-level Demographic Variables by Class

Variable	Class Type	N	Mean	Std. Dev.	t	Sig.
GPA when class started	Traditional	34	2.67	.55	-2.823	.007
	Online	24	3.06	.48		
Credits earned to date	Traditional	37	131.16	28.51	-.984	.329
	Online	26	137.81	23.02		
Age in Years	Traditional	37	22.62	1.72	-4.404	.000
	Online	26	28.88	7.11		
Number of credits taken during term of class	Traditional	37	15.05	1.96	-3.136	.004
	Online	26	12.42	3.95		

TABLE 2: Comparison of Nominal-level Demographic Variables by Class

Class Type	Variable Counts and Percentages		Chi-Square	d.f.	Sig.
	Business Major	Other Major	17.01	1	.000
Traditional	9 24.3%	28 75.7%			
Online	20 76.9%	6 23.1%			
	Female	Male			
Traditional	16 43.2%	21 56.8%			
Online	14 53.8%	12 46.2%			

All students in both versions of the course were required to complete 16 quizzes, each consisting of 15 multiple-choice questions, one per textbook chapter; the quiz questions for each chapter were identical and presented in the same order for both courses. The traditional students were given 14 of the quizzes in class via traditional paper and pencil methods; they were required to complete two of the quizzes online on a computer of their choice, outside of the classroom, on their own time. These two online quizzes were required so traditional classroom students would receive some exposure to the online learning environment, a format they might encounter in future courses. Their first online quiz (Chapter 16, Global Issues) followed a typical lecture on the associated course material, and students had access to on-campus computer labs immediately following the lecture, although most preferred to take the quiz later. For the second quiz (Chapter 11, Benefits), the students were asked to read the chapter and complete the quiz on their own. The professor was available during normal office hours to answer any questions these traditional classroom students might have, but no students sought assistance with the subject matter.

For the online course students, quizzes for each chapter were available on a one-time basis with a 25-minute time limit (same timeframe allowed the traditional students), and each 15-question quiz was to be completed during the week shown in the syllabus. Access to the quiz was denied after the one-week timeframe that corresponded to the traditional classroom's week. The online students had access to the professor via e-mail and phone, but few chose to use these methods. This study compares the results of the two classes' online quizzes since these were identical experiences for both groups, except the traditional classroom students had a typical lecture prior to the first online quiz and were given limited guidance prior to the second online quiz.

Online threaded discussions provided a means for the online students to exchange ideas, taking the place of the in-class discussions and homework. Students were to submit a response to an end-of-chapter exercise or question that could be read and commented on by other class participants in asynchronous time. A rubric was used to rate the responses, with points associated with various types of responses: low points were given to mere opinions, higher points were given when students related their answers to the textbook material, and the highest points rewarded students who not only related responses to the text but also incorporated additional information from websites or from speaking with professionals. The rubric was attached to the

syllabus and readily available to students in both the online course and the traditional classroom course. While the online course students were required to respond to thirteen online threaded discussion questions, the traditional classroom students were only asked to respond to three; the other questions and exercises were part of typical classroom discussions. Both classes responded to identical threaded discussion problems from chapters 5, 7 and 11, and both classes had the same time restrictions placed on them for responses. Grades for these three discussion questions are compared since they are common elements for both classes, although students would have acquired the information differently (in-class discussion versus self-learning).

As the final assessment piece for the course, each student in each course section was required to submit a written report, due the last week of class. Students in both sections of the course were given the option of e-mailing the reports to the professor or handing in a hard copy. All reports were graded from hard copies; those e-mailed to the professor were printed out prior to grading. The same grading rubric attached to both syllabi was used for all grading. Report requirements were described in depth in syllabi for both sections; verbal class discussion of the reports in the traditional classroom was minimal, with students being referred to the syllabus for additional information. Approximately equal numbers of students from both classes required additional explanation of the report requirements--primarily via e-mail and telephone.

Results

Table 3 shows means, standard deviations, and cell sizes for the student scores on the common quizzes, online discussions, and final reports for both the traditional classroom and the online courses. The much larger standard deviations shown for all the assessment tools for the traditional classroom are likely due to the scores of "zero" received by some students for the threaded discussions and quizzes--they apparently "forgot" or chose not to access the online quizzes and discussions prior to the deadline. In one instance, a student from the traditional classroom completed the course, but completed only one of the common assignments used in this study. This student's scores were removed from the analysis with no substantial change to the study's results. Except for this one case, the zero scores students received are random across various students, with no discernable pattern of when they appear; hence, these scores were not

removed as outliers because they were considered to represent the performance of the traditional classroom course as a whole. Table 4 is a correlation matrix that includes all continuous (ratio) dependent variables used in the study.

TABLE 3: Assessment Method Means by Class

Type of class		Online quiz for chapter 16 (15 points possible)	Online quiz for chapter 11 (15 points possible)	Online discussion for chapter 5 (20 points possible)	Online discussion for chapter 7 (20 points possible)	Online discussion for chapter 11 (20 points possible)	Written report (100 points possible)	Overall GPA (4.00 possible)
Traditional classroom course	Mean	10.38	9.86	15.81	17.08	16.30	90.95	2.726
	N	37	37	37	37	37	37	37
	Std. Dev.	4.016	4.547	5.792	6.175	6.476	17.010	.508
Online course	Mean	11.65	13.65	18.81	19.04	18.77	94.19	3.171
	N	26	26	26	26	26	26	26
	Std. Dev.	1.056	1.263	1.550	1.371	4.072	6.099	.368
Totals (combined)	Mean	10.90	11.43	17.05	17.89	17.32	92.29	2.910
	N	63	63	63	63	63	63	63
	Std. Dev.	3.196	4.023	4.760	4.883	5.705	13.623	.503

TABLE 4: Correlation Matrix of Assessment Instruments

	Online quiz for chapter 16	Online quiz for chapter 11	Online threaded discussion for chapter 5	Online threaded discussion for chapter 7	Online threaded discussion for chapter 11	Written report
Online quiz for chapter 16	1					
Online quiz for chapter 11	.454**	1				
Online threaded discussion for chapter 5	.305*	.136	1			
Online threaded discussion for chapter 7	.287*	.285*	.475**	1		
Online threaded discussion for chapter 11	.420**	.548**	.365**	.220	1	
Written report	.415**	.368**	.068	.534**	.358**	1
Overall GPA	.317*	.505**	.425**	.356**	.343**	.271*

* = correlations sig. at .05 level

** = correlations sig. at .01 level

TABLE 5: Univariate Results with Class (only) as Independent Factor

Source	Sum of Sqs.	df	F	Sig.
Online quiz for chapter 16	24.841	1	2.490	.120
Online quiz for chapter 11	219.220	1	17.052	.000
Online threaded discussion for chapter 5	137.143	1	6.599	.013
Online threaded discussion for chapter 7	58.504	1	2.514	.118
Online threaded discussion for chapter 11	93.306	1	2.958	.091
Written report	160.927	1	.865	.356

The findings were initially surprising; it was expected that students in the traditional classroom course would perform better on the quizzes than students in the online course. Often professors emphasize material that will be tested, and students have the opportunity to ask questions and to observe the professor's personal style including verbiage from classroom lectures often used in test question development. One possible explanation for the higher performance of the online class is that these students were more experienced in taking quizzes electronically, but this only explains the observed disparity for the two same-format quizzes. Another possible explanation is that students in the online class were, on average, better students by mere chance. That does not explain, however, why the online students' performances were superior. Their presumed "lower quality" pedagogy, with considerably less faculty interaction, should have systematically resulted in inferior online performances as they proceeded through their mostly online programs.

It was also initially presumed that the traditional classroom students would exhibit poorer performance in their online threaded discussions when compared to the online course students. However, the results showed that the only threaded discussion that was significantly different

between classes was the first threaded discussion the traditional classroom students participated in. An identical rubric for grading the threaded discussions was included in both courses' syllabi, so students knew exactly how their participation would be graded. It is likely that the traditional classroom students weren't as experienced in the threaded discussion format; but after the first discussion, they were participating at a level equal to the online course.

For the students' final reports, it was anticipated there would be no difference between the two course formats because both the traditional and online students had extensive experience through other courses in report writing. All the students were required to turn in a report showing in-depth research on a single topic from the class material (their choice of topic). As anticipated, univariate testing showed no difference between the two courses.

During the initial analysis, the effect of individual differences on scoring outcomes was not considered. To test the effects of individual differences, a second multivariate test was run, adding demographic variables discussed in the method section for which there were significant differences between the two classes as covariates. These included grade point average, age, number of credits taken during the same term, and whether or not the student was a business major. When the demographic variables were added to the model as covariates, the class variable (traditional classroom course versus online course) was no longer significant (Wilks' $\Lambda = .792$, $F = 2.01$, $p > .05$), and the only demographic variable that was significant was grade point average (GPA) (Wilks' $\Lambda = .702$, $F = 3.26$, $p < .05$). The univariate results revealed that student GPAs influenced two of the six dependent variables: online quiz 11 and online discussion 5 (see Tables 6 and 7). These results indicated that individual student differences may account for any differences between the two classes. When the GPA effect was controlled, the course delivery method did not seem to affect student outcomes. Thus, equivalency theory is supported by the results – or is it?

TABLE 6: Univariate results with class as independent factor and demographic variables as covariates

Results related to class

Source	Sum of Sqs.	df	F	Sig.
Online quiz for chapter 16	9.656	1	.958	.332
Online quiz for chapter 11	96.161	1	7.650	.008
Online threaded discussion for chapter 5	50.679	1	2.436	.125
Online threaded discussion for chapter 7	16.975	1	.691	.410
Online threaded discussion for chapter 11	106.438	1	3.329	.074
Written report	13.690	1	.068	.796

TABLE 7: Univariate results with class as independent factor and demographic variables as covariates

Results related to GPA

Source	Sum of Sqs.	df	F	Sig.
Online quiz for chapter 16	39.152	1	3.884	.054
Online quiz for chapter 11	110.114	1	8.760	.005
Online threaded discussion for chapter 5	130.668	1	6.280	.015
Online threaded discussion for chapter 7	20.530	1	.836	.365
Online threaded discussion for chapter 11	121.117	1	3.788	.057
Written report	91.415	1	.452	.504

Discussion and Conclusion

At a time when many institutions are turning to online delivery of courses, it is important to know if students are in fact gaining knowledge equivalent to traditional classrooms through online medium. According to Simonson and colleagues (1999), one of the key elements in equivalency theory is "equivalency," or the design of learning environments that provides equal experiences for all students, regardless of delivery medium. This research suggests that there are no apparent differences between traditional undergraduate classrooms and online education, at least after GPA is controlled, thereby supporting equivalency theory. Students in the traditional classroom appear to be conditioned to hearing information from the professor and need this audio delivery prior to taking quizzes. When this accustomed format is followed prior to taking an online quiz, the students perform equivalent to the online students, but in the absence of a typical lecture, the traditional students have more difficulty with an online quiz. When overall college GPA is taken into account, both teaching modes also appear to provide students with an equal basis for performance on the online threaded discussions and written reports.

But why does GPA need to be controlled for in the first place in order to arrive at support of equivalency theory? Why did the students, on average, perform better while in online programs? Is it possible that, in a way similar to Chandler's (1962) explanation of the superiority of the divisional form of (large) organizations, that the participants involved in online coursework feel more of a sense of responsibility for their work and learning?

Additionally, evolutionary dynamics may be present. It may be that only diligent, conscientious students are able to survive through an online program, while others self-select out of that environment, as did one of the initially enrolled online students involved in this study. Online-program students who survive the more responsible format may develop better self-directed study and learning habits than traditional students. Thus, while equivalency theory may hold for the class-by-class level of analysis, there may be benefits to online learning at the program level of analysis. Students surviving online programs may in fact have obtained a more effective education overall than traditionally educated students.

This increase in learning effectiveness, however, raises the question of the efficiency of online learning. This format requires far more preparation and input from faculty than the traditional classroom setting. Is the increased learning effectiveness worth the tremendous increase in effort put forth by a department's faculty? A future study should analyze the costs and returns of each. Perhaps, as suggested by Arbaugh and Duray (2002), it is time for the online course to be priced higher than the equivalent traditional course.

An additional matter for further investigation concerns the results for the Chapter 11 quiz. Online students performed significantly better than traditional students in this material relative to all other course material, suggesting that some types of online content might be particularly more effective if offered only online. This leads to the idea of semi-online classes with a mix of traditional and online format, depending on the content of the learning material. For example, entire encyclopedic-type chapters could be relegated to an online format, thus giving traditional-format teachers more time to teach more engaging topics. Perhaps schools will someday offer courses consisting of a mixed format of traditional and online components, arranged according to the empirical effectiveness identified by studies subsequent to this one.

Although the small sample size in this study requires caution in generalizing the findings to a larger population, it appears that both the traditional classroom and the online teaching methods in these classes provide students with an equally effective learning method. Any performance differences on the measurements in this study can be explained by the differences in GPA of the students taking the two types of classes. Perhaps the students who are drawn to online courses are actually better self-learners, intrinsically motivated to acquire knowledge beyond that necessary to merely pass the course. Many of the students in the online course were self-reported non-traditional students, which may have accounted for the higher overall GPA. This factor, however, leaves open the possibility that the online format itself may be responsible for higher student GPAs. Therefore, future studies should address the performance of non-traditional students and whether the online courses are their better choice for learning.

Future studies could also proceed in the direction of more experimental control when testing the support of equivalency theory as it applies to online versus traditional learning among

undergraduate university students. More experimental control has the benefit of bringing to light various nuances and limits to the application and relevance of equivalency theory, as this study has attempted to demonstrate. Further studies in the direction of greater experimental control could include a randomized design from the same pool of students, perhaps tracing the same students over a number of courses. The surprising increase in variance among traditional classroom student scores (with the observed zeros for some online discussions) also suggests that more observations may provide more power to the test of equivalency theory.

Finally, the nature and testability of equivalency theory itself must be discussed. The field needs a theory that points to subtle differences to be supported by carefully designed empirical experiments rather than the current state of the field that supports equivalence with the aid of general ad-hoc trend studies that cannot reject equivalence. By adding to an emerging body of research in online vs. classroom business education that is moving away from designs that only compare end of course outcomes toward designs that examine the entirety of courses (Kock, Verville, & Garza, 2007; Sautter, 2007) this study contributes to the “second generation” comparison literature by moving the field toward the development of just such types of middle-range theories. Additional comprehensive comparison studies will allow for a rational scientific approach toward the integration of online learning with traditional learning. In further study, we may find that the inherent limitations of one format will be mitigated by the advantages of the other as they relate to the questions of learning efficiency and effectiveness.

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