Student performance predictors involving numerically based subject matter: Lecture versus web presentation

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ABSTRACT

This study examines whether student performance predictors in a numerically based lecture course are similar to those for the web version of the same course. A numerically based course involves quantitative concepts and requires mathematical calculations. Data were collected from students taking a financial management class at a medium sized state university. Students had the option upon registration to choose the lecture presentation or the web-based version of the course. Examination of the significant variables presents only one common predictor of student performance – semester GPA prior to enrolling in the course. Otherwise, different predictors are significant, dependent upon the method of presentation. Furthermore, students in the lecture class performed better than those enrolled in the web version.

Keywords: web courses, lecture presentation, quantitative concepts, student performance

INTRODUCTION

Mathematical courses often prove challenging for many college students. Math instructors are embracing technology as a method to increase understanding **(**Boster et al, 2006), while many students prefer the traditional classroom setting with an instructor (Johnson et al, 2009). Many studies have found no difference in the success of online students versus those enrolled in the lecture version of the same class (Russell, 1999; Gange and Shephard, 2001; Neuhauser, 2002; and Reuter, 2009). However, few, if any, have tried to examine whether the predictors of student performance were the same for a mathematically oriented course, regardless of the method of presentation.

Therefore, this study examines whether performance predictors for students in a numerically based lecture course are similar to those for the web version of the same course, as well as, to determine if there is a difference in the performance of such students. A numerically based course involves quantitative concepts and requires mathematical calculations. Data were collected from students enrolled in a financial management class at a medium sized state university. Students had the option upon registration to choose the lecture presentation or the web version.

COURSE SURVEYED

The financial management course surveyed is delivered every semester via the traditional lecture format, but is offered as a web-based class in the summer only. Students had the option upon registration for the summer sessions, 2007-2012, to choose the lecture presentation or the online version. Over the six year period, 176 total students signed up for the lecture version of financial management; 128 total students registered for the web class. The textbook (various editions) remained the same, as well as, the methods to assess student performance: chapter quizzes, chapter homework assignments, periodic exams, and a comprehensive final exam. While the course was staffed by three terminally degreed professors, the material covered was identical and included the following topics: time value of money, financial statement analysis, bond and stock valuation, cash flow estimation, risk and return, cost of capital, and working capital management.

Students seeking a baccalaureate degree from the university's college of business must earn a "C" or above in financial management in order to graduate (the class is rarely taken by someone outside of the college.) Because of its mathematical content, financial management is considered by some students to be particularly challenging. There are numerous prerequisites for this course; these include managerial or financial accounting; micro and macroeconomics; statistics; and completion of 54 hours of non-developmental coursework.

Lecture presentation

In the lecture presentation, students attended a two and one-half hour class held on the university campus, Monday through Thursday, for four weeks. Professors lectured and worked problems for those enrolled. Students were encouraged to ask questions and participate in class discussions. Power point slides, as well as, answers to assignments were made available to students. Outside of class, faculty held office hours (10 hours per week); students could also contact faculty via email and discussion forums. The course was not self-paced: certain chapters

were covered at prescribed upon times; assignments and quizzes had specific due dates. Closed book, paper and pencil exams were administered on the dates specified in the syllabus.

Web presentation

All work for the course was delivered over the internet. The Blackboard course management system was utilized until the university discontinued its license. Later, Aplia for Finance, was adopted. The online course was deployed over an 8 week period. Communication between students and faculty occurred via the course management system, as well as, email and discussion forums. As in the lecture presentation, power point slides and answers to assignments were made available to students. The course was not self-paced: online assignments and quizzes had specific due dates, and were to be completed in a certain order. Exams, including the final exam, were made available online and had to be completed on a specific date.

HYPOTHESIS 1

The following relationship is hypothesized: performance predictors for students in a numerically based lecture course are not different than the performance predictors for students in the web version of the same numerically based course. The numerically based course surveyed is financial management; successful completion of which is required for those seeking a baccalaureate degree in business. Success in the course is defined as having earned an A, B, or C, while failure is defined as D, F, or W; students receiving a D, F or W, will have to take the class again. The student performance predictors investigated include the following:

Sex

According to the U.S. Department of Education (2000), more women, than men, are enrolled at U.S. colleges and universities. Thus, women subsequently receive more degrees than men. Kinzie et al (2007) has demonstrated that undergraduate females are more actively engaged in "educationally purposeful activities."

Statistics also show that online students are predominately female (Halsne and Gatta, 2002; and Zirkle, 2003). In regard to online course performance, most researchers (Dille and Mezack, 1991; Lim, 2001; Dutton, Dutton and Perry, 2002; Wojciechowski and Palmer, 2005; Daymont and Blau, 2008; Gerlich, Mills and Sollosy, 2009; and Guidry, 2013) found little to no difference between the sexes. However, Barrett and Lally (1999) and Taplin and Jegede (2001) reported significant performance differences.

Age

Research investigating the age of students enrolled in web-based courses is mixed. Online education is a better fit for many non-traditional students, likely due to employment and familial responsibilities (Reuter, 2009). However, Buhagar and Potter (2010) found that younger students were more comfortable with web-related technology.

Semester load

Most studies found course load and academic performance to be unrelated for traditional lecture classes (Tinto, 1987; Metzner, 1989; and, Pascarella and Terenzini, 1979). However, Adelman (1992, 2005) concluded that students enrolled for fewer credit hours tended to be more academically successful, while Schultz (2007) demonstrated a weak correlation between course load and success.

Weaver (2005) investigated the performance of online students and found that full time students were more academically successful than part time students. Wojciechowski and Palmer (2005) found no relationship between semester load and the eventual grade earned in an online class.

Withdrawals

Previous research (Frankola, 2001 and Oblender, 2002) has shown that online learners are more likely to drop courses when compared to their face-to-face counterparts, and an inverse relation between number of previous withdrawals and grades in an online class (Wojciechowski and Palmer, 2005).

Attempts

Students taking a particular course for a second (or more) time may have not earned the required grade in the course, or withdrew before being awarded a final grade. In both circumstances, the student will have to take the class again. Some students may want to re-take a class in order to bolster their GPAs. Guidry (2013) found that number of attempts and subsequent grade in an online quantitatively oriented course to be negative, but insignificant.

American College Testing (ACT) composite scores, ACT English scores, ACT Math scores, and ACT reading scores

A study authored by Bettinger, Evans, and Pope (2011) found that English and math ACT scores "are highly predictive of positive college outcomes," and the reading and science score "have very little predictive ability." Thus, lumping together these scores with English and math may mar the usefulness of the ACT as a predictor of college success. Gubernick and Eberling (1997) found that online students have higher achievement test scores than those enrolled in lecture classes; and, Guidry (2013) showed that students with higher ACT math scores were more likely to be successful in a quantitatively oriented online course. On the other hand, Freeman (1995) and Mortensen (1995) demonstrated no difference in achievement test scores between online students and lecture students.

Student GPA

Anderson and Benjamin (1994) showed a positive relation between student performance and previous academic efforts. Guidry's (2013) research demonstrated that students with higher GPAs in the semester prior to enrollment in an online class were more likely to be successful in

the online class. However, Buhagar and Potter (2010) found no significant difference between GPAs of online students and the GPAs of lecture students.

HYPOTHESIS 2

It is also hypothesized that students enrolled in a numerically based lecture course will not perform any differently than students enrolled in the web version of the same numerically based course. Some studies (Wynegar and Fenster , 2009; and Stephens and Konvalina, 1999) have noted that students enrolled in math-based courses using computer aided instruction did not perform as well as students in lecture courses; Allen et al (2004) found the opposite result.

MODEL SPECIFICATION AND EMPIRICAL RESULTS

The model for each course (lecture versus web presentation) is written as follows:

$$GRADE_i = f(SEX_i, AGE_i, SEMLD_i, WDS_i, ATTS_i, ACT_i, ENG_i, MATH_i, READ_i, SMGPA_i, CMGPA_i)$$

where:

$GRADE_i$= grade earned by the ith student (A = 4; B = 3; C = 2; D, F or W = 0).
SEX_i = dummy variable indicating sex of student i (SEX = 0 if female; 1 if male).
AGE_i = student i's chronological age (in years) at time enrolled in course.
$SEMLD_i$= student i's total number of hours carried for the semester during which he/she was enrolled in financial management.
WDS_i = total number of "W"s on student i's transcript.
$ATTS_i$ = total number of times student i has attempted financial management.
ACT_i= student i's highest reported composite score on the American College Testing exam (ACT), 0-36.
ENG_i= student i's highest reported ACT English score, 0-36.
$MATH_i$= student i's highest reported ACT math score, 0-36.
$READ_i$ = student i's highest reported ACT reading score, 0-36.
$SMGPA_i$ = student i's semester GPA prior to enrolling in financial management, 0.0-4.0.
$CMGPA_i$ = student i's cumulative GPA prior to enrolling in financial management, 0.0-4.0.

The model is also run with the combined data set, including a dummy variable to denote whether the class was the lecture format or the web version (LEC/WEB = 0 if lecture, 1 if class was web version). The results should show whether the final grade earned is dependent upon the method of presentation, lecture versus web presentation.

The university's student database provided the necessary data for this study. Table 1 (Appendix) presents the descriptive statistics of the entire sample, as well as, for each class surveyed. While the mean grade (GRADE) for the lecture class is higher (2.2955 versus 1.3438), the mean age of the students (AGE) and the semester course load (SEMLD) are similar. All of the mean ACT measures (ACT, ENG, READ, and MATH) are higher for the web class, perhaps due to a self-selection bias: academically stronger students may feel more confident in taking a self-directed class without an instructor present. However, the GPA measures (SMGPA and CMGPA) impart the opposite - higher mean semester and cumulative GPAs for those students in the lecture sections.

The empirical results are presented in Table 2 (Appendix). Examination of the significant variables presents only one common predictor of student success – semester GPA prior to enrolling in financial management (SMGPA). The positive relation demonstrates that students with higher semester GPAs earn higher grades in the course surveyed for this study (The cumulative GPA variable, CMGPA, is only significant for the lecture class.) Otherwise, different predictors are significant, dependent upon the class surveyed. In the lecture version, the number of withdrawals (WDS) is inversely related to course performance, while the number of attempts (ATTS) showed a positive relation – those who were familiar with the material in a previous presentation were more likely to earn a better grade. Results for the web class confirm the results of other studies: students with higher ACT math scores (MATH) are more likely to be academically successful in a numerically based course (Allen and Sconing, 2005; and Guidry, 2013). The combined data set had no significant variables, except for that which distinguished between the two methods of presentation (LEC/WEB). The result seems to validate the findings of Wynegar and Fenster (2009) and Stephens and Konvalina (1999): students in online versions do not perform as well as those enrolled in the lecture class of mathematical material.

CONCLUSION

While the introduction of computer aided technology is a powerful tool to teach college level subjects, including quantitatively oriented material, most students prefer a face-to-face presentation of mathematics. Many studies have found no difference in the success of online students versus those enrolled in the lecture version of the same class. However, few, if any, have tried to examine whether the predictors of student performance were the same for a mathematically oriented course, regardless of the method of presentation. It is the purpose of this study to examine whether the student performance predictors in a numerically based lecture course are similar to those for the web version of the same course, as well as, to determine if there is a difference in the performance of such students. Examination of the significant variables presents only one common predictor of student success – semester GPA prior to enrolling in the course is positively related to the grade earned in the class. Students with higher semester GPAs earn higher grades in the quantitative course. Otherwise, different predictors are significant, dependent upon the class surveyed. In the lecture version of the class, the total number of previous course withdrawals is inversely related to course performance, while the total number of previous attempts at the course surveyed showed a positive relation – those who were familiar with the material in a previous presentation were more likely to earn a better grade. For the online students, those with higher ACT math scores are more likely to earn higher grades in financial management, the class surveyed. Furthermore, students in the online version of financial management did not perform as well as those enrolled in the lecture class.

REFERENCES

Adelman, C. (1992). The way we were: the community college as American thermometer. U.S. Department of Education.

Adelman, C. (2005). Moving into town and moving on: the community college in the lives of traditional age students. U.S. Department of Education.

Allen, Jeff and Sconing, Jim. (2005). Using ACT assessment scores to set benchmarks for college readiness. *ACT Research Report Series*, retrieved on 11/14/12, http://www.act.org/research/reports/pdf/ACT_RR2005-3.pdf.

Allen, M., Mabry, E. Mattrey, M., Bourhis, J., Titsworth, S., and Burrell, N. (2004). Evaluating the effectiveness of distance learning: a comparison using meta-analysis. *Journal of Communication*, 54(30), 402-420.

Anderson, G., and Benjamin, D. (1994). The determinants of success in university introductory economics courses. *Journal of Economic Education*, 25(2), 99-118.

Barrett, E. and Lally, V. (1999). Gender differences in an on-line learning environment. *Journal of Computer Assisted Learning*, 15(1), 48-60.

Bettinger, E., Evans, B., and Pope, D. (2011). Improving college performance and retention the easy way: unpacking the ACT exam. National Bureau of Economic Research, working paper no. 17119.

Boster, F.J., Meyer, G.S., Roberto, A.J., Inge, C. and Strom, R.E. (2006). Some effects of video streaming on educational achievement. *Communication Education*, 55, 46-52.

Buhagar, Tarek and Potter, Robert. (2010). To stream or not to stream in a quantitative business course. *Journal of Instructional Pedagogies*, 3, 1-6.

Daymount, T., and Blau, G. (2008). Student performance in online and traditional sections of an undergraduate management course. *Institute of Behavioral and Applied Management*, 275-294.

Dille, B., and Mezack, M. (1991). Identifying predictors of high risk among community college telecourse students. *American Journal of Distance Education*, 5(1), 24-35.

Dutton, J., Dutton, M, and Perry, J. (2002). How do online students differ from lecture students? *Journal for Asynchronous Learning Networks*, 6(1), 1-20.

Frankola, K. (2001). Why online learners drop out. *Workforce*, 80(10), 53-59.

Freeman, V.S. (1995) Delivery methods, learning styles and outcomes for distance medical technology students. Doctoral dissertation, University of Nebraska-Lincoln.

Gagne, M., and Shepard, M. (2001). Distance learning in accounting. *T.H.E. Journal*, 28, 58-65.

Gubernick, L., and Ebeling, A. (1997). I got my degree through e-mail. *Forbes*, 159(12), 84-92.

Guidry, Krisandra. (2013). Predictors of student success in online courses: quantitative versus qualitative subject matter. *Journal of Instructional Pedagogies*, 10, 100-113.

Halsne, A., and Gatta, L. (2002). Online versus traditionally delivered instruction: a descriptive study of learner characteristics in a community college setting. *Online Journal of Distance Learning Administration*, 5(1), retrieved on 6/27/12, http://www.westga.edu/%7Edistance/ojdla/Spring51.html

Johnson, H.D., Dasgupta, N., Zhang, H., and Evans, M.A. (2009). Internet approach versus lecture and lab-based approach for teaching an introductory statistical methods course: students' opinions. *Teaching Statistics*, 31 (1):21-26.

Kinzie, J., Gonyea, R., Kuh, G., Umbach, P., Blaich, C., and Korkmz, A. (2007). The relationship between gender and student engagement in college. Paper presented at 32nd annual conference of the Association for the Study of Higher Education, Louisville, KY.

Lim, C.K. (2001). Computer self-efficacy, academic self-concept, and other predictors of satisfaction and future participation of adult distance learners. *The American Journal of Distance Education*, 15(2), 41-45.

Metzner, B.S. (1989). Perceived quality of academic advising: the effect on freshman attrition. *American Educational Research Journal*, 26(3), 422-442.

Mortensen, M.H. (1995). An assessment of learning outcomes of students taught a competency-based computer course in an electronically-expanded classroom (distance education). Doctoral dissertation, University of North Texas.

Neuhauser, C. (2002). Learning style and effectiveness of online and face-to-face instruction. *The American Journal of Distance Education*, 16(2): 99-113.

Oblender, T. (2002). A hybrid course model: one solution to the high online drop-out rate. *Learning and Leading with Technology*, 29(6), 42-46.

Pascarella, E. and Terenzini, P. (2005). How college affects students: a third decade of research (2nd edition). New York: Jossey-Bass.

Reuter, Ron. (2009). Online versus in the classroom: student success in a hands-on lab class. *American Journal of Distance Education*, 23(3), 151-162.

Russell, T. (1999). The no significant difference phenomenon as reported in 355 research reports, summaries and papers. Raleigh, N.C.: North Carolina State University.

Schultz, G. (2007). The effect of study group participation and course load on the course completion rates, success rates and grade point averages on first generation college students at the community college. Doctoral dissertation, University of Southern California.

Stephens, L. and Konvalina, J. (1999). The use of computer algebra software in teaching intermediate and college algebra. *Journal of Math Education in Science and Technology*, 30(4), 483-488.

Taplin, M. and Jegede, O. (2001). Gender differences in factors influencing achievement of distance education students. *Open Learning*, 16(2), 133-154.

Tinto, V. (1987). Leaving college: rethinking the causes and cures of student attrition. Chicago: The University of Chicago Press.

U.S. Department of Education. (2000). Getting ready pays off.

Weaver, Paul. (2005). Ascertain unique characteristics and evaluate student success in community college online courses. Doctoral dissertation, Trinity College.

Wojciechowski, Amy, and Palmer, Louann Bierlein. (2005). Individual student characteristics: can any be predictors of success in online classes. *Online Journal of Distance Learning Administration*, 8(2), retrieved on 6/27/12, http://www.westga.edu/distance/ojdla/summer82/wojciechowski82.htm.

Wynegar, R. and Fenster, M. (2009). Evaluation of alternative delivery systems on academic performance in college algebra. *College Student Journal*, 43, 170-174.

Zirkle, C. (2003). Distance education and career and technical education: a review of the research literature. *Journal of Vocational and Education Research*, 28(2), 161-181.

APPENDIX

Table 1: Descriptive Statistics of Sample

	MEAN	STD DEV	MEDIAN	MODE	MAX	MIN
FINANCIAL MANAGEMENT: lecture presentation						
GRADE	2.2955	1.2709	2	2	4	0
SEX	0.5284	0.5006	1	1	1	0
AGE	23.2557	2.6005	23	22	37	20
SMLD	7.9034	3.5708	9	6	15	3
WDS	5.5227	4.7737	4	3	28	0
ATTS	0.6193	0.9243	0	0	5	0
ACT	20.4830	2.8385	20	20	30	14
ENG	20.9659	3.7170	21	20	31	9
MATH	20.2727	3.6086	20	19	32	13
READ	20.9887	4.4619	21	22	35	12
SMGPA	2.6190	0.7749	2.67	3	4	0
CMGPA	2.5551	0.5686	2.45	4	4	1.51
FINANCIAL MANAGEMENT: web presentation						
GRADE	1.3438	1.3483	2	0	4	0
SEX	0.3984	0.4915	0	0	1	0
AGE	23.9219	3.1737	23	23	36	20
SMLD	7.4844	3.6392	6	9	15	3
WDS	6.2656	5.0982	5	5	29	0
ATTS	0.8828	1.1814	0	0	6	0
ACT	21.2500	3.3836	21	21	30	14
ENG	21.7891	4.3374	21	19	34	8
MATH	20.5859	3.7068	20	18	34	13
READ	22.3516	5.0362	22	23	35	11
SMGPA	2.2953	0.9488	2.33	3	4	0
CMGPA	2.4620	0.5497	2.47	3	3.90	1.24

Table 1, continued

COMBINED DATA						
GRADE	1.9013	1.3895	2	2	4	0
SEX	0.4737	0.0287	0	0	1	0
AGE	23.5362	2.8699	23	22	37	20
SEMLD	7.7270	3.5998	6	6	15	3
WDS	5.8355	4.9184	5	3	29	0
ATTS	0.7895	1.5205	0	0	6	0
ACT	20.8059	3.0977	21	20	30	14
ENG	21.3125	4.0038	21	20	34	8
MATH	20.4046	3.6475	20	19	34	13
READ	21.5625	4.7522	21	22	35	11
SMGPA	2.4827	0.8659	2.50	3	4	0
CMGPA	2.5159	0.5617	2.47	4	4	1.24
LEC/WEB	0.4211	0.4945	0	0	1	0

Table 2: Regression Results of Student Performance Predictors: Lecture versus Web Presentation of Quantitative Subject Matter

variables	**LECTURE**	**WEB**	**COMBINED**
CONSTANT	-0.6168 (-1.5126)	0.3376 (0.2353)	1.2899 (1.3216)
SEX	0.0818 (0.4814)	-0.1952 (-0.8082)	-0.1134 (-0.7161)
AGE	0.0525 (1.5660)	-0.0102 (-0.2532)	0.0017 (0.0575)
SEMLD	0.0391 (1.5759)	-0.0472 (-1.4968)	-0.0173 (-0.7793)
WDS	-0.0637 (-2.9052)**	-0.0228 (-0.8274)	-0.0013 (-0.0708)
ATTS	0.2343 (2.2275)**	-0.0569 (-0.9974)	0.0010 (0.0183)
ACT	-0.1043 (-1.0137)	-0.1748 (-1.0573)	-0.1014 (-1.0311)
ENG	0.0586 (0.9697)	0.0093 (0.2366)	0.0154 (0.4150)
MATH	0.0496 (1.1495)	0.1234 (1.9446)*	0.0396 (0.9859)
READ	0.0204 (0.5126)	0.0405 (0.6671)	0.0496 (1.3252)
SMGPA	0.3727 (2.3071)**	0.3850 (2.7441)**	0.1119 (0.9416)
CMGPA	0.8141 (3.2402)**	-0.0005 (-0.7375)	0.3132 (1.4779)
LEC/WEB	----------	----------	-0.9350 (-5.9077)**
R2	0.3466	0.2077	0.1373
F	7.9096**	2.7641**	5.0182**
N	176	128	304

Note: t-statistics are in parentheses.
*denotes significance at 10%
**denotes significance at 5%