DO VIRTUAL COURSES LEAD TO VIRTUAL LEARNING?

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ABSTRACT

This study examines the effectiveness of the virtual classroom concept for graduate courses in economics and finance. The sample consists of MBA students at a regional university enrolled in Macroeconomic Theory, International Economics, Corporate Finance, or Money and Capital Markets. Holding constant ability, effort, and demographic considerations, students enrolled in Internet courses scored ten percent lower than students enrolled in the equivalent campus courses on the comprehensive final exam. The results provide evidence supporting the inferior quality criticism of Internet-based learning. The results are tempered by the observation that Internet education is still in the infancy stage.

INTRODUCTION

The rapidly expanding World Wide Web is changing the customer base of universities and colleges and the way they conduct business. Distance education has now become an important strategic issue for business schools, as it overcomes restrictions of same-time or same-place learning [8]. Online courses can provide an alternative to regularly scheduled classes and can deliver the same services as a regular classroom environment [4]. As the use of Internet instruction expands, concerns are being expressed about instruction quality. Skeptics question whether the Internet instruction mode can offer the same quality of education that students receive in traditional classroom courses [1, 11, 15]. Supporters of online instruction counter with evidence that distance learners retain information better than students in the traditional classroom setting do [6]. The purpose of this paper is to assess the effectiveness of online instruction by comparing student performance in the virtual versus traditional classroom. The results are based on MBA core and elective courses in economics and finance at a regional university.

BACKGROUND

In many ways West Texas A&M University (WT) is typical of most mid-sized colleges. It is the primary source of university education, research, and service for the region. Annual student enrollment is approximately 6,500. The region has a relatively low population density making the campus an ideal school for Internet instruction. For this reason, the University has been encouraged to act as a pioneer school in Internet instruction for the Texas A&M System. The College of Business is a member of and accredited by the Association of Collegiate Business Schools and Programs. In 1997 the College of Business initiated an Internet-based option in the MBA program. The 200 students in the program have the option of completing all courses in the campus and/or virtual mode through a rotation of courses. To date,

eighteen different graduate business courses have been offered on the Internet. The Southern Association of Colleges and Schools during the spring of 2000 positively reviewed the Internet-based MBA program.

This study focuses on four graduate level courses in economics and finance. The courses are Macroeconomic Theory (core economics course), International Economics (elective economics course), Corporate Finance (core finance course), and Money and Capital Markets (elective finance course). All four courses were offered at least once in both the campus and Internet-based format during the study period and the same professor taught each course, regardless of instruction mode. Each economics and finance course had an enrollment of over fifteen students and averaged a class size of approximately twenty-five. Every effort was made to provide consistent methods, procedures, and material in both the traditional and Internet instruction formats. Learning materials including textbook information, detailed lecture notes, and supporting articles were distributed in class or posted on the course Internet site, depending on instruction mode. The traditional lecture and professor interaction is countered in the Internet course by e-mail, bulletin boards, and chat forums [13]. Half the student grade is determined by homework assignments and the other half of the grade is determined by a final exam. In general, both campus and Internet students are required to complete an identical proctored final exam on campus or at an alternative sight arranged by the course instructor or the Information Technology Center at the University.

MODEL AND DATA

Davisson and Bonello (1976) propose an empirical research taxonomy in which they specify the categories of inputs for the production function of learning. These categories are human capital (admission exam score, GPA), utilization rate (study time), and technology (lectures, classroom demonstrations). Using this taxonomy, Becker (1983) demonstrates that a simple production function can be generated which may be reduced to an estimable equation. While his model is somewhat simplistic, it has the advantage of being both parsimonious and testable. A number of problems may arise in this type of work [2, 3, 5]. Among these are errors in measurement and multicollinearity associated with demographic data.

Despite these potential problems, there must be some starting point for empirical research into the process by which business and economic information is learned if we are to access various proposals as to how knowledge may best be imparted to our students. Assume that the production function for learning at the college level can be represented by a production function of the form:

$$(1)\quad Y_i = f(A_i, E_i, D_i, X_i),$$

where Y measures the degree to which a student learns, A is information about the student's native ability, E is information about the student's effort, D is a [0, 1] dummy variable indicating demonstration method or mode, and X is a vector of demographic information.

As noted above, this can be reduced to an estimable equation. The specific model used in this study is presented as follows:

$$(2)\ SCORE_i = B_0 + B_1 ABILITY_i + B_2 HW_i + B_3 NET_i + B_4 ECQ_i + B_5 CORE_i + B_6 AGE_i + B_7 FOREIGN_i + u_i.$$

The dependent variable used in measurin effectiveness of student performance is final exam score (SCORE). The variable associated with the final exam score is measured in percentage terms. The proxy for student's native ability (ABILITY) is based on the composite score of the GMAT exam plus 200 times the upper-level (last 60 hours) undergraduate grade point average (GPA). For example, a student with a GMAT score of 600 and 3.5 GPA would have a composite score of 1300. Many business colleges use the composite score as part of the admission process. The average composite score for the study cohort is 1135, with a slightly higher score of 1155 for individuals enrolled in campus courses. The percentage score on the homework assignments (HW) serves as a proxy for student effort. The homework grade is used to measure effort since students are not constrained by time, research material, or ability to ask the course instructor questions when completing the course assignments. Using homework as a proxy for effort is limited by the observation that some students may have difficulty grasping the material regardless to how much time and effort put forth on homework assignments. The average homework score in the study group is eighty-nine percent. It should be noted that the variance in homework scores is much greater in the finance courses than in the economics courses. Enrollment in the Internet or campus course is noted by the categorical variable NET, with a total of 136 out of the 260 students in the study group enrolling in an online course. Internet students are assigned a one, while campus students are assigned a zero. The categorical variable ECO separates the disciplines and instructors by assigning economics students a one and finance students a zero. Required core classes (Macroeconomic Theory and Corporate Finance) are separated from elective courses (International Economics and Money and Capital Markets) with the categorical variable CORE (one if the student is enrolled in a core course; zero if the student is enrolled in an elective course). The anticipated sign on the CORE variable is negative because all students are required to take core classes, while the students enrolled in the elective courses chose to enroll in them. The assumption being that students that self select into an economics and/or finance course will tend to perform at a higher level than students that are forced into required courses.

The choice as to what demographic variables to include in the model presents several difficulties. A parsimonious model is specified in order to avoid potential multicollinearity problems. The demographic variables in the model relate to student age (AGE) and nationality (FOREIGN). The age variable is included in the model based on anecdotal evidence that distance learners are more mature and self-motivated [10, 14]. Average age in the study cohort is approximately twenty-eight, with a slightly younger group enrolled in campus courses. The model corrects for international students because the majority of international students in the MBA program elected to enroll in the campus-based macroeconomic theory course instead of the Internet class. Specifically, only two international students completed the Internet course in macroeconomics while twenty-one completed the campus course. There was not a significant difference in international student enrollment by mode for the other three courses. While other authors have found a significant relationship between race and gender and learning [9, 16], the terms were not significant in this study. A number of specifications were considered using race, gender, MBA emphasis, hours completed, concurrent hours in various combinations, and interaction terms. Inclusion of these variables into the model affected the standard errors of the coefficients but not the value of the remaining coefficients. For this reason they are not included in the model.

University academic records are the source of admission and demographic information because of the potential biases identified in self-reported data [12]. For example, information about number of hours worked each week at a paid job could help determine selection bias between web-based and traditional instruction but the authors were not able to obtain reliable information from the student cohort. There are a total of 320 students in the initial sample, sixty students being eliminated from the study for dropping the course or withdrawing from the university. Hence, 260 students are in the final sample. It should be noted that a much higher drop rate was observed in the corporate finance course (approximately twenty-five percent) than the other three courses. This higher attrition rate in the corporate finance course could represent a potential bias in the study [7]. Surprisingly, there is not a significant difference in the campus versus Internet-based drop rates across any of the specific economics or finance courses in the study.

RESULTS

Results from the ordinary least squares estimation of equation (2) are presented in Table 1. None of the independent variables in the model have a correlation higher than .35, providing evidence that the model specification does not suffer from excessive multicollinearity. The equation (2) model explains 52 percent of the variance in final exam performance

Table 1
Estimation of Equation (2)

Variable	Combined coefficients (t-stat)	Economics coefficients (t-stat)	Finance coefficients (t-stat)
Intercept	23.12 (2.96)*	33.04 (3.42)*	-3.99 (-0.36)
NET	-10.65 (-6.98)*	-5.16 (-2.44)*	-11.24 (-5.79)*
ABILITY	0.050 (8.07)*	0.042 (5.57)*	0.040 (4.88)*
HW	0.036 (2.65)*	0.012 (0.97)	0.567 (6.16)*
ECO	7.91 (5.19)*		
CORE	-13.08 (-7.85)*	-2.35 (-1.02)*	-13.33 (-5.39)*
AGE	0.078 (0.77)	0.029 (0.24)	-0.058 (-0.43)
FOREIGN	-1.04 (-0.63)	1.05 (0.48)	-3.35 (-1.72)
R-square	.52	.25	.68
n	260	130	130

Note: * indicates $p<.05$

Five of the seven variables in the model are statistically significant at the five-percent level. Of primary interest is the negative and significant coefficient associated with Internet instruction. Holding constant ability, effort, and demographic considerations, students enrolled in the Internet course scored over ten percent lower on the final exam. The empirical results provide evidence supporting the inferior quality criticism of virtual learning. On the other hand, the ten percent quality differential might be acceptable considering Internet-based instruction is still in the infancy stage. Admittedly, the instructors have a vast amount of experience teaching in the traditional classroom versus limited experience with Internet instruction. As Internet instruction continues to develop and professors gain experience within the mode, it seems reasonable to assume performance differentials by instruction mode could be minimal at some point in the near future. Organizational options and presentation quality via the Internet are certain to improve as time goes by. In addition, the negative sign on NET is not necessarily an indictment of the virtual classroom as it is possible that a virtual student could have performed no better, or even more poorly, had he/she taken the course in the traditional classroom setting.

The stability of the model's other coefficients suggest that the model is somewhat robust. Ability as measured by the admission GMAT and GPA composite score has a positive and significant impact on final exam performance. Certainly, higher ability students should perform better on the final exam. Student effort as measured by percentage score on homework assignments yields a positive and statistically significant coefficient. The effort variable does not accurately measure the amount of time that a student applied to the course since productivity is different across students. The effort variable is more of a proxy for willingness to work until complete and adequate homework answers are obtained, organized, and presented to the course instructor. Certainly, ability and effort should be positively related to final exam performance in a random sample of college courses. As expected, the categorical variable CORE is negative and significant, implying that student performance is lower in required core classes than elective courses. The two demographic variables in the model are not statistically significant. Hence, age and nationality does not have a significant impact on final exam performance in this study.

The ECO coefficient is positive and highly significant. The implication is that scores on the final exam in the economics courses are substantially higher than final exam scores in finance courses. The large and significant coefficient on the ECO variable indicates that the combined sample should be split into separate disciplines. The Table 1 results indicate that adjusted final exam scores are five percent lower in the Internet versus the traditional classroom when the sample is derived from the economics course alone, while the comparable results in corporate finance yields an eleven percent difference. The preliminary indication is that economics courses may be more conducive to the virtual learning environment than finance courses. The observation is tempered by the fact that only three instructors are part of this study. Certainly, a wide variety of economics and finance faculty need to be included in the study before the discipline specific results can be presented with a high degree of confidence. We should also note that the model fits the finance only data very well, with an R-square of .68 and 4 of 6 variables statistically significant. The results for the economics only model are adequate but unspectacular, with an R-square of .25 and only 2 of 6 variables statistically significant.

CONCLUSIONS

The Internet has been extended far beyond its original scope as a highly specialized scientific communications network for the defense establishment and major research universities possessing high capacity computers [17]. Today, distance education via the Internet is becoming ubiquitous. The new educational and training technologies available via the Internet have the potential to revolutionize distance education. Electronic mail, chat sessions, bulletin boards, links, attachments, sound, video, and a variety of presentation options combined with easy access and convenience has made Internet delivery the future of distance education. Many fear that distance delivery has been inferior to traditional classroom instruction. The question for the future is will distance education continue to provide an inferior education with the advent of virtual instruction?

The results of this study imply that Internet-based instruction is not as effective as the traditional classroom mode. The specific results indicate that MBA students enrolled in economics and finance courses at a regional college do not perform as well on a proctored comprehensive final exam when instruction is delivered entirely via the Internet versus the traditional classroom approach. The economics courses appear to be more conducive to the virtual mode than finance courses although the results might be confounded by the small sample of instructors participating in the study. Control variables including required or elective course classifications and proxies for ability and effort are also found to be significant determinants of student performance. The results of this study are of a preliminary nature and represent a first step in an attempt to assess the effectiveness of Internet-based instruction. Further research is required before any definitive solutions can be ascertained.

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