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# THE EFFECTIVENESS OF VIRTUAL LEARNING IN ECONOMICS

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## ABSTRACT

*This paper presents empirical results concerning the effectiveness of Internet instruction in economics. The sample consists of MBA students enrolled in either a campus or Internet-based macroeconomic theory courses at a regional university. Holding constant ability, effort, and demographic considerations, students enrolled in the Internet course scored over nine percent lower on the 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 its infancy stage.*

## INTRODUCTION

The Internet and the World Wide Web (WWW) have become pervasive in the academic realm, particularly in the coursework required to achieve success in higher education. 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 (Strong & Harmon, 1997). Distance and independent education available on the Internet are the current buzz-words of higher education, and the hottest topic on many campuses is the “Virtual University.” Colleges all over the country are targeting the geographically, professionally, and personally constrained for the time flexibility of online courses. Despite the growth of online courses, skeptics question whether the Internet instruction mode can offer the same quality of education that students receive in traditional classroom courses. Supporters of online instruction counter with evidence that distance learners retain information better than students in the traditional classroom setting. The purpose of this paper is to assess the effectiveness of online instruction in economics by comparing student performance in the virtual versus traditional classroom. The results are based on an MBA course in macroeconomic theory at a regional college, West Texas A&M University.

## BACKGROUND

In many ways West Texas A&M University (WT) is typical of most regional colleges. It is the primary source of university education, research, and service for the Texas Panhandle and adjacent regions of neighboring states. Annual student enrollment is approximately 6,500. The low population density of the Texas Panhandle region makes WT an ideal school for Internet instruction. For this reason, WT has been encouraged to act as a pioneer school in Internet instruction for the Texas A&M System. The College of Business at WT 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. All essential courses related to the 36-60 (depending on individual leveling requirements) credit hour MBA degree are offered at least once on the Internet and twice on campus within a three-year period. To date, fourteen different graduate business courses have been offered on the Internet.

The specific focus of this study is the MBA course in macroeconomic theory. The macroeconomic theory course was offered twice on campus and once on the Internet during the 1998-1999 academic year. Each course had an enrollment of over twenty students. The author was the instructor in all three courses and 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 (Manning, 1996; Porter, 1997). Half the student grade is determined by homework assignments and the other half of the grade is determined by a final exam. Both campus and Internet students are required to take the final exam on campus, the only campus visit required of Internet students.

## 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 economics. 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 that may arise in this type of work (Chizmar & Spencer, 1980; Becker, 1983). 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 economics is learned if we are to access various proposals as to how economics knowledge may best be imparted to our students. Assume that the production function of learning for economics at the college level can be represented by a production function of the form:

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

where  $Y$  measures the degree to which a student learns economics,  $A$  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:

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

The dependent variable used in measuring 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 the product of twice 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 percentage score on the homework assignments (HW) measures 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 ten course assignments. Enrollment in the Internet or campus course is noted by the categorical variable NET. Internet students are assigned a one, while campus students are assigned a zero.

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 (Kearsley, 1998; Okula, 1999). The model corrects for international students because the majority of international students in the MBA program elected to enroll in the campus course instead of the Internet class. Specifically, only two international students completed the Internet course while ten completed a campus course. While other authors have found a significant relationship between race and gender and learning economics (Siegfried & Fels, 1979; Hirschfeld, Moore, & Brown, 1995), the terms were not significant in this study. A number of specifications were considered using race, gender, MBA emphasis, hours completed, and concurrent hours in various combinations. 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 (Maxwell & Lopus, 1994). There are a total of seventy-four students in the initial sample, nine students being eliminated from the study for dropping the course (Douglas & Joseph, 1995). The two campus courses had a total of forty-two students complete the course with five drops, while twenty-three students completed the Internet course and four dropped the course.

## RESULTS

Results from the ordinary least squares estimation of equation (2) are presented in Table 1. None of the dependent variables in the model have a correlation higher than .28, providing evidence that the model specification does not suffer from excessive multicollinearity. The equation (2) model explains 58 percent of the variance in final exam performance. Three of the five variables in the model are statistically significant at the one-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 nine percent lower on the final exam. The empirical results provide evidence supporting the inferior quality criticism of Internet-based learning (Lezberg, 1998; Conlin, 1999). On the other hand, the nine-percent quality differential might be acceptable considering Internet-based instruction is still in its infancy stage. Admittedly, the author has 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.

Variable	Coefficient	t-statistic
Intercept	-44.2539	-2.0457
NET	-9.1551	-5.2934*
ABILITY	0.0282	3.9764*
HW	0.9646	4.0160*
AGE	0.1140	0.9701
FOREIGN	1.2216	0.4585

Notes: R-square = .58, F = 16.35, \*p<.01, and n = 65.

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. Student effort as measured by percentage score on homework assignments yields a positive and 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. The two demographic variables in the model have positive coefficients but are not statistically significant. Hence, age and nationality does not have a significant impact on final exam performance in this study.

## CONCLUSIONS

Distance learning is not a new concept. Correspondence, cable television, interactive television, traveling instructors, and a myriad of other modes have played a part in distance education. 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. Most would agree 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 a macroeconomic theory course at a regional college do not perform as well on the final exam when instruction is delivered on the Internet versus the traditional classroom approach. The model used corrects for performance factors such as ability and effort. 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. The fluidity of the environment and the rapid pace of change characterizing the WWW require further research on the topic. Specific future extensions of this paper include collaboration with other economic and business faculty at WT and other regional colleges in order to determine the consistency of the results and implications derived in this study.

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