

Instructional Design And The Online Student: Do On-Line Students Learn More Than Face-To-Face Students? Some Suggestive Evidence

by

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Abstract

An asynchronous course in the foundations of economic analysis depends on mastery of content before students may progress to the next module. Each module is formulated with introduction, content, graded and non-graded assessment. Student success over four semesters is pronounced with little withdrawal and mostly grades of A being received. This presentation describes the instructional design, the testing environment and the degree of student and professor interaction that leads to these observed outcomes.

The author and his colleague at the University of Akron are undertaking an experiment comparing the success rates of face-to-face to online courses. Two professors are offering the same undergraduate economics course and will measure the difference in pre-and post-test scores on a standardized exam to test whether students learn more in face-to-face or online courses. The study will control for the level of prior economic literacy, previous grades and academic characteristics, attitudes towards economics and the amount of effort expected and actually spent in studying and performing in this class. Previous research has shown that students in online courses do not do significantly worse than face-to-face students, but can not perform on as high a complex plane. Our study will directly test this as well.

Author Biography:

Steven C. Myers received his Ph.D. in Economics from the Ohio State University and has taught at the University of Akron for the last 22 years. Myers has served as Department Head, chair of the University of Akron's World Wide Web committee, as Associate Vice President and CIO, and as Assistant to the CIO for Distance Education Support Services. He has specialized in classroom technology and classroom design and offered web-enhanced courses since 1994 and web-based courses since 2001.

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The economics profession and others disciplines are moving to the online world. Courses are ported to the web with and without regard to the appropriateness of the instructional design. An online course in the Department of Economics has apparently led to great student success and greater interest in the study of economics based on the grades received and the evaluations of the students.¹

The author and his colleague are involved in an experiment, a head-to-head competition between the online and face-to-face offerings of a one-semester Introduction to Economic Analysis course. The online design is a competency or mastery based learning design and the economics profession has dealt sparingly with this concept. The in-class design is based on traditional and active learning techniques. How students perform in each class will be examined and compared. In particular we hope to eventually answer:

- (1) Are learning outcomes higher in a web-based course, that is, does the mode of delivery (in-class or web-based) have an influence on learning outcomes?
- (2) Are students in an online environment as likely to do as well as in face-to-face classes? Will they be able to equal the complex problem solving of the face-to-face students?
- (3) Will web-based students develop more favorable attitudes towards economics than the attitudes developed by students in the face-to-face class?
- (4) Do student myths about economics affect their learning outcomes and attitudes towards economics?

The class under study is a three-credit general education principles of economics course (combined micro and macro) and is a required course for students in the College of Engineering. Experience in a similar online course at a graduate level seems to imply that students succeed at higher rates, become more interested in economics, and have a better attitude towards the field of economics. In fact, students' assessments and evaluations have led to questions of whether student learning is taking place at the same levels as in face-to-face classes since the student comments seem to be overwhelmingly positive in the online experience.

This paper is being authored during the early stage of the Fall 2002 semester and final results are yet not achieved, but some suggestive evidence is possible based on the pre-test, initial survey responses and the scores achieved on a first set of exams. After a discussion of online and face-to-face instruction, and the research design, the results will concentrate on scores on a pretest of economic knowledge and a survey of awareness of economic realities, information gathering processes and attitudes towards economics. Those scores will be to the extent possible be correlated with initial and early scores on graded quizzes and exams through the 5th week of the 15 week term.

Online Learning

Many online courses are offered with various elements of an instructional design. By online learning in this paper we mean a course that is 100% offered and completed on the Internet, and in particular this online course takes place in the WebCT course management system. Any casual reading of papers and articles on online learning reminds one immediately of the failures of such endeavors. These points of failure include high dropout rates, much more work for students and professors, professors facing the need to be programmers and trouble shooters, alienation of students, one-size fits none offerings, and in general frustration for professors and students.²

A problem of some offerings on the Internet is the porting of the same instructional design as used in a face-to-face class. This is a problem for at least two reasons. First, what is appropriate in a face-to-face class is not necessarily appropriate or easily portable to the online environment. Second, the face-to-face course may not have a well thought out instructional design, nor need it, since much of the flow of the course may be improvised on the fly. Professors that simply try to replicate the face-to-face experience in the online environment are not guaranteed to offer the same level of student success as the face-to-face experience.

Face-to-face classroom-based learning

By face-to-face learning in this paper we intend to communicate a class held on a regular basis with students attending in a common classroom under the direction of a professor. The design of the course involves both lecture and active learning strategies. In many disciplines this is taken as granted, but according to Becker and Watts (2001), fully 83% of economics instructors at all institutions, across rank and across all subfields use a technique they call chalk-and-talk. They define chalk-and-talk as a course, primarily lecture, where nearly everything written or displayed is created during the class. Uses of collaborative and active learning techniques is a small percentage of offerings, however, this is growing. Thus the face-to-face offering in this experiment can be thought of as a best of breed face-to-face class presentation.

Mastery or Competency Based Learning

In this paper mastery learning and competency-based learning are defined in the following way. Mastery learning based classes require the student to achieve a certain level of mastery over the course material before the student is certified to progress to the next level. The entire course material is organized into several modules. In particular, a student reading over a few chapters of material that may make up a single module will be expected to complete an examination on that material at a sufficiently high level or have to repeat the examination. In an unconstrained environment the student will never move past a module in which they have not achieved mastery, e.g. achieving at least a certain percentage score. In a traditional semester system, with a desire to have student balance mastery learning with the constraints of a 15-week term, the students are limited on each module to a limited number of trials and will move forward regardless of score on the final attempt.³

Competency based learning is similar to the above in that the material over which the student must achieve mastery is based on course objectives within each module. The module objectives are those statements as general as "Incentives matter" or a specific as "consumers will increase their consumption of an item as its price falls, all other things being held constant." In the online course the objectives of each chapter are formed into the objectives of the module. Multiple quiz questions are then chosen to match each objective as a test bank is assembled. The actual quiz that a student takes is randomly assembled by choosing questions from the testbank for each objective in order to test whether the student achieves competency over that objective. A mapping of questions to objectives ensures that each randomly generated 10-item quiz is qualitatively identical to every other quiz on that module across both students and attempts.

Combining mastery learning and competency learning, a student is expected to achieve mastery over the competencies (objectives) of the course. A student achieving mastery over the competencies will necessarily achieve a high course grade. Lower grades are those that result from not mastering the content after three attempts on various modules.

Instructional Design

In the face-to-face class the professor uses a combination of lecture and active learning techniques. In the online course the professor uses an instructional design based on mastery learning. The students in the face-to-face classes have the professor to lead them and have immediate access to him for both the

“sage on the stage” style of presentation as well as his spontaneous comments and answers to questions posed by the students.

In the online class, the professor does not lecture in any way. There is provided to the student in each module a set of readings and presentation-type material to help guide the student in achieving mastery over the objectives of the module. The professor is in this case the “guide on the side” having prepared a path for the student to follow and being available to students for their questions. Required assessments that are graded and non-graded help the instructor and student navigate through the modules. The specific design of the online course is described in presentational materials available at <http://gozips.uakron.edu/~myers/online>.

The assessment component of the online course is the testing where students must complete a randomly assembled to the objectives module quiz with a perfect score or re-take it up to three times. The student receives the highest grade of the three attempts. After completion of the module quiz the student is required to complete a module evaluation which consists of four questions which are related to the classroom assessment techniques (CAT) of the minute paper and the muddiest point (Angelo and Cross (1993)).⁴ Chizmar and Ostrosky (1998) used a similar CAT and find student success to be 6.6% higher in a pre-test/post-test experiment for those students that participated in the CAT.⁵ This CAT is one of the principal reasons that student-professor interaction in the online course is so high and may promote active learning and certainly breakdowns the anonymity and fosters better communication between student and professor.⁶

When a course is successful in the face-to-face venue, the temptation is that instructors will port it to the web as is. It is our contention that each venue (face-to-face and online) requires appropriate and often quite different instructional designs, such that they are appropriate for that venue and for the strengths of the instructor.

Research Design

Two classes, one face-to-face and one online are set up to have certain similarities. The content is the same, the textbook is the same, the pre and posttests and all writing assignments are the same.

Five economists active in the teaching field validated the pre-test. A forty-item instrument was created by sending 120 questions to our reviewers and asking them to rate each question according to whether it fit the content standard and complexity level. The questions were selected from a popular test bank and matched to the twenty national voluntary content standards published by the Foundation of Teaching Economics (Seigfried (1996)). Additionally each question was rated as to level of complexity in three categories: Recall and recognition, Simple Application, and Complex reasoning. Since the objective of the national voluntary content standards is to indicate the level of competency that students graduating high school should have, it seemed reasonable to use the standards as a basis for the pre-test. A post-test will be similarly employed at the end of the class.⁷

We suspect that students with more favorable initial endowments (including higher pre-test scores, greater awareness of the economy, more favorable attitudes towards economics) will succeed at higher rates.⁸ Controlling for student characteristic differences within and between the classes will allow us to see the effect of mode of delivery on student success.

A twenty-item survey of economic facts was administered to the students to gauge their awareness. The idea posited is that students who score higher on the economic facts survey will be more aware of the economy around them. Two additional questions are asked about economic information gathering activities and intensity, and three questions measure attitudes towards economics. The attitude questions are modeled after Maki and Maki (2002) who find that stronger students benefit more from online courses and addressed a series of questions to the students at the beginning and the end of the class to assess the change in students' attitudes. At this juncture we have the initial attitudes measures. Student characteristics include information pulled from the students' academic record. The survey is appended to this paper.

All data collection was then subject to the aegis of the Institutional Research Board for the Protection of Human Subjects at the University of Akron and all data used in this study derive from students that have given their signed written consent to be in the study. Few students selected to opt out of the study, one in the online course and 9 in the face-to-face course.

Preliminary Results

Table 1 describes the variables and expected signs in a regression of *examscore* on the independent variables listed. Table 2 shows the means and Table 3 the regression results. Since this work is very preliminary, the results are only suggestive. In future papers we will look at the post-test scores and scores on two writing assignments as measures of success.

Data on 93 students are divided between 73 face-to-face and 20 online students of which 89 took the exams and 80 have all variables available. The online students are older, have been in college longer, more favorably disposed towards economics and spend a higher portion of their time on gathering news in business and economics. The face-to-face course contains a higher portion of females and of those who are freshman level and undecided about their major.

The dependent variable, *examscore*, is the first indication we have in the class (which is on-going at the time of this writing) of whether the students are learning economics. For now, a comparison of the in-class exam over the first six chapters is added to the online students average performance over the first three modules that cover the same material. Online student are allowed to repeat the randomized quiz for each of the modules up to three times or until they achieve 'mastery' by getting all ten questions right. Only 13 students at the time of this writing had completed all 3 modules so the average of their scores on the completed modules is used. For both of these reasons one would expect the online students to score higher. Later studies will examine the students' performance on a standardized final exam and on their ability to write over two writing assignments. At that time the online variable will have a more precise interpretation, but now it indicates that indeed the online students are receiving a higher grade.

Other results are encouraging, upholding our prior expectations on the variables. In short, each of initial endowments, awareness and attitudes are found to be important to student success, even if we cannot yet say whether online students learn at a higher rate. In fact the literature is full of reports that online students show no significant difference (Twigg (2001)) or if a difference its minor, but showing lesser ability to think complexly (Brown and Leidholm (2002)).

To test the complexity assertion as well as the no significance assertion, a standardized examination was developed and externally validated. As a regressand in Model 1 (of table 3) the pre-test score is shown to be very important in predicting success, but the surprising and reassuring finding is in Model 2. There we see that the type of pre-assessed knowledge is extremely important. Breaking down the pre-test results by level of complexity, being able to recognize and recall has no effect, being able to apply economic principles in a simple application is of great importance and being able to answer more complex problems is of the greatest importance in predicting student success.

Three survey variables about attitudes were asked of the students: about their interest in economics, whether they expect to like the course and whether they plan on taking more economics courses. The variables were entered in all combinations and the importance varied from the "like" variable on the low end to the "take more courses" variable on the high end. Because of multicollinearity issues and a desire to have a more aggregate score the variable *attitudes* enters Modules 1 and 2 and is very powerful adding over 15 points on the students scores for those who answer all strong agreement on the three variable.

Of the three categories of variables (endowments, awareness, and attitudes) clearly the awareness shows as the weakest albeit positive effect on student success. Those who scored as many as 10 correct answers (of 20 in total) would be expected to score from 6.7 to 8.5 percentage points higher on the assessment over the first 6 chapters. No combination of the two questions asked on business and economic newsgathering, as measured, ever achieved significance.

Controlling for student characteristics is important in a study such as this as the results are not surprising other than older students tend all things equal to do slightly worse and those undeclared or undecided in their major suffer almost a full letter grade (based on 10 points per letter grade) for being so early in their career.

Conclusion

The data as of yet support no firm conclusions, since the class is still ongoing and standardized instruments of success are yet to be administered. However, we do find confirmation of our model and anticipate a full line of inquiry into student success for the near future. A major premise of the work is that the instructional design for the online and the face-to-face class offerings need not be the same and indeed need to be tailored to the mode of course delivery. The online variable here is suggestive that mastery-based online students may indeed do better than their face-to-face counterparts, but it is for further research to demonstrate that and to see if we have avoided 'no significant difference' in this design,

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Table 1: Variable Definitions and Prior Expectations

Dependent Variable

Examscore A percentage correct score (scaled as 100 for 100%) on questions asked over the first six chapters of the required textbook. This is created by the score on the first in-class examination in the face-to-face class and the average of the scores over the first three module quizzes in the online course.

Independent Variables

Initial Endowments

Pre-test percentage correct (scaled as 1 for 100%) on a 40 item pre-test administered at the beginning of the class (positive)

Recog_ptst percentage correct (scaled as 1 for 100%) of the 13 items of the pre-test that assess recall and recognition (positive)

Apply_ptst percentage correct (scaled as 1 for 100%) of the 14 items of the pre-test that assess simple applications of economic principles (positive)

Complex_ptst percentage correct (scaled as 1 for 100%) of the 13 items of the pre-test that assess complex reasoning to economic principles (positive)

GPA Cumulative GPA across all college work (positive)

Previous Binary variable indicating having taken the course at least once before (no prior)

Awareness

Survey Number of correct answers from a 20-item survey of economic facts to assess the level of awareness of various trends and facts in the economy (positive)

News_high Binary variable equal to 1 if the student reports collecting news about business and economics for 2 or more hours per week (positive)

Attitudes

Attitudes average of three variables: (1) pre_interest – whether the student reports being interested in economics, (2) pre_like – whether the student reports that they expect to like the economics class, and (3) pre_take_other – whether the student reports that they expect to take more economic courses after this one. The scales for each are 5=strongly agree, 4=agree, 3=no opinion, indifferent, 2=disagree, and 1=strongly disagree (positive)

Student Characteristics

Major binary variables equal to one if the student is an engineering major (engmajor), an undecided or undeclared major (undecmajor), or other major (othermajor) (no prior)

Freshman Freshman status (negative)

Credits Total cumulative credits earned in college (no prior)

Fem binary variable equal to 1 if the student is female (no prior)

Black binary variable equal to 1 if the student is black (no prior)

Age student's age during the first week of school (no prior)

Course modality

Online a binary variable equal to 1 if the student is taking the online course and equal to 0 if face-to-face (no prior)

Table 2: Means of Variables

Name	Combined		Face-to-face		Online		
	N	mean (Std dev)	N	mean (Std dev)	N	mean (Std dev)	
Examscore	89	78.13 (12.62)	72	75.51 (12.15)	17	89.22 (7.69)	***
Pre-test	91	0.45 (0.12)	71	0.45 (0.12)	20	0.45 (0.11)	
Recog_ptst	93	0.45 (0.16)	73	0.44 (0.16)	20	0.50 (0.18)	
Apply_ptst	93	0.46 (0.16)	73	0.47 (0.17)	20	0.45 (0.14)	
Complex_ptst	93	0.41 (0.17)	73	0.41 (0.18)	20	0.40 (0.13)	
GPA	93	2.41 (1.24)	73	2.41 (1.28)	20	2.42 (1.12)	
Previous	93	0.15 (0.36)	73	0.12 (0.33)	20	0.25 (0.44)	
Survey	91	8.76 (2.41)	71	8.80 (2.33)	20	8.60 (2.74)	
News_high	93	0.25 (0.43)	73	0.21 (0.41)	20	0.40 (0.50)	*
Attitudes	86	3.39 (0.74)	66	3.30 (0.76)	20	3.70 (0.59)	**
Pre_interest	86	3.74 (0.77)	66	3.76 (0.79)	20	4.00 (0.65)	*
Pre-like	86	3.60 (0.83)	66	3.58 (0.80)	20	3.70 (0.92)	
Pre_take_more	86	2.83 (1.23)	66	2.65 (1.17)	20	3.40 (1.27)	**
Engmajor	93	0.46 (0.50)	73	0.45 (0.50)	20	0.50 (0.51)	
Undecmajor	93	0.45 (0.50)	73	0.51 (0.50)	20	0.25 (0.44)	**
Othermajor	93	0.09 (0.28)	73	0.04 (0.20)	20	0.25 (0.44)	*
Freshman	93	0.48 (0.50)	73	0.53 (0.50)	20	0.30 (0.47)	*
Credits	93	40.76 (40.72)	73	34.25 (36.55)	20	64.50 (46.99)	***
Fem	93	0.78 (0.41)	73	0.88 (0.33)	20	0.45 (0.51)	***
Black	93	0.06 (0.25)	73	0.04 (0.20)	20	0.15 (0.37)	
Age	93	20.71 (3.65)	73	20.37 (3.74)	20	21.95 (3.10)	*
Online	93	0.22 (0.41)					

Standard deviations are in parenthesis. Results of tests of significance difference in the means marked for the following significance levels: * .10, ** .05, *** .01.

Table 3: Regression Results: Dependent Variable is Examscore

Variable	model 1		model 2	
Intercept	53.174	***	54.178	***
	(5.64)		(5.92)	
Pre-test	41.360	***		
	(4.50)			
Recog_ptst			-2.263	
			(-0.33)	
Apply_ptst			17.959	***
			(2.43)	
Complex_ptst			24.753	***
			(3.48)	
GPA	1.246	*	1.286	**
	(1.42)		(1.50)	
Previous	-11.118	***	-12.675	***
	(-3.71)		(-4.28)	
Survey	0.85	**	0.673*	
	(1.77)		(1.43)	
News_high	-0.336		-0.177	
	(-0.14)		(-0.08)	
Attitudes	3.38	**	3.810	***
	(2.33)		(2.72)	
Undecmajor	-8.322	***	-8.564	***
	(-3.70)		(-3.88)	
Othermajor	-3.006		-2.783	
	(-0.67)		(-0.64)	
Freshman	-2.576		-2.025	
	(-1.09)		(-0.87)	
Fem	0.678		0.993	
	(0.24)		(0.36)	
Black	-4.139		-3.854	
	(-0.75)		(-0.72)	
Age	-0.500	*	-0.545	**
	(-1.83)		(-2.05)	
Online	10.632	***	12.089	***
	(3.78)		(4.35)	
N	80		80	
F	9.30	***	9.03	***
\bar{R}^2	0.58		0.60	

Student t-statistics in parenthesis.

Significance levels: * .10, ** .05, *** .01.

Appendix 1: Survey of Economic Awareness, Information Gathering and Attitudes Towards Economics.

Permission to use this survey in its entirety is given freely with the following conditions. (1) You must email myers@uakron.edu with your intention to use the survey, (2) cite this source in all presentations and publications that use this survey, and (3) share your results in raw and summary form along with characteristic student data giving us permission to use your results in summary fashion and for comparison. Answers available from the author.

Department Of Economics, The University Of Akron, 3250:244 Introduction To Economic Analysis

Dear Student,

Economics is a subject that we have all been exposed to over the years, in school, in the media and in our home. Perhaps you have discussed points of economics and not actually known that is what you are doing. Separately we have or will test your economic thought process as we begin this course, but here we want to know more about you. This is not a graded exercise and will not count towards your grade in any way. However, how the class as a whole thinks on a variety of issues, how they get their information and their attitudes towards economics may be related to how well they learn the content of this course. By knowing more about you, we can better serve your needs as we progress through the course. Good Luck with your studies, but for this survey, relax and give us your best guesses of the following questions.

Yours in learning,

Your Econ 244 Professors: Dr. Steven Myers and Dr. Michael Nelson

Note: Your answers will not affect your grade, only our teaching.

Survey of Prior Knowledge

1. Approximately, what is the unemployment rate in the United States?
a. 1% b. 5% c. 10% d. 20%
2. Have average wages increased, decreased, or remained the same as inflation in recent years?
a. Increased b. Decreased c. Remained the Same
3. Do people earning greater than \$50,000 per year pay a higher, lower, or the same tax rate than people earning less than \$50,00?
a. Higher b. Lower c. Remained the Same
4. Through the first seven months of 2000, did the stock market rise, fall, or remain the same?
a. Rise b. Fall c. Remain the Same
5. Are the percentage of workers who work in the service sector, more, less, or the same as in than the 1960s?
a. More b. Less c. Same
6. Approximately, what percentage of current workers are being paid the minimum wage?
a. 1% b. 5% c. 25% d. 50%
7. Approximately, what is the inflation rate this year?
a. 1% b. 5% c. 10% d. 20%
8. Have the average wages of women relative to men increased, decreased, or remained the same in the past 30 years?
a. Increased b. Decreased c. Remain the Same
9. In general, do trade restrictions on foreign goods help, hurt, or has no effect on the U.S. economy as a whole?
a. Help b. Hurt c. No Effect
10. Since 2000, has the federal government deficit increased, decreased, or remained the same?
a. Increased b. Decreased c. Remained the Same

11. Has the overall poverty rate increased, decreased, or remained the same since 1960?
 - a. Increased
 - b. Decreased
 - c. Remained the Same
12. Are there more male or female college students?
 - a. Male
 - b. Female
13. Were there more, less, or about the same number of families receiving welfare assistance in 2000 than in 1990?
 - a. More
 - b. Less
 - c. The Same
14. With which country does the United States trade the most?
 - a. Japan
 - b. China
 - c. Canada
 - d. United Kingdom
15. With which two countries does the United States have the largest trade deficit?
 - a. Russia and Saudi Arabia
 - b. United Kingdom and France
 - c. Mexico and Canada
 - d. Japan and China
16. What is the institution that controls the money supply in the United States?
 - a. U.S. Treasury
 - b. Congress
 - c. President
 - d. Federal Reserve
 - e. Wall Street
17. Since 1980, has union membership increased, decreased, or remained the same?
 - a. Increased
 - b. Decreased
 - c. Remained the Same
18. Approximately, what percentage of married women participate in the labor force?
 - a. 50%
 - b. 60%
 - c. 70%
 - d. 80%
 - e. 90%
19. Approximately, what percentage of married men participate in the labor force?
 - a. 55%
 - b. 65%
 - c. 75%
 - d. 85%
 - e. 95%
20. Since 1985, has percentage of families owning their home increased, decreased, or remained the same?
 - a. Increased
 - b. Decreased
 - c. Remained the same

Survey of Information Gathering Process

21. Please indicate how you collect business, financial and economic information (choose all that apply)
 - a. Newspapers and Magazines
 - b. TV and/or Radio news
 - c. TV and/or Radio talk shows
 - d. Internet and Web Based Sources
 - e. Other (please specify)
22. For each of the ways of gathering information listed in the last question, how many hours per week do you watch, listen or read about business, finances and economics?
 - a. 0 (zero)
 - b. less than one hour per week
 - c. 1 to 2 hours per week
 - d. 2 to 4 hours per week
 - e. more than 4 hours per week

Survey of Attitudes Towards Economics

23. I will like my economics class.
 - a. strongly agree
 - b. agree
 - c. no opinion, indifferent
 - d. disagree
 - e. strongly disagree
24. Economics is an interesting subject.
 - a. strongly agree
 - b. agree
 - c. no opinion, indifferent
 - d. disagree
 - e. strongly disagree
25. After you finish this class, how likely are you to take more economics classes.
 - a. strongly agree
 - b. agree
 - c. no opinion, indifferent
 - d. disagree
 - e. strongly disagree

¹ In Fall 2001 and Spring 2002, there were 27 grades of A, 2 Bs, and 4 withdrawals or failures in the MBA version of this course. This is the first full semester for this online course at the undergraduate level.

² Some examples of student distress in online courses can be seen in Hara and Kling (2001).

³ WebCT offers a selective release mechanism that will open future modules as modules are completed, however, much of the navigation relies on the manual opening of modules and module quizzes since WebCT can not handle multiple selective release criteria, nor count the number of times that a student has completed a quiz as part of the selective release mechanism. Additional desirable features of WebCT could include the ability to lock out test questions from ever being repeated to a student once asked and to automatically email warnings and messages to individual students based on certain criteria, e.g., achieving too low of a score or having not logged on in too many days.

⁴ The questions are: i. What comments do you have on this module and your experience in completing it? ii. What main point have you learned that you did not fully understand before? iii. What questions do you have at this time? Include any points that still remain muddy or unclear. Do consider posing the muddy points to your fellow students in the discussions. iv. What recommendations do you have for us as we continue to change and enhance the course?

⁵ Additionally they find that the improvement to the student's economic knowledge is not significantly related to the instructor or the students' ability level. If Maki and Maki (2002) that distance learning benefits the strongest, then the use of the CATs may be a proportionally more valuable addition for the weaker students.

⁶ Chizmar and Walbert (1999) discuss the minute paper as encouraging contacts between students and faculty.

⁷ Pre and post testing have been used in much of the literature to assess the value added to students by taking a certain course and in comparison studies. One example is from Chizmar and Ostrosky (1998) who used the TUCE (Test of Understanding of College Economics). The TUCE has come under criticism for a variety of reasons and we decided that we wanted to measure learning on a set of content standards with which we were comfortable. This can be seen as only a weak response to Walstead's call for "new standardized tests in economics to measure outcomes from economic courses and for evaluations of teaching innovations in economics." (Walstead (2001)).

⁸ What we include as initial endowments, Chizmar and Ostrosky (1998) calls aptitude in economics (for the pre-test score) and aptitude in all other courses (for GPA). Our previous variable would have to come under their aptitude in economics, but they did not include such a variable.