Do On-Line Students in a Mastery Based Principles Course Analyze, Synthesize And Evaluate Better Than Face-To-Face Students?

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Abstract

An asynchronous course in the introduction to 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 in a similar course over four semesters is pronounced with little withdrawal and mostly grades of A being received. This paper examines student outcomes on a common pre- and post-test, a common writing assignment, and examines the formation of attitudes towards economics.

The authors at the University of Akron undertook an experiment comparing the success rates of face-to-face to online courses. The study finds that the level of initial student endowments, awareness of the current economy, initial attitudes towards economics, and student characteristics are important in explaining student success and attitude formation. 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 suggests that the online students do as well in complex tasks and exceed their face-to-face counterparts at lower levels of learning.

Acknowledgments:

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The economics profession and other disciplines are moving to the online world. In some cases instructors use the web to supplement or complement traditional in-class activities (web-enhanced courses) while others have ported their entire course to web and the class never meets in a face-to-face setting (web-based courses). A number of interesting issues have arisen with the advent of web-based courses, including their cost effectiveness, exam security, and their relative effectiveness with regards to student learning outcomes and attitudes towards the discipline.

Of interest here is to bring empirical evidence to bear on the latter issues. Specifically, we compare and contrast the outcomes of a one-semester principles of economics course taught in web-based and traditional face-to-face settings. 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, and is web-enhanced. How students perform in each class will be examined and compared. In particular, we bring empirical evidence to bear on the following questions:

(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 awareness about economic institutions and current events affect their learning outcomes and attitudes towards economics?

Instructional Design

The class under study is a three–credit course of combined micro and macro principals offered in the 2002-2003 academic year. While the course can be taken by anyone to satisfy their general education requirements it was specifically set up to for students in the College of Engineering. Economics and business majors usually take separate three-credit courses, one in microeconomics and one in macroeconomics. Typically, about half of the students in the course under analysis are engineering majors. Each semester two sections of the course were offered, one web based and the other face-to-face with some web enhancements. In the fall semester the course was taught by different instructors, each with approximately equal amount of teaching experience; in the spring, both sections were taught by the same instructor. In each section the course content is the same, the textbook is the same, the pre and posttests and all writing assignments are the same.

The online course was 100% offered and completed on the Internet. In designing the course we were informed by the extant literature on online learning which reminds one immediately of the potential for failure of such an endeavor. 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.[1]

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. Porting the same instructional design used in a face-to-face class to the Internet can pose 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.

The online course we use is designed around mastery learning and competency-based learning.[2] Mastery learning based classes requires the student to achieve a certain level of mastery over the course material before the student is certified to progress to the next level. To accomplish this, we organized the course into several modules, each consisting of two or three chapters of the textbook and related readings. The student is also provided with presentation-type material and on-line quizzes to help guide the student in achieving mastery over the objectives of the module.

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. In the online course the objectives of each chapter are formed into the objectives of the module. The assessment component of the course includes 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)).[3] 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.[4] 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.[5]

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.

The design of the face-to-face 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.

Assessment between the two courses were different in that students in the face-to-face course were not permitted to retake exams and quizzes to achieve higher scores. Both the online and face-to-face course have a common comprehensive exam and a writing assignment. Each of these is described further below.

Measures of Student Success

In this study student success is measured in several ways: the scores on a standardized multiple-choice exam, a writing assignment designed at a high level of complexity and an index of student attitudes towards economics at the end of the course.

Standardized exam. The standardized exam, administered as both a pre- and post-test, consists of 40 multiple choice questions that relate to the twenty *Voluntary National Content Standards in Economics* published by the Foundation of Teaching Economics (Seigfried (1996)).[6] These standards represent the economic knowledge that students should know upon graduation from high school. They include such principles as "productive resources are limited, therefore people cannot have all the goods and services they want, they must choose some things and give up others."

A set of 120 questions covering each of the twenty standards was assembled using a test bank associated with a well-known principles of economics textbook. Each question was also rated with respect to the level of

competency according to a standard that roughly translates into the lower three or four categories of Bloom's taxonomy: knowledge, comprehension, application, and analysis. The set of questions was then sent to five economists active in the teaching field for external validation. Each reviewer as asked to rate each question according to whether it fit the content standard and complexity level using a 5-point Likert scale. The three levels of complexity used in this standardized exam are referred to as recall and recognition, simple application, and complex reasoning.

Based upon this external assessment, 40 questions were selected covering all 20 standards. Thirteen of these questions were categorized as "knowledge," another 14 were rates at the "comprehension" level of competency and the remaining 13 at the higher "application" level. When the exam was given as a pre-test, student were asked to give their "best effort," but their result did not figure in the final course grade. The post-test was used in the calculation of the final course grade, with approximately equal weight in both sections. Students were not permitted to retake the exam for a higher score in either section.

Writing Assignment. A common writing assignment was designed to assess students at a complex level of competency as measured by Bloom's taxonomy. The assignment was written in a manner to test the students' ability to think on a higher plane, to research a problem, synthesize the analysis, and evaluate which of many facts are actually important to make recommendations to a student's hypothetical employer. In terms of Bloom's taxonomy, we viewed this exercise as requiring the student to demonstrate competency up to the "analysis/synthesis" level, but perhaps short of the highest "evaluation" category.

The actual problem was explained in a rather lengthy handout (or webpage), with starter references and the question(s) stated finally as:

> *Mr./Mrs. Economist, what is going on in the national economy and how does this compare and contrast with what is going on in our regional economy here in Ohio? How does all this affect your employer's business? What solutions would you suggest to your employer with regard to how s/he runs the business in coming months?*

Students had to research and identify trends in the national economy, trends in the Ohio economy, and then draw conclusions about what might be important for the local economy of the employer. Students could adopt any employer they would like and those working often tried to relate to their actual situation. The students' responses are graded according to a rather strict grading rubric. The rubric chosen is presented by Diane Ebert-May at flaguide.org and is a rubric for scoring essays. A copy of that rubric is included in the appendix.[7]

Final Student 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. Specifically, students were asked to respond to the following three questions using a 5-point Likert scale:
- I (will like) liked my economics class.
- Economics is in interesting subject.
- After you finish this class, how likely are you to take more economics classes?

The scales for each question were 5=strongly agree, 4=agree, 3=no opinion, indifferent, 2=disagree, and 1=strongly agree (positive) and the average student response at the end of the semester to the three questions was used as the final attitudes measure of student success.

Empirical Setup

To explain student success, we posit the following model:

(1)   Student success = f(initial endowments, economic awareness, initial attitudes towards economics, student characteristics, mode of delivery)

It is our expectation that students with more favorable initial endowments (including higher pre-test scores and GPA levels and whether the student has taken the class before) will achieve a higher level of success.[8] We also

investigate where students entering the course with greater economic awareness and more favorable initial attitudes towards the disciple will perform better in the class.

Economic awareness is measured by a twenty-item survey of economic facts administered to the students at the beginning of class. 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.

Finally, we control for student characteristic differences within and between the classes will allow us to see the effect of mode of delivery on student success. Student characteristics include information pulled from the students' academic record.

Further details on each of the right-hand side variables use in the model can be found in Table 1 and the expected signs for the regression coefficients for each student success measure. All data were collected under 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. In the face-to-face class 23 students (16.2%) did not give consent while only 4 students (7.7%) in the online courses did not give consent. The significantly better coverage in the online course was due to a fact that students could not progress in the course until they answered the consent question. Students in the face-to-face class could avoid or fail to complete the form without penalty to progress. No grade weight was assigned to the completion of this form.

Results

Table 2 shows the means and standard deviations for the right-hand-side variables in the model. Data on 167 students are divided between 119 face-to-face and 48 online students of which 135 took the standardized final exam and have all the right-hand side variables required to estimate the model. For the writing assignment there are 126 observations with complete data and 113 for the final attitudes outcome measure.[9] The online students have a higher GPA and more favorably disposed towards economics. They tend to have less knowledge of economic facts and institutions. The face-to-face course contains a higher portion of males and of those who are freshman level and undecided about their major.

Tables 3 to 5 report the results of the multivariate regressions. We have approached the question of student success in a multifaceted approach embracing both learning outcomes and attitudes. Table 3 reports regressions of the post-test, which was given as the final examination (Final Exam) in the course. The components of the 40 multiple choices questions that represent recognition and recall (FE_Recog), application (FE_Apply) and complex reasoning (FE_Complex) questions are also used as dependent variables. Table 4 shows the regression for the writing assignment (Writing), which was written at the highest level of Bloom, and an average post-attitudes measure (Final Attitudes). Table 5 summarizes these equations and the overall results of 4 additional attitude equations. Table 5 summarizes by reporting for comparison the size and significance of each online variable and shows tests for each of the "variables" of the theoretical model.

Student Success on the standardized post-test

Model 1 of Table 3 shows that students in the online course scored significantly higher on the final exam. Online students scored an average of 76 percent as compared to 69 percent of the face-to-face class. When the multivariate controls for initial endowments, awareness, prior attitudes and student characteristics were included the difference between the online and face-to-face students fell from the 7-percentage point difference to an insignificant difference of 3.3 percentage points. All fours categories of variables in our model proved statistical significant as can be seen by reference to the first result of Table 5. Specifically, the results of the model show the importance of having a higher GPA and students who are repeating the class tend to do better than the first time students. Awareness of the economy measured in the first week of classes (Survey) is shown to be helpful in doing better on the final exam. The three survey variables about attitudes (Pre_interest, Pre_like and Pre_take_more) were also asked of the students in the first week and included as controls for attitude in the final exam equation. While the variables were individually insignificant, the F-test of Table 5 shows that all taken together are statistically significant.[10] Additionally, the category of student characteristics is statistically significant with being an engineering major being an advantage since the alternative to being an engineering major (the

reference group) is having an other declared major or failing yet to declare a major show 8 to 9-percentage point penalties on the final exam score. Older students are seen to do marginally better as well.

The models 2, 3 and 4 show the same analysis applied to the individual student's score on questions on the final from different levels of complexity. Tests for significant difference between the online students' and face-to-face students' mean on the breakdown of the final into its recognition and recall, application and complex components revel that the online students are 13 points better in recognition scores, 8 points better in application scores and exactly the same in complex scores. Applying the regression analysis to these scores separately we see that student initial endowments and student characteristics are important in all three models. GPA is more important in the higher order learning while repeating the course is an advantage in lower order learning. Better scores on the pretest seem positively related to better scores on the same questions on the final, however reached statistical significance only at the lowest level of learning (FE_recog). Awareness issues, seems to have a minimal effect and previous attitudes are spotty as well on the effect on the dependent variables. Universally having failed to declare a major, holding level (Freshman) and age constant, is seen as consistently negative on success on the final examination and thus on success in the economics course.

Looking at the size and significance of the online coefficient across all models 1 through 4, one can see that the online students do significantly better in the lower level questions of recognition and recall, better in application questions, but no different in complex questions. The online coefficient in the complex equation is negative, but fails to reach significance under any specification.

Success on the Second Writing Assignment
The writing assignment was designed to require students to synthesize and evaluate rather than just analyze. This provides a look into the complex reasoning skills of the students and can be compared to the results of final_complex. This way we have both a measure of complex reasoning based on multiple-choice questions and in an open ended writing project. This writing assignment was not an in-class assignment, but one that the students could take a few days to a week on. As can be seen in model 4 and model 5, the online variable is insignificant as is the simple difference between the mean scores of the face-to-face and online students. The distance learning literature is full of reports that online students show no significant difference in typical outcomes (Twigg (2001)). In economics, Brown and Leidholm (2002) show that their online students do not do significantly worse overall, but do show lesser ability to answer complex multiple-choice questions. In these results of model 4 and model 5 we see no support for the online students doing worse. If online students do not do worse, that is we cannot reject the null that they perform the same as the in-class students, then the advantages of distance learning to shift time and place does not have to be paid for through lower learning.

The students who succeed on the complex writing assignment all things equal are those who come into the course with a higher GPA, a higher level of understanding of economic facts and who have declared a major (or are an engineering major). Curiously, in Model 5, we see the only time that being a freshman, female or being black reaches statistical significance. The black coefficient is large and significant suggesting that on a 10 point writing assignment, black students score over 2 points (and hence likely 2 letter grades) worse. While this may be an anomalous result, if true, it suggests an interesting avenue of inquiry.[11]

Attitudes of Students towards Economics

Model 6 shows the coefficients for the final attitudes equation. Final_attitudes is a variable averaging the scores students give to the three statements: "I liked my economics class." "Economics is an interesting subject," and "Now that you have finished this class, how likely is it that you will take more economics classes?" The three same statements scored at the beginning of the class are important in explaining the dependent variable. The only other variable that reaches significance is Complex_ptst, the score on the complex questions of the pre-test suggesting a relationship between students who enter with complex reasoning skills being associated with more favorable attitudes towards economics. Other than this, no other variable is suggestive. This is apparent in the four additional attitude variables summarized in Table 5 where only the pre-attitude variables are significant. While not displayed in the tables, none of the last five measures in Table 5 show significant differences in mean values between the online and face-to-face students.[12] By and large there is no consistent evidence that online students form better attitudes towards economics.

Awareness and Student Success Outcomes

Summarizing our findings regarding the fourth hypotheses posed at the beginning of this paper, there is evidence that a student's awareness of basic economic facts and institutions upon entering the class (Survey) contributes positively to learning outcomes when measured by their score on the final exam and the writing assignment. In contrast our prior expectations, students who devote more time weekly to collecting news about business and economics tend to perform worse on exams, other things equal. Neither measure of awareness appears to affect student attitudes towards the discipline. A contributing factor regarding the "news gathering" awareness variable is this it measured relatively crudely as a binary dummy variable and it does not distinguish among the venue by which the news is gathered (e.g., TV, newspaper, radio news or talk shows).

Conclusion

When subjected to multiple regression analysis based on a model of student success, where success is measured by commonly administrated instruments, online and face-to-face students do not score significantly differently at the highest level of learning and do not form significantly different attitudes towards economics. Students in the online courses do seem to out perform face-to-face students at lower levels of thinking. If Brown and Liedholm (2002) are correct that students in an online class, based on a similar instructional design to the face-to-face class, cannot reason at a high complex level, then this paper suggests a solution. A major premise of this study 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. Mastery learning may be ideal for the online student and the results of this study suggest that complex reasoning is identical between the online and face-to-face students.

References

Angelo, Thomas A. and K. Patricia Cross. Classroom Assessment Techniques: A handbook for College Teachers (second edition), Jossey-Bass, 1993.

Becker William E. and Michael Watts. "Teaching Economics at the Start of the 21st Century: Still Chalk and Talk," American Economic Review (May 2001): 446-451.

Byron Brown and Carl Liedholm "Can Web Courses Replace the Classroom? Lessons from Microeconomics," American Economic Review, May 2002.

Chizmar, John F. and Anthony L. Ostrosky. "The One-minute Paper: Some Empirical Findings," Journal of Economic Education, Winter 1998.

Chizmar, John F. and Mark S. Walbert. "Web-Based Learning Environments Guided by Principles of Good Teaching Practice," Journal of Economic Education, Summer 1999.

Hara, Noriko and Rob Kling. "Student Distress in Web-Based Distance Education," Educause Quarterly, November 2001.

Maki, William S. and Ruth H. Maki. "Multimedia Comprehension Skill Predicts Differential Outcomes of Web-Based and Lecture Courses." Journal of Experimental Psychology: Applied, 8 (2) 85-98, 2002.

Simkins, et al. "Pretesting Students to Improve Teaching and Learning," Source International Advances in Economic Research, Feb 2000.

Siegfried, John, et al. National Voluntary Content Standards (1996) from the web at http://www.fte.org/teachers/nvcs/nvcs.htm.

Twigg, Carol. Innovations in Online Learning: Moving Beyond No Significant Difference, Center for Academic Transformation, Rensselaer Polytechnic Institute (2001) from the web at http://www.center.rpi.edu/PewSym/Mono4.html

Walstad, William B. "Improving Assessment in University Economics," Journal of Economic Education, Summer 2001.

Table 1: Variable Definitions and Prior Expectations

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)

Initial Attitudes

Attitudes : average of three variables: (1) pre_interest, (2) pre_like, and (3) pre_take_other. The scales for each of these and this variable are 5=strongly agree, 4=agree, 3=no opinion, indifferent, 2=disagree, and 1=strongly agree (positive)

Pre_interest : whether the student reports being interested in economics (positive)

Pre_like : whether the student reports that they expect to like the economics class (positive)

Pre_take_other : whether the student reports that they expect to take more economic courses after this one (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)

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)	
Pre-test	161	0.47 (0.11)		114	0.47 (0.11)		47	0.47 (0.12)	
Recog_ptst	161	0.48 (0.15)		114	0.47 (0.15)		47	0.52 (0.17)	*
Apply_ptst	161	0.50 (0.14)		114	0.51 (0.14)		47	0.48 (0.14)	
Complex_ptst	161	0.42 (0.16)		114	0.42 (0.16)		47	0.42 (0.16)	
GPA	167	3.05 (0.67)		119	2.98 (0.71)		48	3.23 (0.53)	**
Previous	167	0.10 (0.30)		119	0.09 (0.29)		48	0.10 (0.31)	
Survey	162	11.10 (4.18)		117	11.80 (4.40)		45	9.27 (2.87)	***
News_high	167	0.22 (0.41)		119	0.19 (0.40)		48	0.27 (0.45)	
Attitudes	157	3.51 (0.70)		112	3.39 (0.72)		45	3.79 (0.56)	***
Pre_interest	157	3.83 (0.74)		112	3.75 (0.78)		45	4.02 (0.62)	**
Pre-like	157	3.77 (0.76)		112	3.71 (0.76)		45	3.91 (0.73)	
Pre_take_more	157	2.92 (1.16)		112	2.71 (1.13)		45	3.44 (1.10)	***
Engmajor	167	0.45 (0.50)		119	0.38 (0.49)		48	0.63 (0.49)	***
Undecmajor	167	0.45 (0.50)		119	0.55 (0.50)		48	0.19 (0.39)	***
Othermajor	167	0.10 (0.30)		119	0.07 (0.25)		48	0.19 (0.39)	*
Freshman	167	0.52 (0.50)		119	0.58 (0.50)		48	0.38 (0.49)	**
Female	167	0.22 (0.41)		119	0.14 (0.35)		48	0.40 (0.49)	***
Black	167	0.04 (0.20)		119	0.03 (0.18)		48	0.06 (0.24)	
Age	167	20.78 (4.53)		119	20.40 (3.86)		48	21.71 (5.81)	
Instructor	167	0.12 (0.33)		119	0.00 (0.00)		48	0.42 (0.50)	
Online	167	0.29 (0.45)		119	0.00 (0.00)		48	1.00 (1.00)	

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 Final Exam Score

Variable	Model 1 Final Exam		Model 2 FE_Recog		Model 3 FE_Apply		Model 4 FE_Complex	
Dep. Var Mean	*0.70 (0.12)*		*0.73 (0.15)*		*0.70 (0.14)*		*0.67 (0.16)*	
Face-to-face mean N=110	*0.69 (0.11)*		*0.70 (0.15)*		*0.68 (0.13)*		*0.67 (0.15)*	
Online mean N=37	*0.76 (0.13)*		*0.83 (0.13)*		*0.76 (0.14)*		*0.67 (0.17)*	
t-test for diff. & significance	*3.17*	***	*4.75*	***	*3.21*	***	*0.08*	*ns*
Intercept	0.342	***	0.312	**	0.380	***	0.476	***
	(3.33)		(2.47)		(2.98)		(3.25)	
Recog_ptst	0.040		0.123	**				
	(0.63)		(1.66)					
Apply_ptst	-0.044				0.102			
	(-0.57)				(1.14)			
Complex_ptst	0.073						0.134	
	(1.18)						(1.60)	
GPA	0.045	***	0.023		0.048	**	0.045	**
	(2.62)		(1.04)		(2.18)		(1.75)	
Previous	0.084	**	0.137	***	0.090	*	0.017	
	(2.19)		(2.95)		(1.95)		(0.32)	
Survey	0.006	***	0.003		0.004	*	0.001	
	(2.53)		(1.08)		(1.51)		(0.23)	
News_high	-0.063	***	-0.072		-0.028		-0.054	
	(-2.67)		(-2.48)		(-0.96)		(-1.57)	
Pre_interest	0.019		0.024		0.028	*	0.002	
	(1.25)		(1.24)		(1.47)		(0.08)	
Pre_like	-0.014		-0.011		-0.029		-0.019	
	(-0.91)		(-0.59)		(-1.51)		(-0.86)	
Pre_take_other	0.007		0.018		-0.009		0.016	
	(0.69)		(1.51)		(-0.76)		(1.16)	
Undecmajor	-0.083	***	-0.126	***	-0.046		-0.082	**
	(-3.62)		(-4.35)		(-1.57)		(-2.41)	
Othermajor	-0.087	***	-0.146	***	-0.044		-0.064	
	(-2.19)		(-2.92)		(-0.87)		(-1.08)	
Freshman	-0.009		0.006		-0.024		-0.028	
	(-0.51)		(0.26)		(-1.06)		(-1.05)	
Fem	-0.018		0.009		-0.043		-0.033	
	(-0.77)		(0.30)		(-1.47)		(-0.98)	
Black	-0.091		-0.114		-0.098		0.011	
	(-1.39)		(-1.47)		(-1.19)		(0.12)	
Age	0.007	**	0.010	***	0.006		0.004	
	(2.40)		(2.91)		(1.65)		(1.07)	
Online	0.033		0.068	**	0.075	**	-0.055	
	(1.40)		(2.26)		(2.50)		(-1.58)	
N	135		135		135		135	
F	4.86	***	6.09	***	2.50	***	2.09	**
$\bar{R}^2$	0.33		0.36		.20		.11	

Student t-statistics in parenthesis.
Significance levels: * .10, ** .05, *** .01.

Final Exam = percentage score on final exam
FE_Recog = percentage score on the recall and recognition questions on the final exam
FE_Apply = percentage score on the simple application questions on the final exam
FE_Complex = percentage score on the complex application and analysis questions on the final exam

Table 4: Regression Results: Dependent Variables are Writing Assignment and Final Attitudes

Variable	Model 5 Writing		Model 6 Final_Attitudes	
Dep. Var Mean	*6.69 (1.61)*		*3.36 (0.89)*	
Face-to-face mean	*6.60 (1.53)*		*3.30 (0.88)*	
	n=98		*n=84*	
Online mean	*6.94 (1.80)*		*3.50 (0.91)*	
	n=36		*n=36*	
t-test for diff. & significance	*1.11*	*ns*	*1.12*	*ns*
Intercept	2.873	*	1.399	***
	(1.75)		(1.56)	
Recog_ptst	-1.039		-0.461	
	(-0.99)		(-0.81)	
Apply_ptst	0.052		0.369	
	(0.04)		(0.56)	
Complex_ptst	1.226		1.065	**
	(1.24)		(2.00)	
GPA	0.719	***	-0.067	
	(2.58)		(-0.41)	
Previous	-0.095		0.056	
	(-0.13)		(0.16)	
Survey	0.065	**	-0.021	
	(1.78)		(-1.02)	
News_high	0.250		-0.198	
	(0.67)		(-0.93)	
Pre_interest	0.194		0.418	***
	(0.79)		(3.17)	
Pre_like	0.161		-0.088	
	(0.65)		(-0.66)	
Pre_take_other	-0.127		0.322	***
	(-0.78)		(3.56)	
Undecmajor	-0.617	*	0.044	
	(-1.66)		(0.21)	
Othermajor	-0.654		0.166	
	(-1.01)		(0.48)	
Freshman	-0.287		0.047	
	(-0.98)		(0.30)	
Fem	0.408		0.153	
	(1.11)		(0.80)	
Black	-2.266	*	-0.383	
	(-1.95)		(-0.59)	
Age	0.005		-0.010	
	(0.12)		(-0.41)	
Online	0.028		-0.102	
	(0.07)		(-0.49)	
N	126		113	
F	2.06	**	3.41	***
$\bar{R}^2$	0.13		.27	

Student t-statistics in parenthesis.
Significance levels: * .10, ** .05, *** .01.

Writing = score out of 10 on a final writing assignment discussed in the text.
Final Attitudes = same as attitudes defined in table 1, but for the same questions asked at the end of the term.

Table 6: Regression Results and tests of variable contributions to the model.

Dep. Variable (Outcome Measure)	Online Coeff. (t-stat)		Student Endowment F-statistic		Student Awareness F-statistic		Student Attitudes F-statistic		Student Charact. F-statistic		F		N	R²
				Right – hand Side Variables							Summary Statistics			
Final Exam Grade	0.033 (1.40)	*	2.30	**	6.72	***	0.93	***	4.32	***	4.86	***	134	.33
Final - Recognition	0.068 (2.26)	**	3.39	**	3.74	**	1.91		5.36	***	6.09	***	134	.36
Final – Application	0.075 (2.50)	**	2.64	*	1.59		1.06		1.96	*	3.16	***	134	.20
Final – Complex	-0.055 (-1.58)		1.89	*	1.28		0.67		1.81	*	2.09	**	134	.11
Writing Assignment	0.028 (0.07)		1.86	*	1.77		0.82		1.55		2.06	**	125	.13
Final Attitudes	-0.102 (-0.49)		1.12		0.99		13.66	***	0.23		3.41	***	112	.27
Post: Interest	0.004 (0.02)		1.10		2.44		12.11	***	0.24		3.14	***	112	.25
Post: Like	-0.351 (1.46)		1.03		0.65		5.94	***	1.24		1.84	**	112	.11
Post: Take Other	0.040 (0.13)		1.48		0.24		9.55	***	0.72		3.23	***	112	.25
Post: Better Learning	0.131 (0.51)		0.35		1.67		3.42	**	1.05		1.49		112	.07

Student t-statistics in parenthesis.
Significance levels: * .10, ** .05, *** .01.

Appendix 1: Grading Rubric Used in the Writing Assignment

Level of Achievement	General Presentation	Reasoning, Argumentation
Exemplary (10 pts)	- Provides a clear and thorough introduction and background - Addresses the question - Presents arguments in a logical order using appropriate tools from class - Uses acceptable style and grammar (no errors)	- Demonstrates an accurate and complete understanding of the question - Uses several arguments and backs arguments with examples, data that support the conclusion
Quality (8 pts)	- Combination of above traits, but less consistently represented (1-2 errors) - Same as above but less thorough, still accurate	Uses only one argument and example that supports conclusion
Adequate (6 pts)	- Does not address the question explicitly, though does so tangentially - States a somewhat relevant argument - Presents some arguments in a logical order - Uses adequate style and grammar (more than 2 errors)	- Demonstrates minimal understanding of question, still accurate - Uses a small subset of possible ideas for support of the argument
Needs improvement (4 pts)	- Does not address the question - States no relevant arguments - Is not clearly or logically organized - Fails to use acceptable style and grammar	- Does not demonstrate understanding of the question, inaccurate - Does not provide evidence to support response to the question
No Answer (0 pts)		

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 (Pre-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

Survey of Attitudes (Post-attitudes) Towards Economics

(asked as part of the final evaluations)

1. I liked my economics class.
   a. strongly agree   b. agree   c. no opinion, indifferent   d. disagree   e. strongly disagree

2. Economics is an interesting subject.
   a. strongly agree   b. agree   c. no opinion, indifferent   d. disagree   e. strongly disagree

3. Now that you have finished this class, how likely is it that you will take more economics classes?
   a. strongly agree   b. agree   c. no opinion, indifferent   d. disagree   e. strongly disagree

4. My economics course was a better learning experience than my other courses.
   a. strongly agree   b. agree   c. no opinion, indifferent   d. disagree   e. strongly disagree

5. My economics course was more work than my other courses.
   a. strongly agree   b. agree   c. no opinion, indifferent   d. disagree   e. strongly disagree

6. Hours spent on your economics course per week.
   a. more than 8   b. 6 to 8   c. 4 to 6   d. 2 to 4   e. less than 2

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

[2] The specific design of the online course is described in presentational materials available at http://gozips.uakron.edu/~myers/online.

[3] 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?

[4] 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.

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

[6] 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 variable measuring previous attempts of the course would have to come under their aptitude in economics, but they did not include such a variable.

[7] The actual rubric is at http://www.flaguide.org/cat/rubrics/rubrics3.htm. The homepage www.flaguide.org is the Field-tested Learning Assessment Guide for science, math, engineering and technology instructors. The guide is based at the University of Wisconsin-Madison.

[8] 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 Walstad's call for "new standardized tests in economics to measure outcomes from economic courses and for evaluations of teaching innovations in economics." (Walstad (2001)).

[9] Of the 167 students, 147 took the final exam (110 in the face-to-face course and 37 in the online courses). There are 134 valid observations on the writing assignment (98 in the face-to-face and 36 in the online courses) and 120 completed final evaluations from which the final attitude questions are gathered (84 face-to-face and 36 online students).

[10] Because of multicollinearity issues and a desire to have a more aggregate score the variable *attitudes* (an average of (pre_interest, pre_like and pre_take_more) was entered into the various equations and all models were rerun. The only qualitative change was the strong significance of the attitudes variable in model 2 (coefficient 0.035, t-stat = 2.01 significant at the .05 level.)

[11] It is probably the case that this reflects the small size of the 'black' sample. Only 7 students are identified as black of which 6 are in the Fall term and 1 is in the Spring term. Dropping this variable does not affect the conclusions of this paper.

[12] The means and t-tests are for Post_interest (3.58 for the face-to-face students, 3.83 for the online students, and a t-statistic of 1.230, for Post_like (3.74, 3.67, t= -0.38), for Post_take_other (2.58, 3.00, t= 1.63) and for Post_better_learning (3.31, 3.47, t= 0.81). the means are on a 5 point scale with 5 being the highest rated. Interestingly there is some evidence that the online students scored the likelihood of taking additional classes in economics higher at an 11 percent level of significance. While outside the usual bounds of conventional significance, it is suggestive that the online students indicated that they are more likely to take more economics.