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TEACHING METHODS

An Assessment of Student Acceptance and Performance in Distance Education with Two-Way Interactive Compressed Video

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This paper summarizes the debate concerning the value of distance education, reports distance education experiences in agricultural economics courses at The Ohio State University, and analyzes the effects of "distance" on student performance in and acceptance of the distance course. Results suggest that distance and "live" students performed equally in the same course, and they evaluated the course experience in a similar manner. These results provide some assurance that distance education, at least using the two-way interactive synchronous learning model of the courses in this study, does not place the distant student in jeopardy.

Distance education technologies are causing institutions of higher education to face both dramatic changes in demand for their services and new educational competitors. To meet these challenges, many universities are offering distance education courses or have joined consortia to provide them (Neal). Teaching a course at distance adds significant challenges to both the instructor and students.

In this article, we summarize the debate concerning the value of distance education, report distance education experiences in agricultural economics courses at The Ohio State University (OSU), and analyze the effect of "distance" on student performance in and acceptance of these courses. Results of multivariate statistical analyses are presented that examine the effects of several factors, including distance education technology, on student learning and satisfaction in three agricultural economics courses. Specific contributions of this research are (1) an assessment of distance learning experiences in agricultural

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economics where few, if any, studies have been reported; (2) use of a measure of student performance that is superior to measures typically used in analyses of modes of instruction; and (3) an analysis of student performance and acceptance that allows comparison of students with "live" and distant contact with the instructor while controlling for differences in student characteristics.

The American Council on Education defines distance education as a process that connects learners with distributed learning resources, that often involves a separation of instructor and learner by place and/or time, and interaction between instructor and learners is conducted through one or more media (Sullivan and Rocco). Much recent attention has been focused on *asynchronous* distance education methods, particularly internet-based methods. Asynchronous methods are very appealing because individual learners can participate at a time that meets their needs or preferences. However, the more traditional synchronous distance education format remains popular (Neal). This research examines student performance in a synchronous distance education format compared to a live class format. Specifically, classes were taught to live sections of students at the main campus with simultaneous broadcasts to students at as many as five regional campus locations using interactive two-way compressed video technology.

Value of Distance Learning Technology

Distance education attracts similar numbers of advocates and skeptics. Advocates stress the increased demand for educational services and potential cost savings. DiBiase claims that the key distinction between distance and traditional instruction is not the mode of delivery, nor the distances in time and space that separate students and teachers. Rather, it is that distance learners are a qualitatively different, older population, with different educational needs from traditional on-campus students. Distance education offers the opportunity to increase demand for education and that should take precedence over allegiance to conventional notions of knowledge delivery. According to Poley, "it is clear that public higher education will only thrive and survive by meeting the learning needs of citizens throughout their life cycle . . . and incorporating the possibilities of new technology . . . into organization and delivery systems" (Poley, p. 973).

Proponents of distance education argue that it can lower costs and increase the supply of education services. Drucker admonishes, "Thirty years from now the big university campuses will be relics" (p. 41). He suggests that the costs of higher education have risen uncontrollably without "visible improvement in either the content or the quality of education" (p. 41). Drucker asserts that classes can be delivered off campus using satellite or two-way video at a "fraction of the cost" (p. 41) of traditional courses. In spite of Drucker's assertion that the virtual university is low cost, experience to date suggests the opposite (Burton). Wilson concludes that "distance courses require three to four times more dollars to develop and three to eight times more faculty and support resources to operate on a day-to-day basis." (p. 99)

Skeptics argue that student learning of course material may be weakened by distance education. Neal observes that many college-age learners may lack the

motivation, purpose, learning styles, and intellectual skills that allow educational success in a distance education mode. In addition, undergraduate education is much more than the acquisition of knowledge or student satisfaction with a course (Agre). The traditional on-campus undergraduate experience also facilitates a student's contact with graduate education, interaction with the global research community, exposure to public service activities of the academe, development of social networks, and much else. Davey suggests that the most significant goals of higher education are to challenge students to: examine their held beliefs, learn to think critically about issues, generate new solutions to problems, develop communication skills, and contribute to knowledge building efforts. Distance learning courses appear to be incompatible with these diverse functions of undergraduate education. In fact, the major controversy surrounding distance education may not be its success at delivering knowledge, but that most students come to research universities looking for skills while their professors have a much broader vision of the role of the university in educating students.

There have been a number of attempts to evaluate student learning in distance courses. Gilroy et al. suggest that meaningful evaluation of the higher education distance class should be based on ensuring the course "meets the student expectations" and ensures "the quality of the student experience" (p. 14). Such an approach, they suggest, should elicit student expectations for the course as well as determine whether or not those expectations were met. Hillesheim reported the evaluation of six on-line courses taught by six different instructors. Evaluations varied greatly among instructors. Hillesheim suggests that such variation may be due in large part to barriers faced by students and faculty, and the effectiveness of strategies employed by the instructor to overcome these barriers.

Brown and Liedholm compared students who completed an economics course online with those who took the same course in a traditional classroom. They found that the distance students performed more poorly on a set of standardized exam questions than those students in the live setting. Duvall and Schwartz address the performance of business students enrolled in courses delivered using two-way, interactive, compressed video technology. Student performance was assessed as overall academic performance in the course, specifically the student's final course grade. They found no significant difference in performance between distance learners and their on-campus counterparts.

Distance Education in Agricultural Economics at The Ohio State University

Since Spring 2000, the Department of Agricultural, Environmental and Development Economics (AEDE) has developed three courses that feature audio-video delivery of course lectures to students at five OSU regional campuses. Each class has been structured to include a live audience at the Columbus campus lecture site plus students at up to five remote locations.

One objective of the distance offerings was to create a portal of entry to the agribusiness major and minor from the regional campuses. Distance education allows regional campus students to start the major or minor earlier in their

educational programs and to facilitate these students remaining at the regional campus longer. However, students must enter the Columbus campus to complete their Bachelor's degree. Offering courses in the major or minor at distance sites may be strategically important for the department, increasing the likelihood that students entering Ohio State from the regional campuses will select the department's major or minor.

The experiment began with a request for AEDE to expand its course offerings at the regional campus locations. The department has a history of occasionally offering classes at some of these locations in a traditional classroom setting. This required the instructor to drive up to 3 hours each meeting day. Over time, these regional campus offerings had decreased to one or two classes annually at one regional campus. The department agreed to an experimental offering of three courses to the five regional campuses using distance education technology. If the demand for these courses was sufficient to justify the offerings, they would be continued and other distance classes added.

The potential advantages of distance education courses for regional campuses are clear. Costs for a professor in a traditional classroom course at one regional location usually range from about $6,100 to $7,200, plus travel expenses. For the distance education offering, each regional campus contributes $1,500 regardless of whether the location has students enrolled in the class. This agreement generates $7,500, which is available to support the professor's salary plus communication costs. Thus, costs for one regional campus using the traditional classroom format are about the same as for all five regional campuses using the distance education format. We estimate that the regional campus would need 12 students to cover the cost of teaching a course staffed by a commuting Columbus faculty member. Using a distance approach, the breakeven enrollment would be 3 students per regional campus.

AEDE 401, 402, and 403 are introductory courses in agribusiness management, agribusiness marketing, and managerial finance. Three course instructors are involved, one for each course. AEDE 401 and 402 require only an introductory microeconomics principles prerequisite. AEDE 403 also requires introductory statistics and the first course in accounting. All three courses are required of students majoring in Agribusiness and Applied Economics. AEDE 401 and 402 are also required of students selecting the Agribusiness and Applied Economics minor. Each 4-hour class meets twice a week for 1 hour and 48 minutes for 10 weeks.

Teaching a course at distance adds significant challenges to the instructor. The teaching methods must be adjusted to fit the distance format and the technology imposes challenges that require some adjustment by the instructor and students. Becker and Watts observe that despite recent advances in technology, the dominant teaching approach in college economics classrooms is "chalk and talk." Results from their survey of college economics instructors indicate that the median survey respondent uses the chalk-board-illustrated lecture 83% of the time. The same time allocation prevailed for all course types, class sizes, and kinds of institutions. The teaching styles used in traditionally taught AEDE courses closely parallel this dominant chalk and talk approach.

The AEDE distance learning courses were offered by two-way interactive compressed video. This synchronous learning model has all students, live and

distant, in class simultaneously, at different locations. The primary method of communication is oral. PowerPoint slides are used for most illustrations, although an overhead camera projector is available for paper-based illustrations and replaces the chalkboard for traditional demonstrations of solutions, list building, or similar expositions. Because the methods used to communicate with students are not that different from those used in a traditional classroom, the time required to convert these courses to distance offering was less than to develop an asynchronous web-based distance course.

The technology permitted students to see the instructor at all times and was interactive. The technology was limiting in that the instructor could see the students for only one of the distant locations at a time: the TV monitor switched to a remote campus when a microphone was activated. Each course offered a web site with class assignments, lecture notes, and links to supplemental course materials. Student performance was evaluated using quizzes, tests, homework assignments, and exams. Other required adjustments included changing one course from three days a week to two, converting all overhead transparencies to PowerPoint, developing strategies to involve remote students in class discussions, and establishing procedures with the regional campuses to proctor exams and quizzes, collect and deliver materials, and facilitate many of the mechanical activities of the class. Because the distance students are located at OSU regional campuses, they have access to libraries, computer laboratories, computer support personnel, and most other support resources available to Columbus campus students.

The AEDE experience with distance education began in spring quarter 2000 with the offering of AEDE 401. The course was offered to 37 students: 32 in the live audience at Columbus and 5 at the Lima regional campus (table 1). Autumn quarter, the AEDE 403 course grew to three locations (two remote), with 6 students taught at distance. The AEDE 402 winter quarter offering saw five locations and 36 students, with equal numbers of live and distant students.

Table 1. Enrollment in the distance classes by quarter and campus

Campus	Spring 2000 AEDE 401[a]	Autumn 2000 AEDE 403[b]	Winter 2001 AEDE 402[c]	Spring 2001 AEDE 401
Columbus	32	35	18	25
Distance classes				
Lima	5	3	4	3
Mansfield		3	4	4
Marion			4	1
Newark			6	1
Agricultural Technical Institute (ATI)				6
Total	37	41	36	40

[a] AEDE 401, Principles of Agribusiness Management.
[b] AEDE 402, Principles of Agribusiness Marketing.
[c] AEDE 403, Principles of Managerial Finance.

Finally, AEDE 401 was offered in spring 2001 to 40 students, with 15 at five remote locations.

Data and Procedures

Students differ among the various campuses. Table 2 summarizes student characteristics by campus as well as measures of performance in the courses. Average student age and gender mix for distant students varied little from those at Columbus. Cumulative hours of enrollment were less for distant students who generally were in the first two years of enrollment. Columbus students were enrolled in larger course loads, but distance students had more hours of employment. Attendance rates were higher for distant students than for Columbus students.

Student scores on the standardized American College Testing (ACT) exam were not substantially different for Columbus (21.9) and distant students (22.4). However, there were substantial differences in these scores across the remote locations. Caution should be exercised, because the number of observations is small for each location. In fact, two exceptionally high ACT test scores at the Lima campus may distort these comparisons. In the future, it is expected that distant students will have lower average ACT scores than Columbus students because the OSU Columbus campus has selective enrollments, whereas the regional campuses are less selective.

Enrolled students in each of the three courses completed evaluations regarding their experience in the course. An internet-based form was used. The evaluations were identical for the autumn 2000, winter 2001, and spring 2001 sections of AEDE 403, 402, and 401, respectively. The questionnaire administered to AEDE 401 in spring 2000 differed only in that six opinion questions were not included in that first evaluation. Students completed the evaluation during the final week of classes. To provide an incentive, students were given a small number of bonus points for completing the evaluation and were assured that the course instructor would not be given access to the data until the course grades had been submitted.

Evaluation of the Distance Experience

The 12 evaluation questions had five response options ranging from strongly disagree to strongly agree. Mean responses for the full group and for the groups of Columbus and distant students are given in the rightmost columns of table 3. These results pool responses across the three studied courses which each were taught by different instructors. The number of responses is smaller for some questions because the spring 2000 class was not asked these questions.

Even though the Columbus students were enrolled in a live class, they also faced inconveniences associated with distance offering of the course. Columbus students could see students at the distant site through monitors positioned throughout the classroom. Compressed video results in momentary lags which occasionally caused students to talk over each other. Occasionally, open microphones at remote sites introduced noise into the Columbus classroom requiring the instructor to pause and advise the offending site to close their

Table 2. Student characteristics by campus of enrollment

	Columbus	Lima	Mansfield	Marion	Newark	ATI	All Distant Students	All Students
N	90	15	7	4	3	6	35	125
Age	22.0	21.3	24.7	23.0	20.7	23.8	22.6	22.2
Percent female	41	47	43	75	0	50	46	42
Cummulative hours	144.3	101.0	117.9	87.0	79.0	84.8	98.1	131.3
Cummulative GPA	2.6	3.5	2.3	2.5	2.2	3.2	3.0	2.7
Current quarter hours	15.9	13.9	11.9	10.5	9.3	12.2	12.4	14.9
ACT composite score	21.9	26.8	18.4	23.7	17.3	20.0	22.4	22.0
Percent working	80	73	100	100	100	83	86	81
Work hours per week	17.7	22.3	27.4	29.2	29.7	19.3	24.3	19.6
Attendance rate (%)	85	97	89	94	95	83	93	87
Class rank%	52	78	22	47	28	42	53	52

Table 3. Summary of student response to the evaluation of the distance character of the studied courses

		Percent[b]					Mean[c]		
	N[a]	SA (5)	A (4)	N (3)	D (2)	SD (1)	All Students	Columbus	All Distant Locations
The content of this course was appropriate.	124	35	56	43	43	0	4.2	4.3	4.1
The class web page was a valuable addition to the course.	123	50	29	15	4	2	4.2	4.2	4.3
The distance education component of this course was an interesting and pleasant class experience.	123	15	39	24	14	9	3.4	3.3	3.4
My performance was weaker because of the distance offering nature of this course.	124	8	16	28	28	19	3.6	2.5	3.0*
Homework, exams and other graded material were returned to students in a timely manner.	94	16	43	14	19	9	3.4	3.5	3.1
I found it difficult to communicate with the instructor outside of class.	93	3	14	29	40	14	2.5	2.3	3.1***
If another required course is offered as distance learning, I would not hesitate to enroll in that distance course.	124	20	37	27	7	8	3.5	3.5	3.7
The teaching methods used were appropriate for this course.	94	13	61	14	12	1	3.7	3.8	3.5*
I did not learn as much in this course as I would have in a traditional (non-distance) version of this course.	124	76	15	24	33	21	2.5	2.4	2.9*
The instructor did a good job of managing communications with the several sites.	93	17	62	13	5	2	3.9	3.9	3.8
I found the presence of cameras and monitors in the classroom to be distracting.	94	9	22	22	34	13	2.8	2.8	2.8
Generally, I was well pleased with this course.	94	13	46	27	10	5	3.5	3.6	3.4

[a]These questions summarize responses for four sections taught Spring 2000–Spring 2001 summarized in table 1. The *N* is smaller for selected questions because these questions did not appear on the Spring 2000 questionnaire.
[b]Responses are *Strongly Agree*, *Agree*, *Neutral*, *Disagree*, and *Strongly Disagree*. For the calculation of the mean response, these are assigned values of 5, 4, 3, 2, and 1, respectively.
[c]One and three asterisks indicate differences in the means for distance and Columbus students that are significantly different than zero at the 0.1and 0.01 levels of probability, respectively.

microphones. On rare occasions, a site connection was lost and the class needed to pause until contact could be reestablished. Clearly such inconveniences were smaller for Columbus students than for distant students, but these are absent in traditional classes

Several questions focused on the quality of the distance education experience. When asked if *the distance component of this class was an interesting and pleasant class experience*, more than half agreed or strongly agreed. The mean response was somewhat larger for students located at distance; however, this difference was not statistically significant at the 0.10 probability level as judged by a *t*-test of equality of the means for local and distance students. Students were also asked to respond to the statement *if another required course is offered as distance learning, I would not hesitate to enroll in that distance course.* Fifty-seven percent responded agreed or strongly agreed. The mean responses for Columbus and distant students were 3.46 and 3.74, respectively, but again the difference was not significant at the 0.10 probability level. Students were asked to respond to the negatively worded statement *I did not learn as much in this course as I would have in a traditional* (*non-distance*) *version of this course*. Fifty-four percent disagreed or strongly disagreed with this statement. However, responses differed significantly (0.10 probability level) between Columbus and distance students. Distance students were more likely to agree with this statement than were Columbus students. Similarly, student responses to the negatively worded statement *my performance was weaker because of the distance offering nature of this course* were statistically significant and indicated that distant students were more likely to agree that their performance had been hindered because of the distance nature of the course.

In a statement of overall evaluation, students were given the opportunity to respond to *generally, I was well pleased with this course*. Fifty-eight percent either agreed or strongly agreed. The mean response was slightly larger for the Columbus students; however, this difference was not statistically significant. This last question probably should be viewed as a combined evaluation of the course and its offering method, whereas the three previously discussed questions focused clearly on the distance component of the course. The distant students gave higher evaluations to the first two questions (*interesting and pleasant* and *would take another distance course*) but were more likely to agree that they could have done better in a traditional course or that their performance was weakened by the distance nature of the course. We interpret this as a critique of the distance course relative to the optimum—a traditional course with instructor and student in the same room. Exit interviews conducted at some regional campus locations suggest that the distance students were generally quite pleased that these courses had been offered at distance, providing them the opportunity to complete additional courses from their regional campus.

The results of the evaluations generally support the notion that these courses have been offered with little apparent disadvantage to the distant audience. Open-ended questions gave additional insight into student evaluations. A few responses from Columbus students suggested that they found the presence of cameras and remote audiences distracting and they did not see why they should be subjected to such distractions. It should be noted, however, that Columbus students elected to enroll in these sections that bore a distance offering

designation: In most cases another traditional section of the course was available during the same quarter but at another time of day.

Multivariate Analyses

Multiple regression techniques were used to examine the relationship between student attributes and their performance in and acceptance of the distance-offered course. The primary hypothesis to be tested was that student performance in these classes was identical for live and distance students. A multivariate analysis was used to allow other student attributes to be controlled and thus to avoid bias in the distance coefficient.

Student Performance Model

For the course performance model, the student's percentile ranking in the class was used as the dependent variable. Independent variables included measures of student attributes and a distance enrollment indicator. Specifically, the model estimated is displayed as equation 1:

$$
\begin{aligned}
(1) \qquad \textit{Rank}\% = {} & B_0 + B_1\, \textit{Distant} + B_2\, \textit{ACT} + B_3\, \textit{QtHrs} + B_4\, \textit{WorkHrs} \\
& + B_5\, \textit{Pages}\% + B_6\, \textit{Attendance}\% + B_7\, \textit{Major} + B_8\, \textit{Minor} \\
& + B_9\, \textit{Age} + B_{10}\, \textit{Gender} + e_i .
\end{aligned}
$$

where:

Rank% is	the student's percentile ranking in the course based on overall course grade;
Distant is	one if the student is enrolled at a remote site and zero for Columbus;
ACT is	the student's composite ACT (American College Testing) score;
QtHrs is	the student's credit hour load for the quarter enrolled in the distance offering;
WorkHrs is	the number of hours of weekly employment for the student;
Pages% is	the percentage of assigned readings that the student reported reading;
Attendance% is	the percentage of class sessions the student reported attending;
Major is	one if the student is an Agribusiness major and zero otherwise;
Minor is	one if the student is an Agribusiness minor and zero otherwise;
Age is	the student's age at last birthday; and
Gender is	one if the student is female and is zero otherwise.

Our model is similar to those used in previous analyses of student performance in distance education courses, with one exception: performance is measured by class rank at the end of the course rather than test performance. Typically, scores on a single test or responses to specific test questions are used

as the performance variable (e.g., Brown and Liedholm; Huff). Becker notes that differences in performance on a single multiple-choice test of 25 to 40 items are almost always trivial, and small differences in test scores between control and experimental groups are the rule, not the exception, in analyses of instructional variables. Our performance variable, class rank, varies from 0 to 100 (100 denotes the top ranked student in a class) and measures combined performance on homework, exams, and in-class exercises over the entire 10-week offering. It appears to be superior to test scores, which have a smaller range of outcomes and measure performance at a single point in time. Class rank is used rather than class grade to allow a better comparison of students across three courses and three instructors. This dependent variable clearly identifies the relative performance of Columbus and distance students.

Regression results for the student performance model are reported in table 4. The model was significant at the 0.01 level of probability as indicated by the model *F*-value. The model explained 34% of the variation in student class percentile rank.

The primary hypothesis to be tested is that student performance in these distance education classes was equal for distant and live students. All students at remote sites are indicated with a value of one for *Distant*. The regression coefficient for this variable is negative but is statistically different from zero only at the 0.61 probability level. Hence, the conclusion is that the location of students (Columbus or distant) made no difference in student performance when the effects of all other student attributes are held constant. This suggests that distant students are not placed at a competitive disadvantage simply due to their remote location, at least for the distance learning model followed in these courses. These results are consistent with findings by Wade et al.; Johnson; Petracchi and Patchner; and Huff. However, findings of Brown and Liedholm

Table 4. Regression of student and course characteristics on student class rank percentile

Variable	Regression Coefficient	Prob $> \|t\|$
Intercept	−40.32	0.520
Distant	−5.73	0.391
ACT	4.10	0.000
QtHrs	−1.68	0.073
WorkHr	−0.42	0.087
Pages%	0.15	0.120
Attendance%	0.48	0.007
Major	14.21	0.069
Minor	23.53	0.006
Age	−1.23	0.544
Gender	4.61	0.384
N	84	
Model *F* statistic	5.35	0.000
R-square	0.42	
Adjusted *R*-square	0.34	

strongly suggest that distance students perform more poorly than live students for an economics course that employs asynchronous delivery.

To test for interaction effects of distance on other key independent variables, slope-shifting binary variables were also included to measures differential effects of distance enrollment with *ACT* scores and *Gender* on *Rank*%. These parameter estimates were highly nonsignificant and were not included in the model reported.

As documented earlier, students differed in a number of ways between Columbus and regional campuses. To avoid bias in the estimation of the distance parameter, these variables were also included as explanatory variables. The student's ACT score is a standardized measure that reflects combined ability and preparedness following high school. This was selected over other measures of college performance, such as cumulative grade point average (GPA), because the latter is not standardized. There may well be significant differences in the courses and grading system used at the various student locations, and thus in GPA. The hypothesis is that student ACT score is positively associated with course grade. Brown and Liedholm report that ACT score has a positive and statistically significant effect on performance in microeconomics courses across all modes of instruction.

The regression coefficient for *ACT* is 4.10, and is statistically different from zero at the 0.01 level of probability. The regression coefficient suggests that for every one-point increase in the student's ACT score, with all other variables constant, their rank in the class increases 4.1 percentage points.

QtHrs and *WorkHrs* are included to indicate the demands on the student's time from other classes and from work responsibilities. *QtHrs*, the number of course credit hours in which the student was enrolled during the quarter, is statistically significant at the 0.10 level. Each additional hour of enrollment, all else equal, results in a 1.68-percentage point reduction in student class rank. *WorkHrs* also is significant at the 0.10 probability level. The regression coefficient suggests that each hour of employment is associated with a 0.42 percentage point reduction in the student's rank in the class.

Pages% and *Attendance*% are included as a measure of the effort that individual students committed to class study. *Pages*% was the student's self-reported percentage of assigned readings completed. This variable is positively signed: Those students who completed more of the assigned readings tended to rank higher in the class. However, this variable is significant only at the 0.12 probability level. *Attendance*% is the percentage of class meetings the student reported attending. Student attendance ranged from 10 to 100%, with a mean of 87%. The regression coefficient for *Attendance*% is highly significant and positive. Each percentage point increase in class attendance rate is associated with a 0.48 percentage point increase in student class rank.

Two binary variables were included to indicate whether the student was a major or minor in Agribusiness and Applied Economics. Regression coefficients for *Major* and *Minor* both are statistically different than zero. The regression coefficients suggest that students who are majors earned a class rank 14.2 percentage points greater than students who are neither major nor minor. Students minoring in Agribusiness earned class ranks 23.5 percentage points higher than the excluded group.

Student age and gender were included because these two demographic variables often differed between Columbus and distance students. Other studies analyzing the effect of gender on learning in economics classes report that test scores of females are significantly lower than those of men (Ferber; Shea et al.). However, Brown and Liedholm found that females tended to perform relatively better in distance than in live classes. In our analyses, neither age nor gender were statistically significant at the 0.10 probability level.

Student Acceptance Model

A second multivariate model was formulated to consider the impact of distance on student acceptance of the distance education experience. The dependent variable is an evaluation index based on four opinion questions:

1. *The distance education component of this course was an interesting and pleasant class experience.*
2. *If another required course is offered as distance learning, I would not hesitate to enroll in that distance course.*
3. *My performance was weaker because of the distance offering nature of this course.*
4. *I did not learn as much in this course as I would have in a traditional* (*non-distance*) *version of this course.*

Table 3 shows the response distributions and mean responses for these questions for distance and Columbus students. For the regression analysis, the latter two measures (*my performance was weaker*. . . and *I did not learn as much*. . .) were recoded from negative to positive statements. The dependent variable is computed as the mean of these four responses. The dependent variable varies continuously from 1 to 5, where 5 represents a *strongly agree* response or a very positive evaluation of the distance education experience.

The independent variables are the same as those included in the student performance model. The model is significant at the 0.01 level of probability (table 5). Adjusted *R*-square indicates that the model explains about 26% of the variation in this dependent variable.

Again, the primary hypothesis is that students' evaluations of the course experience were equal for live and distant students. In a study evaluating the distance education arm of the University of Maine that connects 10 Centers and more than 100 sites in Maine with an interactive television system, Johnson reports that students were satisfied with logistics of courses offered, with the professors, and with the technology. The estimated coefficient for *Distant* was not significantly different from zero; hence, the hypothesis cannot be rejected. This is important in that it suggests that, with all other explanatory variables constant, Columbus and distant students gave equal evaluations of the distance education experience. Thus, distance education, at least in the synchronous, two-way video format employed with these three courses, did not leave distance students feeling shortchanged. Again, slope-shifting binary variables were included to test for important interactions between *Distant* and *ACT* and *Gender*. Neither of these parameter estimates was significantly different than zero, and both were excluded in the reported model.

Table 5. Regression of student and course characteristics on student evaluation of the distance class experience

Variable	Regression Coefficient	Prob > |t|
Intercept	1.93	0.430
Distant	−0.13	0.612
ACT	0.06	0.077
QtHrs	−0.01	0.858
WorkHr	0.01	0.289
Pages%	0.01	0.010
Attendance%	−0.01	0.086
Major	1.01	0.001
Minor	0.99	0.003
Age	−0.02	0.839
Gender	0.46	0.028
N	84	
Model *F* statistic	3.97	0.000
R-square	0.35	
Adjusted *R*-square	0.26	

The other measures of student characteristics were included as independent variables to eliminate bias in the *Distant* coefficient estimate. The *ACT* score regression coefficient is statistically significant at the 0.10 level and is positively signed. The interpretation is that more capable students (with higher ACT scores) tend to give higher evaluations for the distance education experience. *QtHrs* and *WorkHr*, as measures of competition for student study time, are not significant in the model. Student effort, as measured by *Pages*% and *Attendance*%, are both statistically significant. *Page*% displayed the expected sign, indicating that those students who completed larger portions of the assigned readings tended to give higher evaluations of the distance education experience. However, the sign for *Attendance*% is opposite from that expected. Those students who more frequently attended the class tended to give lower evaluations, all other factors constant. Perhaps one explanation is that more frequent attendance is associated with more sincere students who have a greater expectation of the course, and thus who tend to be more critical of the distance education experience.

Major and *Minor* are highly significant explanatory variables in the evaluation model. With all else equal, students who are either a major or minor gave evaluations that are about one point higher (on a five-point scale) than students who were neither. There was no significant difference in the evaluations of Agribusiness majors and minors.

Student *age* and *gender* were included to test for difference by these demographic variables. *Age* is not statistically significant, but *gender* is significant at the 0.05 probability level. These results suggest that female students had more positive feelings about the distance education experience

than male students. This is consistent with Shea et al. and Brown and Liedholm, who report that women experience a more favorable learning environment in on-line distance education courses than in the traditional classroom.

Conclusions

This research reports an evaluation of student performance in and acceptance of three distance education courses offered using interactive, compressed video technology. Agribusiness Management, Agribusiness Marketing, and Managerial Finance were taught to a live audience of students at the main campus with simultaneous broadcast to students in classrooms at five regional campuses. This research makes important contributions to the distance education literature because we use an improved measure of student performance and a common questionnaire that allows pooled analysis for three different courses. In addition, each class contains both distant and Columbus students, allowing a more reliable comparison of performance of distant and live students. Although much recent attention in distance education has been focused on asynchronous, web-based courses, this research demonstrates that synchronous compressed video courses can be both effective and cost efficient where an infrastructure of branch campuses already exists.

Students differ somewhat among the campuses. Distance students often included both the youngest and oldest students in the class, although average student age was essentially equal for distant and Columbus students. Distance students tended to take lighter course loads, and generally were employed more hours. Class attendance rates for the distant students were somewhat higher than for Columbus students.

Evidence from the three quarters experience at Ohio State suggests little difference between live and distance students with regard to their performance in and acceptance of the course. While mean responses to selected questions appear to differ between the two groups, multivariate analysis that allow several student attributes to be jointly considered with the distance variable suggests the two groups of students performed and evaluated the quality of the course experience equally. These results provide some assurance that the distance offering of courses, at least using the two-way interactive synchronous learning model, does not place the distant student in jeopardy. Anecdotal evidence provided through exit interviews of distance students on one campus further supports that distance students viewed the offering of these courses positively because it expanded the number of courses they could complete at the regional campus location.

Although the location of the student was not important in determining the student's performance in the course, a number of other parameters were significant determinants of student performance. Student ability, measured by the ACT exam score, amount of work time, course load and other factors, did vary significantly between Columbus and regional campuses. Our results suggest that these are important predictors of student performance, and may be important parameters for the distance instructor to consider as a course is designed and implemented.

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