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Distance Education in Agricultural Economics: An Assessment of Student
Acceptance and Performance.

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Short abstract:

This paper reports an analysis of student evaluation of and performance in three agricultural economics classes offered at distance by audio-visual connection in real time. Multiple regression analyses of student questionnaire data are used to examine the relationship between student attributes and their evaluation of and performance in the distance-offered course.

**Distance Education in Agricultural Economics:
An Assessment of Student Acceptance and Performance**

The Department of Agricultural, Environmental and Development Economics (AEDE) has taken a leadership role in distance education at The Ohio State University. In the past year, AEDE has developed three courses that feature audio-video delivery of course lectures to students at five OSU regional campuses via T-1 lines. Each class is structured to include a live audience at the Columbus lecture site plus students at up to five remote locations. The objective of the distance offering was to create a portal of entry to our major and minor from the regional campuses. Distance Education allows regional campus students to start the major or minor at an earlier stage 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 of courses in the major or minor at distance may be of strategic importance for the department, increasing the likelihood that students entering Ohio State from the regional campuses will select the department's major or minor.

The teaching of a course at distance adds significant challenges to both the course instructor and to the distant students. This paper will describe our distance education offerings, including the technology used and the changes necessary from our standard versions of these courses. A perspective will be offered of differences between Columbus campus students and those enrolling at distance. Student evaluations of the distance offerings will be discussed. Finally, a multivariate statistical analysis of: 1) student performance in the distance courses, and 2) student evaluation of the courses will be presented.

Perspective on Distance Learning

Poley warns, “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.” Drucker admonishes, “Thirty years from now the big university campuses will be relics. Universities won’t survive. It’s as large a change as when we first got the printed book. Do you realize that the cost of higher education has risen as fast as the cost of health care? Such totally uncontrollable expenditures, without any visible improvement in either the content or the quality of education, mean that the system is rapidly becoming untenable. Already we are beginning to deliver more lectures and classes off campus via satellite or two-way video at a fraction of the cost. The college won’t survive as a residential institution.” Predictions such as these are unsettling to faculty and administrators, and universities are responding by offering distance learning courses using an array of technologies and delivery mechanisms.

In spite of Drucker’s assertion that the virtual university is low cost, experience to date indicates that distance learning courses are expensive. (Burton) Wilson’s summary of distance educators experiences is 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.” (Wilson)

Internet-based “asynchronous” courses have received the most attention. Using web based e-mail, bulletin boards, listservs, chat rooms, web-based information, video and audiotaped material, and on-line testing, there are few instructional objectives that cannot be accomplished through asynchronous distance education. However, the more traditional “synchronous” distance education format, as used in our courses, remains popular. This format

connects groups of students at distant sites using interactive video systems, which allows a teacher to be in one location with students at one or more other locations. Typically, this format includes some combination of mail, video tape, videoconferencing, satellite broadcasts, e-mail, and a course web site, which contains course information and web site links. (Neal)

In our analysis, two dependent variables are used: student satisfaction and performance. We recognize that these measures are narrow indicators of output from education. Agre argues that undergraduate education is much more than the acquisition of knowledge or student satisfaction with a course. 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: 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 are not necessarily incompatible with these diverse functions of undergraduate education, but they are not assessed in this study.

In fact, the major controversy surrounding distance education may not be its success at delivering knowledge. The major tension in undergraduate teaching has always been that most students have come to research universities looking for skills while their professors have had a much broader vision of the role of the university in educating students. How successful is distance education in delivering the whole undergraduate experience? We do not address this important question.

The Ohio State Experience

The experiment began with a request from the regional campuses for the College of Food, Agricultural and Environmental Sciences to expand its offering of course at the regional campus locations. Our department has a history of offering classes occasionally at some of these locations, but these have always been in traditional face-to-face meetings with the instructor driving three hours per day to the more remote locations. Over time, these regional campus offerings had decreased to one or two classes annually at the Lima campus. The department agreed to enter into an experimental offering of three courses using distance education technology. If the demand for these courses was sufficient to justify the offerings, they would be continued and other classes might be added to the list of distance offerings.

AEDE 401, 402 and 403 are introductory courses in agribusiness management, agribusiness marketing, and managerial finance. AEDE 401 and 402 require only an introductory microeconomics principles prerequisite. AEDE 403 requires introductory statistics and the first course in accounting as additional prerequisites. 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 class meets twice a week for one hour and 48 minutes for ten weeks. Students earn four credit hours for each course.

The teaching of a course at distance adds significant challenges to the course instructor. The teaching methods must be adjusted to fit the distance requirements and the technology imposes new challenges that require some adjusting for the instructor and the students. In our case, the courses were offered by two-way audio-video connection using existing T-1 lines. This synchronous learning model has all students in class simultaneously, just 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. A video tape player also is seamlessly integrated into the system. 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 not nearly as great as for developing an asynchronous web-based distance course.

The teaching materials had to be prepared more carefully keeping in mind the technology being used. The technology permitted the students to see the instructor at all times and was interactive so students could ask and the instructor answer questions or the instructor could ask the students questions. The technology was limiting in the sense that the instructor could see the students for only one of the distant locations at any one time: The TV monitor switched a remote campus when a microphone was activated. Each course offered a Web site to supplement the class meetings where students could go to obtain class assignments, lecture notes, hot links to supplemental course materials, and answers for tests. Student performance was evaluated using quizzes, tests, homework assignments, and exams. Other required course changes included conversion of one course from a three day per week format to a two-day format, converting all overhead transparencies to PowerPoint presentations, developing strategies to involve remote students into class discussions, and developing an infrastructure with the regional campuses to establish the video link at the beginning of each class, proctor exams and quizzes, collect and deliver materials, and facilitate many of the mechanical activities of the class.

Our 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 six students taught at distance. The AEDE 402 Winter quarter offering saw five locations with equal numbers of local and distant students. Finally, for the current quarter, not scheduled to end until after the deadline for this paper, AEDE 401 has 40 students enrolled, 15 of whom are at five remote locations.

Table 1. Enrollment by quarter and Location.

Campus	Spring 2000	Autumn 2000	Winter 2001	Spring 2001
	AEDE 401	AEDE 403	AEDE 402	AEDE 401
Columbus	32	35	18	25
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

Students differ among the regional campuses. Table 2 summarizes student characteristics by campus as well as measures of performance in the courses and results for the ACT exam. Average student age for distant students varies little from the Columbus campus students (22.6 years versus 22.0). Likewise, the gender mix of students differs little among local and distant students. Clearly, cumulative hours of enrollment are less for the distant students who generally are in the first two years of enrollment. Differences also exist for the number of hours of current (quarter) enrollment as well as the number of hours of employment for the average student. Columbus students enrolled in somewhat larger course loads during the quarter of their distance course, but distance students had somewhat more hours of employment. Attendance rates for the distant students were higher than for Columbus students. Attendance was uniformly high across the remote locations.

Table 2. Student characteristics by campus.

	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	41.1	46.7	42.9	75.0	0.0	50.0	45.7	42.4
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	73.8	75.0	100.0	100.0	100.0		85.0	76.5
Work hours per week	15.9	23.8	23.3	29.0	32.5		25.4	18.1
Attendance rate (%)	87.4	98.1	91.7	94.7	92.5		96.0	89.4
Class Rank %	49.9	75.3	16.3	51.9	38.9		59.3	52.1

Student scores on the standardized ACT test were not substantially different for the groups of Columbus (21.9) and distant students (22.4). However, there was substantial difference in these scores across the remote locations. Caution should be exercised, because the number of observations is small for each location, but these data suggest that student ACT test scores differ by location. This difference is supported by the fact that the OSU Columbus campus has selective enrollments, whereas the regional campuses are less selective.

Enrolled students in each of the three courses completed identical evaluations regarding their experience in the course. The evaluation was done using an internet-based form. Students were allowed to complete the evaluation during the final week of classes and the week of final exams. To provide an incentive, students were given a small amount of bonus points for completing the evaluation. Students were also assured that the course instructor would not be given access to the data until the course grades had been submitted.

Results of twelve evaluation questions are summarized in table 3. All questions were presented with 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. Results were not available for the Spring 2001 offering because this course was still ongoing at the time of this writing. Also, the number of responses is smaller for selected questions because these questions were not asked of the Spring 2000 class.

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*, half gave agree or strongly agree responses. The mean response was larger for those students located at distance. 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-five percent responded with agree or strongly agree responses. The mean responses for Columbus and distant students were 3.4 and 4.1, respectively. 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-three percent disagreed or strongly disagreed with this statement. Mean responses were 2.54 and 3.30 for Columbus and distant students, respectively. Student responses to the negatively-worded statement *my performance was weaker because of the distance offering nature of this course* indicated that distant students were more likely to agree with the statement than were local students. Finally, students were given the opportunity to respond to the statement *Generally, I was well pleased with this course*. Forty-three percent responded either agree or strongly agree. The mean response was slightly larger for the distant student group. 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. It is interesting to note that

Table 3. Summary of student response to the evaluation.

	N ^a	Percent ^b					Mean		
		SA (5)	A (4)	N (3)	D (2)	SD (1)	All Students	Columbus	All distant locations
The content of this course was appropriate.	85	29.41	61.18	4.71	4.71	0.00	4.15	4.17	4.10
The class web page was a valuable addition to the course.	84	40.48	30.95	20.24	5.95	2.38	4.01	4.00	4.05
The distance education component of this course was an interesting and pleasant class experience.	84	14.29	35.71	28.57	13.10	8.33	3.35	3.25	3.65
My performance was weaker because of the distance offering nature of this course.	85	8.24	18.82	25.88	27.06	20.00	2.68	2.65	3.20
Homework, exams and other graded material were returned to students in a timely manner.	55	14.55	32.73	18.18	25.45	9.09	3.18	3.30	2.87
I found it difficult to communicate with the instructor outside of class.	55	5.45	12.73	32.73	41.82	7.27	2.67	2.43	3.33
If another required course is offered as distance learning, I would not hesitate to enroll in that distance course.	85	21.18	34.12	30.59	8.24	5.88	3.56	3.40	4.10
The teaching methods used were appropriate for this course.	55	3.64	63.64	20.00	10.91	1.82	3.56	3.63	3.40
I did not learn as much in this course as I would have in a traditional (non-distance) version of this course.	85	7.06	15.29	24.71	34.12	18.82	2.58	2.54	3.30
The instructor did a good job of managing communications with the several sites.	54	9.26	72.22	14.81	3.70	0.00	3.83	3.79	3.93
I found the presence of cameras and monitors in the classroom to be distracting.	55	10.91	24.45	18.18	36.36	9.09	2.93	3.00	2.73
Generally, I was well pleased with this course.	55	3.64	40.00	41.82	9.09	5.45	3.27	3.25	3.33

a 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.

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.

Several questions focused on characteristics of the course. When presented with the statement *I found the presence of cameras and monitors in the classroom to be distracting*, only 35 percent gave either agree or strongly agree responses. For the statement *I found it difficult to communicate with the instructor outside of class*, less than 20 percent gave agree or strongly agree responses. Clearly, this was more of a problem for distant students: Columbus students had the same access that they would have for a traditional course offering.

Students were offered the opportunity to respond to *the teaching methods used were appropriate for this course*. The mean responses for Columbus and distant students were very similar and favorable, at 3.63 and 3.40 respectively. When asked if *the instructor did a good job of managing communications with the several sites*, mean responses of 3.79 and 3.93 for local and distant students, respectively, gave no indication of a problem. Finally, the students were asked to respond to the statement *the class web page was a valuable addition to the course*. Seventy one percent of the students gave agree or strongly agree statements, with approximately equal means for local and distant students.

The results of the evaluations generally support the notion that these courses have been offered at distance 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 didn't see any reason that they should be subjected to such distractions. A common theme

from the distant students can be characterized as appreciation for the opportunity to take additional courses at their local site.

Multivariate Analyses

Multiple regression techniques were used to examine the relationship between student attributes and their evaluation of and performance in the distance-offered course. For course performance models, 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 was:

$$\text{Rank\%} = B_0 + B_1 \text{ Age} + B_2 \text{ Gender} + B_3 \text{ CumGPA} + B_4 \text{ Distant} + B_5 \text{ QtHrs} \\ + B_6 \text{ WorkHrs} + B_7 \text{ Pages\%} + e_i$$

where:

Rank% is the student's percentile ranking in the course,

Age is the students age at last birthday,

Gender is one if the student is female and is zero otherwise,

CumGPA is the student's cumulative GPA (on a 4 point scale),

Distant is one if the student is enrolled at a remote site and is zero for Columbus students,

QtHrs is the students credit hour load for the quarter enrolled in the distance offering,

WorkHrs is the number of hours of weekly employment for the student, and

Pages% is the percentage of assigned readings that the student reported reading.

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 46 percent of the variation in student class percentile rank.

Table 4. Regression of student characteristics on students class rank percentile.

Variable	Regression Coefficient	T-value
Intercept	8.52133	0.25
CumGPA	34.23415	7.11 ***
Age	-1.71427	-1.8 *
Gender	7.95726	1.67 *
Distant	-7.38816	-1.11
QtHrs	-1.39757	-1.95 *
WorkHr	-0.10166	-0.48
Pages%	0.18092	2.06 **
Model F Statistic		11.24 ***
R-Square		0.51
Adjusted R-Square		0.46

One, two and three asterisks indicate statistical significance at the 0.10, 0.05 and 0.01 levels of probability, respectively.

The student's Cumulative grade point average (CumGPA) is an indicator of either the ability of the student and of the amount of work that he/she puts into class study or both.

CumGPA is included to reflect the history of each student's grade performance

The student's Cumulative grade point average is included to reflect students' historic grade performance. Clearly, high GPAs can result from either high ability, extraordinary effort in the class, or a combination. As should come as no surprise, cumulative GPA is statistically significant and displays a positive sign, indicating that a one unit (e.g., from 2.0 to 3.0) change in cumulative GPA is associated with a 34-percentile increase in the class percentile ranking.

Student age was included to reflect potential differences in performance due to age. Although the mean ages of students were very similar across campuses, there was a substantial range of

ages -- from 18 years to 37 years. Age was statistically significant at the 0.10 level of probability. Age displayed a negative sign, indicating that a one year increase in student age, all other variables unchanged, resulted in a 1.71 percentile decrease in the student's class percentile rank.

Gender is a binary variable that takes on a value of one if the student is female. Gender also is statistically significant at the 0.10 level of probability. On average, females performed better in the classes. The regression coefficient of 7.96 suggests that being female results in a 7.96 percentage point higher class ranking.

QtHrs and WorkHrs are included to indicate the demands on the student's time from other classes and from work responsibilities. QtHrs is statistically significant at the 0.10 level and indicates that each additional hour of enrollment, all else equal, results in a 1.40 percentage point reduction in the class ranking. Hours of employment also has a negative sign but was not statistically significant in this model.

Pages% was the students self-reported percentage of assigned readings they completed. Certainly, as faculty, we should be pleased to see that this variable is significant (0.05 probability level) and displays a positive sign. Each additional percentage of the reading assignments completed is associated with a 0.18 percentage point increase in the student's class ranking.

Finally, the variable of greatest interest in this analysis is the distance indicator. All students at remote sites are indicated with a value for Distant of one. The regression coefficient for this variable is negative but not statistically different from zero at the critical level. Hence we must conclude that the location of the students (Columbus or distant) made no difference in the student's performance in the class 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.

The course evaluation models

Two additional multivariate models were formulated to consider the impact of the distance character of the course on student evaluations of the course. The first model focused on a single evaluation question that seems to capture well the students overall evaluation. The dependent variable is the five-item response to the statement: *If another required course is offered as distance learning, I would not hesitate to enroll in that distance course*. The mean score for this question was 3.56, where strongly agree is scored as five and strongly disagree is scored as one. The distance students score this question more highly, with a mean for this group of 4.10.

The independent variables in the model were the same as those included in the student performance model. They are a mixture of personal characteristics, time competition from other classes and from employment, and an indicator for distant enrollment. Results of the model are presented in table 5. The model is significant at the 0.10 level of probability. Adjusted R-square indicates that the model explains about 7 percent of the variation in this dependent variable.

Only two explanatory variables displayed regression coefficients that were statistically different from zero at the 0.10 level. Pages%, the percentage of assigned reading that was completed by the student, was positive and significant at the 0.05 level. Thus, those students who place more effort into the course, at least to the extent of completing assigned readings, were more likely to be pleased with the course. WorkHr, the number of hours of student employment, also was significant and positive in sign. Thus, students who worked more hours were more appreciate/tolerant of the distance offering. The binary variable that indicates distant

students is positive and significant only at the 0.23 level of probability. These results provide some evidence that distant students were more appreciative of the distance offering than were local students.

Table 5. Regression of student characteristics on students' willingness to take another distance course.

Variable	Regression Coefficient	T-value
Intercept	1.68014	1.02
CumGPA	0.27522	1.16
Age	0.00218	0.05
Gender	0.17069	0.73
Distant	0.40303	1.22
QtHrs	0.00976	0.28
WorkHr	0.01804	1.74 *
Pages%	0.00864	2.00 **
Model F Statistic		1.92 *
R-Square		0.15
Adjusted R-Square		0.07

One, two and three asterisks indicate statistical significance at the 0.10, 0.05 and 0.01 levels of probability, respectively.

The second evaluation model focused on the two negatively-worded statements regarding the students perception of their performance in the course. The two statements were 1.) *my performance was weaker because of the distance offering nature of this course* and 2.) *I did not learn as much in this course as I would have in a traditional (non-distance) version of this course*. Twenty-seven and 22 percent of the enrolled students agreed or strongly agreed with these statements, respectively. The dependent variable was the mean response to the two questions. Results for this model are reported in table 6. The model was not statistically significant as indicated by the model F-value. The model explained only 4 percent of the variation in the dependent variable.

Two independent variables were statistically significant at the 0.10 level or less. Gender was significant at the 0.01 probability level and displayed a negative sign. This suggested that

female students (gender=1) were less likely to agree with these negatively-worded statements -- They are less likely to attribute disappointment in their performance or what they derived from the course to the distance nature of the course. Pages% also was negative and significant, indicating that as more effort was given to completing assigned readings (and perhaps other course requirements), the student was less likely to blame the distance class for poor performance or lesser learning. Again, the distance binary variable is not significant, suggesting that local and distant students evaluated the course similarly with respect to its impact on their performance.

Table 6. Regression of student characteristics on students' perception that their class performance was weakened by the distance nature of the course.

Variable	Regression Coefficient	T-value
Intercept	4.68889	2.75 ***
CumGPA	-0.37888	-1.55
Age	0.00429	0.09
Gender	-0.63293	-2.61 ***
Distant	0.33881	0.99
QtHrs	-0.0257	-0.70
WorkHr	-0.00703	-0.66
Pages%	-0.00754	-1.69 *
Model F Statistic		1.54
R-Square		0.12
Adjusted R-Square		0.04

One, two and three asterisks indicate statistical significance at the 0.10, 0.05 and 0.01 levels of probability, respectively.

Conclusions

Evidence from three quarters experience at Ohio State suggests little difference between local and distance students with regard to their performance and to their evaluation 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 attribute suggest the two groups of students performed equally in the class and they evaluated the course experience in a similar manner. These results provide some assurance that the distance offering of courses, at least using the two-way interactive synchronous learning model of our courses, does not place the distant student in jeopardy.

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