

The Cost of Delivering Courses via Distance Education



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Abstract

From 1998 to 2002, the faculty of the Food and Resource Economics Department, College of Agricultural and Life Sciences, University of Florida taught 212 courses on campus and an additional 19 courses via distance technologies. Using data from these experiences, the authors estimate the average additional costs associated with distance education as compared to on-campus courses to be \$16,631 per-course and \$1,661 per-student-taught. Data limitations are discussed and caveats concerning conclusions about the specific costs of distance education are provided. Within the context of these limitations and caveats, the authors do substantiate several general findings: courses taught via distance are more costly to an academic unit than courses taught on-campus, both in terms of per-course taught and per-student-taught; estimates of costs will vary, depending on assumptions made about what costs should be included in the analysis; and, quantifying the costs of distance education ultimately must be evaluated within the broader context of potential benefits and trade-offs across departmental and college program priorities.

Introduction

In the late 1990s, the College of Agricultural and Life Sciences (CALs), Institute of Food and Agricultural Sciences (IFAS), University of Florida (UF) instituted several degree programs to be delivered via distance education. The original intent was to offer a Master of Agriculture (MAG) through CALs with three areas of specialization. These areas were in agricultural education, agribusiness and horticulture. The target audiences for these programs included extension agents and place-bound individuals working in agricultural industries. Because degree programs are offered through departments, the Food and Resource Economics Department (FRED) assumed the responsibility for the MAG agribusiness specialization. Distance education technologies proposed for

these programs included videoconferencing, web-based interactive course sites, Internet chat rooms and email, videotapes and course materials bundled in CD-ROM "packets."

During that same time period, the State Legislature authorized funding for IFAS to establish the Indian River Research and Education Center (IRREC) satellite campus in Ft. Pierce, FL, a site approximately 240 miles from the main campus. FRED hired four faculty members to teach live courses to students at the IRREC and to deliver these courses to other sites throughout Florida via distance technologies. These distance courses initially were for the Master of Agriculture degree, while distance courses for an undergraduate minor in agribusiness management were added over time to serve students pursuing CALs bachelor degrees at several satellite campuses.

FRED faculty and CALs administrators have had to address a range of development and implementation issues since these programs were initiated, including the determination of course and degree equivalents, curricula design and costs of delivery. Though all of these are important and inter-related, the primary purpose of this paper is to analyze the costs of delivery of distance education courses and the possible resource-allocation implications of these costs for departmental and college planning. The continuing trends in reduced federal and state funding for higher education in general, and Colleges of Agriculture and Natural Resources in particular, provide further impetus for this paper, as reductions in budgets are forcing administrators and faculty to examine the costs and benefits of all program activities.

Background and Methods

Researchers have analyzed core planning and implementation issues related to CALs' efforts at instituting its distance education programs (Martin and Cheek, 2004; Telg and Cheek, 1998; Comer et al.,

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1996), and other researchers have examined the development of specific UF distance education programs in horticulture and natural resource conservation (Klock-Moore et al, 2000; Linehan et al., 2000). Though insightful, this literature does not comprehensively address specific cost issues associated with distance education.

Other researchers have provided suggestions for how to estimate the costs of distance education technologies and programs. For example, Taylor, et al. (2001) provide an example of estimating the costs of distance education in the Texas A&M university system. Their cost estimates, calculated on a cost-per-semester-hour basis, summed operating, administrative and other direct costs. Similarly, Sharratt (1993) calculated the break-even points and returns on investments for different modes of delivery, and Rumble (2001) outlined the various types of costs to be considered when analyzing the benefits and costs of distance education programs.

Drawing from these examples, the authors of this paper developed a framework for conducting an ex-post analysis of the costs associated with the development and implementation of FRED's distance education courses that were taught from 1998 to 2002. The specific objectives for this analysis were to (a) identify course demographics and the cost of traditional on-campus course delivery, and (b) identify the additional costs (or savings) of delivering a FRED course via distance education both from the IRREC and from the main campus in Gainesville.

In order to complete this analysis, the authors reviewed archival data on course demographics, and then contacted all FRED faculty members who had taught at least one course, at the graduate or undergraduate level, using distance technologies during the years 1998-2002. Each faculty member estimated the following: (a) time to prepare a new course or convert an existing course to be taught via distance education over and above the time required to prepare a course in a traditional classroom, (b) the cost of technical computer staff to design and develop course materials delivered via distance, (c) the cost of additional secretarial support staff needed to convert existing courses or to assist in creating new courses in a format suitable for distance delivery, (d) the cost to deliver the class via distance (e.g., telephone transmission fees, etc.), (e) the cost of paying site coordinators at remote delivery sites to backstop the technologies (e.g., run video streaming equipment), and (f) the extra

time needed to deliver distance courses (e.g., increased use of emails and telephone) above traditional on-campus classes.

Results and Discussion

The first step in the analysis was to estimate a baseline of on-campus delivery costs for the department. This baseline data on course enrollments, faculty preparation time needed, etc. could then be used to calculate the marginal costs (i.e., additional costs) of using distance technologies.

Between fall 1998 and summer 2002, FRED faculty taught 212 courses on the main campus in Gainesville. Eighteen percent of the classes had fifteen students or less enrolled, 25% had class enrollments of 16 to 30 students, 27% had enrollments of 31 to 50 students, 28% had a class size that was more than 50 but no more than 100 students, and only 2% had more than 100 students in class. A total of 8,418 students were enrolled in these 212 courses. During this time, the average faculty salary in FRED was approximately \$70,000 for a 12-month appointment. Multiplying this average salary by 1.3 to include "fringe" benefits yields an estimated average cost of \$91,000/yr for a 100% teaching appointment. Using a standard of seven courses per year per 100% FTE of teaching, the authors estimated the average cost per on-campus course in faculty salary and benefits to be \$13,000 ($\$91,000/7 = \$13,000$).

The authors converted this average cost for faculty time on a per-course basis to a per-student-taught basis, as enrollment figures during the 1998-2002 period differed considerably when comparing the courses taught on campus to those taught via distance technologies. Hence, for each of the 212 courses, a per-student-taught cost estimate was calculated by dividing \$13,000 by the course enrollment, resulting in an average per-student-taught faculty cost of \$662 (Table 1).

This faculty salary cost should be viewed with caution because there were considerable differences in the per-student-taught cost estimate across different

Table 1. Average fixed cost of faculty time per-student-taught for delivering an on-campus course (1998-2002), assuming an average faculty salary cost per-course-taught of \$13,000

	Number of Students Enrolled Per Course										Summary Statistics over all courses taught
	1-15	16-30	31-45	46-60	61-75	76-90	91-105	106-120	121-135	151-165	
Average Cost	\$2,095	\$560	\$358	\$250	\$187	\$154	\$136	\$119	\$96	\$83	\$662
Standard Deviation	\$2,150	\$102	\$40	\$19	\$10	\$9	\$6	\$1	--	--	\$1,133
Maximum	\$13,000	\$765	\$419	\$283	\$213	\$169	\$143	\$119	\$96	\$83	\$13,000
Minimum	\$867	\$433	\$289	\$217	\$173	\$144	\$129	\$118	\$96	\$83	\$83
Number of Courses	38	52	45	34	19	14	6	2	1	1	212
Average Enrollment	9	24	37	52	70	85	96	110	135	157	41

course enrollments. Courses with enrollments of 15 students or less have an estimated average faculty salary cost of \$2,095 per student taught, whereas for a course with 157 students, the estimate is only \$83 in faculty salary per student taught. This difference provides a good indication of the economies of size involved with teaching. Similarly, the standard deviation in faculty cost is highly variable, with it being greater with small enrollments relative to classes with large enrollments. In addition, it is important to recognize that these faculty salary figures are the fixed costs for a given course and do not include the cost of teaching assistants or any adjustments for variability in the preparation and teaching intensity of a given course (e.g., it was assumed that the “intensity” of teaching effort for an upper division course based on case-study discussions was identical to an introductory course taught primarily in a lecture

format). While faculty salary costs are fixed costs, variability in the preparation and teaching intensity of a given course (e.g., classes are not all equally time consuming) is captured in the marginal analysis discussed below.

The second step in the analysis was to compile the faculty responses concerning additional costs of delivering FRED courses via distance education. Information in Table 2 summarizes the additional per-student-taught cost estimates for a three-credit course taught using distance technologies. During the period 1998-2002, FRED faculty delivered 19 courses via distance technologies from either the main campus in Gainesville or the IRREC. The average class size for these 19 courses was 12 students. Overall, the average additional cost of teaching these courses via distance education is \$1,661 per-student-taught, with a standard deviation of \$1,063. This additional, “marginal,” per-student-taught cost estimate was calculated by dividing each faculty member's reported additional total costs incurred as a result of teaching using distance technologies by the corresponding course enrollment. These additional costs are listed in the previous section and included additional hours spent in course preparation, technical support and service fees, and additional on-line time.

The data in Table 2 indicate that there are significant additional costs associated with distance technologies but there can be considerable variability in cost estimates reported on a per-student-taught basis. The limits of “small numbers” in the data (e.g., only one course with 11 to 15 students enrolled) complicate interpreting the results in Table 2. To help clarify these findings, two additional “finer cuts” at the data set are presented.

Table 2. Average additional cost for delivering courses via distance technologies on a per-student-taught basis, by different class sizes (1998-2002)

	Enrollment per course						Summary Statistics over all courses taught
	1-5	6-10	11-15	16-20	21-25	26-30	
Average additional cost	\$2,741	\$1,488	\$495	\$1,672	\$1,073	\$1,026	\$1,661
Standard deviation	\$1,144	\$1,101	--	\$195	\$712	--	\$1,053
Maximum additional cost	\$4,384	\$3,083	\$495	\$1,806	\$1,577	\$1,026	\$4,384
Minimum additional cost	\$1,832	\$405	\$495	\$1,449	\$569	\$1,026	\$405
Average enrollment/course	4	8	14	18	22	29	12
Number of courses	4	8	1	3	2	1	19

Table 3. Average additional cost on a per-student-taught basis for delivering a Course via Distance Education, by enrollment and number of delivery sites (1998-2002)

Number of Sites	Enrollment per course						Summary Statistics for Sites, across all course sizes
	1-5	6-10	11-15	16-20	21-25	26-30	
1	\$2,778	\$1,149		\$1,806			\$1,842
2		\$911			\$569		\$740
3		\$2,912					\$2,912
4	\$2,630	\$990	\$495	\$1,761		\$1,026	\$1,478
5				\$1,449			\$1,449
7		\$3,083					\$3,083
10					\$1,577		\$1,577
Summary Statistics for enrollment numbers, across all site totals	\$2,741	\$1,488	\$495	\$1,672	\$1,073	\$1,026	\$1,661

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The data on average additional costs per-student-taught via distance technologies are sorted by both course size and number of sites receiving the course (Table 3). There appears to be two variables that have opposite effects on the per-student-taught cost estimates. Some costs appear to increase as the number of sites increases, that is, some costs are fixed on a per site basis such that each additional site automatically increases total fixed costs by some amount. Increases in the number of delivery sites also tend to increase the total number of students enrolled, which lowers the average per-student-taught estimate, countering the effect of per-site fixed costs. As with Table 2, the data in Table 3 do not present a definitive message about additional costs of distance education. Specifically, no clear message is discernable about whether increasing the number of sites increases or decreases the additional per student costs; and, no absolute conclusion can be made about the effect of increasing the number of students enrolled on the estimates of average additional per student costs.

Another approach to analyzing the data is to sort cost data by number of sites accessed and delivery method used (Table 4). The objective of Table 4 is to

test the presumptions that (a) some delivery technologies have higher use costs than others, and (b) as the number of sites increase, costs increase. The data in Table 4 also are presented by both an average additional cost on a per-course basis and an average additional cost on a per-student-taught basis. Again, limits in the data set constrain interpretation; however, there is a general trend suggesting that average costs on a per-course basis increase as the number of sites increase. This is true in both cases where comparisons are possible (i.e., the interactive video and video tape/email/web delivery methods). The use of interactive video also tends to increase the average additional costs of course delivery relative to other distance technologies.

The comparisons summarized in the Tables do not document all of the nuances of cost estimates. For example, instructors who chose to deliver their courses using primarily interactive video incurred lower development cost than those delivered via the Internet (even though the department and college incurred higher operating costs with this technology). This is not surprising because an instructor who uses interactive video does not need to do much to modify an on-campus course. In this case, the instructor is

primarily talking to a camera rather than to a room full of students. Interactive video courses can be supplemented with web delivery of course content to facilitate learning, student-instructor interaction, and the logistics of moving information to students, but these web-sites take a considerable amount of time to develop and maintain. In fact, the most costly approach to distance education would be the combination of interactive video, web-site delivery and internet chat and email. Interactive video has high technical costs and user fees, web-site delivery has high development costs, and internet chat and email create very time-intensive demands on faculty time a troika of costs. The authors recognize that universities vary

Table 4. Average additional cost for delivering a course using distance technologies, by number of delivery sites and delivery method (1998-2002), reported both in per-course and per-student-taught bases.

		Number of Sites							Summary Statistics
Delivery Method ^a	Cost Basis	1	2	3	4	5	7	10	
Interactive Video	Per Course			\$20,381	\$24,625	\$24,625		\$36,260	\$22,459
	Per Student			\$2,912	\$1,449	1,449		\$1,577	\$1,375
Interactive Video + Lecture	Per Course		\$8,705						\$8,705
	Per Student		\$740						\$740
Interactive Video + Web	Per Course						\$24,663		\$24,663
	Per Student						\$3,083		\$3,083
Internet + Web + Email	Per Course	\$18,800							\$18,800
	Per Student	\$2,236							\$2,236
Internet + Web + Email + Lecture	Per Course	\$6,178							\$6,178
	Per Student	\$1,537							\$1,537
Video Tape + Email + Web	Per Course	\$8,000			\$13,150				\$9,717
	Per Student	\$1,360			\$2,630				\$1,783
Summary Statistics on Total average additional cost on a per-course basis		\$12,945	\$8,705	\$20,381	\$21,262	\$24,625	\$24,663	\$36,260	\$16,631
Summary Statistics on Total average additional costs on a per-student taught basis		\$1,842	\$740	\$2,912	\$1,478	\$1,449	\$3,083	\$1,577	\$1,661

a. Interactive video meant that virtually all of the course instruction was accomplished via compressed video. A course that contained both interactive video and lecture involved the instructor presenting part of the instructional material via compressed video and part of it live in front of the class, i.e., the instructor traveled to the course site to deliver the course. Three courses have been delivered via this technique.

in how these costs are administered. For example, some institutions may place a social value on offering courses via distance education and not charge for delivery and development costs. These situations still require an accurate accounting of the actual and opportunity costs involved with delivering a distance education program, and are therefore included in the analysis.

Not surprisingly, from 1998 to 2002, the FRED faculty have demonstrated considerable variation in their approaches to distance technologies, from individual instructors who chose to put up a "shell" site to those who maintained both a full, active website and used interactive video. These choices have been influenced by both individual preferences and the relative level of support and degree of adoption of a given technology by colleagues within the department and the college.

To conclude, the authors' summarize the "take-away" message of the data in Tables 1 to 4 and the accompanying discussion as follows,

- Courses delivered via distance technologies cost a department more than courses delivered in traditional on-campus formats. Departments are not billed for brick-and-mortar, but they are billed for technology use fees, video-conferencing access, satellite links and other up-front costs associated with distance education;

- Economies of size exist and must be exploited if average per-course and per-student costs are to even begin to approach the lower levels of on-campus average costs;

- Diebel, et al. (1998) provided a first step documentation of costs for one course, taught twice in a two-year period via distance. The analysis in this article provides a needed "next step" in the assessment of the benefits and costs of distance education by documenting the costs for a set of distance courses for one department over a five-year period. Given that interest in distance education remains high among Colleges of Agriculture and Natural Resources (in part because its fit with the historic land grant missions of teaching and outreach), a much broader multi-state/province, multi-university study that would quantify costs and benefits across multiple institutions is needed to further clarify the appropriateness of distance education for Colleges of Agriculture and Natural Resources.

On a final note, the authors only have examined one-half of the equation—the costs of delivery for distance education. As Martin and Cheek (2004) note, there are clear benefits in offering courses via distance technology, although they do not quantify these benefits. The challenge for FRED, and for all departments and colleges of agriculture and natural resources that are considering distance education technologies, is to determine the net gains or losses in terms of quantified costs and benefits. Further, unless course enrollments are high and initial start-up costs can be shared across departments and/or colleges, distance education programs that offer graduate and

undergraduate degrees have high opportunity costs and their costs raise the bar for necessary, achievable benefits to a potentially prohibitive level. If legislators, university administrators and/or departmental faculty deem distance education as an essential component of a department's or college's mission, then the technologies will be employed at any costs. If distance education is to be treated as one alternative among several for use of scarce campus resources, then this article provides some basis for estimating the trade-offs in making those resource allocation choices.

Summary

Courses that are taught using distance technologies cost more on a per-course basis as compared to courses taught on-campus in traditional formats—additional costs ranging from \$6,000 to \$24,000 more per course offered. Note, these are "marginal" costs, as it is difficult to generate comprehensive cost streams for making comparisons based on total cost streams. In this study, all investments in campus infrastructure, buildings, etc. were treated as sunk costs and hence, not included in cost estimates. The only costs considered were additional faculty compensation and implementation costs associated with adopting distance technologies.

Comparisons based on average costs on a per-student-taught basis are difficult as these comparisons are highly sensitive to the total number of students enrolled in a given course. Given this limitation and certain limitations in the data set, the authors still conclude that the average additional per-student-taught cost for distance education is relatively high (ranging from just over \$400 to over \$4,000 more per student), compared to the benchmark of on-campus delivery cost of \$662 per student taught.

The choice of distance technology (or combination of technologies) can dramatically alter total costs involved in the delivery of a distance education course. Choices about which technology(ies) to adopt are driven by a range of factors, including out-of-pocket costs to a department, the opportunity costs of faculty time, the individual preferences of a faculty member, and the technologies being adopted by colleagues within a department and/or college.

Before definitive conclusions can be made about the appropriateness of distance education programs, both benefits and costs must be clearly articulated and quantified. To that end, a robust study based on a far greater number of distance courses is needed. Clearly, a collaborative effort at generating, collecting and analyzing relevant cost and benefit data from colleges of agriculture and natural resources throughout North America is a needed "next step" towards a general understanding of the true trade-offs associated with distance education in agriculture.

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