

# Distance Education versus Classroom Instruction in Horticulture—An Introduction to Fruit Crops—Case Study

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**SUMMARY.** At the University of Georgia, HORT 3020 (Introduction to Fruit Crops) is a two-credit survey of the botanical characteristics, taxonomy, and production practices of the world's major fruit crops. It is offered via traditional classroom instruction, and as a distance education (DE) course through the University System of Georgia Independent Study program. The DE version of the course is designed to be identical in content, final exam, and grading scale. However, due to the nature of independent study, the end-of-topic evaluations are open-book, written assignments in the DE course, whereas students in the classroom version have closed-book quizzes at the end of each topic. Student performance in the two versions of the course was compared over a 3-year period (May 1998 to May 2001) by analyzing scores on end-of-topic evaluations, final exams, and overall course grades. Students in the DE version had higher scores on end-of-topic evaluations in all 3 years, higher scores on a comprehensive final exam in 2 of 3 years, and consequently higher overall course grades than classroom students in all 3 years. Better performance of DE over classroom students may have been related to 1) qualitative differences in end-of-topic evaluations (written assignments versus quizzes), 2) differences in student demographics (nontraditional students in DE, traditional undergraduates in classroom), 3) the elective (DE) versus required (classroom) nature of the courses, or 4) differences in course duration (1 year for DE, 15 weeks for

classroom). Equal or better performance of DE students suggests that survey courses such as Introduction to Fruit Crops can be offered via distance education without compromising learning outcomes.

Distance education (DE) has been used for decades for delivery of college-level curricula to off-campus locations and nontraditional students. Originally, these correspondence courses were taken through the mail, and while such print versions of courses continue to be important, many courses have evolved into forms available through Internet- or satellite-based delivery systems (Klock-Moore et al., 2000). A 1998 survey of distance education by the University Continuing Education Association showed 59 institutions offering college-level courses for a total enrollment of over 152,000 (McCrory and Andrews, 1999). Just over 50% of the institutions surveyed indicated they were making good progress toward getting courses on the Internet, and 73% indicated that their Internet offerings would exceed their print offerings by 2008. Indeed, entire undergraduate and graduate degrees are now offered through the Internet from several virtual universities.

Although the vast majority of US public institutions now offer some form of distance education, agriculture and natural resource courses comprise less than 1% of total enrollment (Pardue, 2001). The lag in development of agricultural curriculum relative to other disciplines is probably related to many factors including concerns that the specific nature, visual content, and hands-on learning typical of agriculture may not translate well on a web page, satellite transmission, or video tape. The lack of literacy of these technologies among faculty and lack of support for course development have no doubt contributed to the paucity of DE courses in agriculture (Lineberger, 1998). Other barriers to course development include increased DE course preparation time relative to traditional courses (Miller and Miller, 2000; Mugglicockett, 1992), problems with scheduling satellite or interactive communications networks (Miller, 1997; Miller and Miller, 2000), poor student access to instructors through electronic means (Paparozzi and Williams, 2000), and other off-campus challenges (Miller, 1995). Also, faculty have the general perception that

DE is inferior to traditional classroom instruction (Born and Miller, 1999; Miller and Shih, 1999a, 1999b), which undermines the ability of those qualified and trained in DE to offer such courses. This perception prevails despite studies (Russell, 1999) which report nonsignificant differences in learning outcomes between DE and classroom delivery methods of instruction.

Declining enrollment in horticulture, and the need to reach off-campus or place-bound students interested in horticulture prompted the development of DE version of Introduction to Fruit Crops (HORT 3020) at the University of Georgia (UGA). Beginning in 1998, HORT 3020 was offered via DE through the University System of Georgia Independent Study program, as well as in traditional classroom format each spring semester. The course content is identical between the two versions, but the audiences and delivery systems are different. This study was undertaken to examine the performance of students in HORT 3020, as measured by course grades, between the DE and classroom delivery formats.

## Materials and methods

**COURSES.** HORT 3020, Introduction to Fruit Crops, is a two-credit, required course for the Horticulture major at UGA. It is a survey of the taxonomy, botanical characteristics, and general culture of the world's major fruit crops. The syllabus, content, and further details related to the course are available at <[www.uga.edu/fruit](http://www.uga.edu/fruit)> (Rieger, 2002). The course has been taught via traditional classroom instruction since 1990 and typically has 30 to 45 students enrolled each spring semester. There are five major topics in the course, each lasting 3 weeks in a typical 15-week semester: introduction and pome fruits, stone fruits, small fruits, nut crops, and tropical fruits. A 20-point quiz is given at the conclusion of each topic, and a comprehensive final is given at the conclusion of the course. The quizzes and the final exam are closed-book, in-class, written examinations. Students can accumulate a maximum of 150 course points from the five 20-point quizzes and the 50-point final, and letter grades are assigned according to the following point scale: 135–150 = A, 120–135 = B, 105–120 = C, 90–105 = D, < 90 = F.

In 1997, a DE version of HORT 3020 was developed using Web Course

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Tools (webCT; WebCT Inc., Lynnfield, Mass.) software, as well as a fully analogous print or hardcopy version for students without Internet access (University System of Georgia Independent and Distance Learning, Athens, Ga.). The webCT and print versions are identical, except for the assignment submission format (e-mail for webCT, US mail for print). Students are given 1 year from the time of enrollment to complete the course, and can submit no more than one assignment per week for grading. Complete data were not available at the time of writing, but a subsample ( $n = 10$ ) of the DE students finishing most recently showed an average time for course completion of 34.5 weeks, ranging from 9 to 52 weeks.

To the extent possible, the DE course was designed to be identical to the traditional classroom course described above. In fact, the content, final exams, and grading scales were identical for the classroom and DE versions. The main difference between the DE and classroom versions involved the periodic evaluation methodology. Instead of in-class quizzes at the end of a topic, DE students completed an open-book, written assignment after finishing the required reading for each topic. Questions on written assignments were short answer or discussion format, since DE students could refer to the text, whereas quiz questions were multiple choice, true or false, or short answer format, since classroom students have to memorize information and are under stricter time constraint. However, all questions addressed the same basic principles, terminology, and crops. Written assignments were weighted the same as the quizzes.

To ensure academic honesty, students in all DE courses offered through the University System of Georgia must complete a proctored final exam before receiving credit for a course. Students can travel to a number of sanctioned testing sites throughout the United States for this purpose. Thus, both DE

and classroom students are subjected to the same exam and testing procedures for the comprehensive final.

**DATA ANALYSIS.** Performance of students in the classroom or DE versions of the course was compared statistically during approximately the same 3-year period, May 1998 to May 2001. Enrollment in the classroom version was 46, 37, 36 for years 1999, 2000, 2001, respectively, and a total of 22 students completed the DE course during that period. Comparisons between DE and classroom scores only were of interest (not comparisons among years within the classroom version). The following data were analyzed by *t* test, assuming unequal variance: overall course points (out of 150), quiz or written assignment mean scores (out of 20); final exam scores (out of 50); and percentage drop in performance from quiz/assignment to the final. For the latter, the point values for the quizzes, assignments, and final exams were converted to percentages so the relative change in performance on end-of-section evaluations versus the final could be assessed.

## Results and discussion

DE students scored significantly higher than classroom students in all 3 years on end-of-topic evaluations (quizzes or written assignments), and in 2 of 3 years on the comprehensive final (Table 1). Thus, overall course point totals were significantly higher for DE than classroom students in all 3 years (Table 1). Final exam scores were 3.2 to 3.5 points higher for DE than classroom students when differences occurred. Therefore, the bulk of the 10 to 16 point difference in overall course point totals was explained by differential performance on narrower focus quizzes and written assignments, rather than performance on the comprehensive final. Given the qualitative differences in end-of-topic evaluations between the two groups, the data may reflect differences in performance due to evaluation

method (i.e., open-book assignment versus closed-book quiz) rather than course delivery (DE versus classroom). Consequently, the best comparison of course delivery method may be the comprehensive final scores, since the same test and testing format were used for both groups. Although statistically different in two of three cases, absolute differences in final scores were 7% or less, suggesting that DE and classroom delivery methods resulted in roughly similar comprehension of the subject, with a slight advantage of DE over classroom.

When all scores were converted to a percentage basis, it was found that DE students dropped about 15% from written assignment averages to the final exam, a decrease of about one letter grade (Table 2). The analogous drop from quiz average to final exam in classroom students was significantly less than decreases noted for DE students in 2 of 3 years. This suggests that overall grades of DE students were negatively impacted by the final more than were grades of classroom students. The relatively greater drop in performance from the end-of-topic evaluations to the final for DE students may represent difficulties in adjusting from the open-book, discussion format of the written assignments, to a closed-book, short answer format on the final. The classroom students had no such transition, since the format of their quizzes did not differ materially from that of the final. This evaluation style transition in DE is difficult to avoid without potentially compromising the nature of UGA's Independent Study, as well as academic honesty in students. In other words, DE students are (and should be) allowed to work independently, and with full exposure to texts and resources during the course, but to ensure they complete their written assignments unassisted, they must present identification and take a proctored final exam before receiving credit for a course. In HORT 3020 and most other DE courses at

**Table 1. Mean quiz or written assignment scores, final exam scores, and total course points in distance education (DE) and traditional classroom versions of HORT 3020 over 3 years.**

Item	DE 1998–2001	Classroom		
		1999	2000	2001
Quiz/written assignment grades (out of 20)	18.2	15.1	16.7	15.7
<i>P</i> , <i>t</i> test versus DE	---	<0.0001	0.0020	<0.0001
Final exam grades (out of 50)	37.8	34.3	34.6	40.1
<i>P</i> , <i>t</i> test versus DE	---	0.0249	0.0459	0.1027
Total course points (out of 150)	128.5	111.8	118.3	118.3
<i>P</i> , <i>t</i> test versus DE	---	<0.0001	0.0024	0.0005

**Table 2. The relative change in grades (%) from quiz averages for traditional classroom students, or written assignment averages for distance education (DE) students, to the final in DE versus classroom versions of HORT 3020 over 3 years.**

Change	DE 1998–2001	Classroom		
		1999	2000	2001
Change in grade (%)	-15.2	-6.8	-14.3	1.6
<i>P</i> , <i>t</i> test versus DE	---	0.0031	0.7506	<0.0001

UGA, the final exam is comprehensive and closed-book format, and therefore quite different from their previous experience in the course. This is a problem that many instructors face when converting classroom courses to DE format, although there are reasonable solutions (e.g., change the final to open-book format for both delivery methods).

Overall, the data show that DE students performed statistically better than classroom students in HORT 3020. This suggests that survey courses in horticulture can be implemented successfully via DE, contrary to the common perception by faculty that DE is inferior to traditional instruction (Born and Miller, 1999; Miller and Shih, 1999a). DE versions of courses have produced similar learning outcomes to traditional undergraduate horticulture courses (Lineberger 2001) and in non-credit Master Gardener courses (Jeannette and Meyer, 2001; Stack, 1997), although the latter are structured very differently from traditional university courses. In a broader survey of over 350 case studies of DE versus traditional classroom instruction, no significant difference in learning outcomes was reported (Russell, 1999). However, the author is unaware of any studies that report *improved* performance in DE versus classroom delivery methods. A few reasons can be offered for this observation.

As discussed above, it is likely that some of the differences in performance between the two student groups relates to differences in end-of-topic evaluation method (open versus closed book) rather than course delivery method *per se*.

The DE enrollment is comprised of more non-traditional students than the classroom enrollment. On average, DE students are older, more mature, and, in my experience, have better self-motivation skills than the typical 19- to 22-year-old undergraduate horticulture student. Course load is generally low for DE students, while

classroom students usually take four additional courses in the same 15-week semester. However, many more of the DE students worked full or part-time during the course. It is important to note that several UGA students have enrolled in the DE version of the course for reasons of increased flexibility in class schedule, so the two populations studied contain some individuals from the same demographic group.

Many DE students take HORT 3020 as an elective, simply because they are interested in the subject, and many are not majoring in horticulture. In the classroom version, 80% to 90% of students are Horticulture majors and take the course because it is required. Research on student evaluation of courses shows that students dislike required courses more than elective courses (Broder and Dorfman, 1994), thus interest level in the subject matter is likely higher in DE than classroom students.

The time frame allowed for course completion differs substantially—1 year (DE) versus 15 weeks (classroom). DE students are working at their own pace over a longer time period, which averaged 34.5 weeks in this study. The instructor noted increased submissions during semester breaks, summers, and holidays from DE students who are on campus, suggesting DE students effectively prioritize their time.

As on-line courses and degree programs gain more public acceptance in the future, and enrollment in colleges of agriculture continues to decline, it is likely that horticulture curricula will have to implement DE to effectively compete for students. This case study suggests that DE is an equally effective, alternative delivery mechanism for instruction in horticulture, at least for survey courses such as Introduction to Fruit Crops. Furthermore, DE courses create flexibility in class scheduling for our traditional students, and may generate additional contact hours by attracting nontraditional students to horticulture departments.

## Literature cited

- Born, K.A. and G. Miller. 1999. Faculty perceptions of web-based distance education in agriculture. *J. Agr. Educ.* 40(3):30–39.
- Broder, J.M. and J.H. Dorfman. 1994. Determinants of teaching quality: What's important to students. *Res. Higher Educ.* 35:235–249.
- Jeannette, K.J. and M.H. Meyer. 2001. Master gardener training on-line equals classroom learning. *HortScience* 36:432.
- Klock-Moore, K.A., G.E. Fitzpatrick, and R.K. Schoellhorn. 2000. Development of a bachelor of science degree program in horticulture at the University of Florida for place-bound students. *HortTechnology* 10:390–393.
- Lineberger, R.D. 1998. Integrating the world wide web into existing extension and educational technology. *HortTechnology* 8:313–315.
- Lineberger, R.D. 2001. The transition from web-assisted to web-based teaching: The HORT 315 experience. *HortScience* 36:524.
- McCrary, R. and J. Andrews. 1999. Independent study program profiles 1997–1998, Final report. La. State Univ. Office of Independent Study, Baton Rouge.
- Miller, G. 1995. Off-campus study in agriculture: Challenges and opportunities. *J. Agr. Educ.* 36(2):1–7.
- Miller, G. 1997. Agricultural education at a distance: Attitudes and perceptions of secondary teachers. *J. Agr. Educ.* 38(1):54–60.
- Miller, G. and W. Miller. 2000. A telecommunications network for distance learning: If it's built, will agriculture teachers use it? *J. Agr. Educ.* 41(1):79–87.
- Miller, G. and C-C Shih. 1999a. Comparing quality in on-campus and off-campus courses: Perceptions of college of agriculture faculty. *J. Agr. Educ.* 40(1): 49–56.
- Miller, G. and C-C Shih. 1999b. A faculty assessment of the rigor of on- and off-campus courses in agriculture. *J. Agr. Educ.* 40(1):57–65.
- Mugglicockett, N.E. 1992. Preparing and implementing an animal science course for distance education at Utah State University. *J. Dairy Sci.* 75:3257–3260.
- Paparozzi, E.T. and K.A. Williams. 2000. Using chat rooms in a plant nutrition course: bane or boon? *HortTechnology* 10:280–282.
- Pardue, S.L. 2001. The virtual revolution: Implications for academe. *Poultry Sci.* 80:553–561.
- Rieger, M. 2002. Mark's fruit crops. 26 Apr. 2002. <<http://www.uga.edu/fruit>>.
- Russell, T.L. 1999. The no significant difference phenomenon: As reported in 355 research reports, summaries and papers. N.C. State Univ. Publ., Chapel Hill.
- Stack, L.B. 1997. Interactive television delivers master gardener training effectively. *HortTechnology* 7:357–359.