Teaching Methods

Integrating a University and Community College Course in Landscape Construction

Rolston St. Hilaire[1] and James M. Thompson[2]

Additional index words. landscape horticulture, learning assessment, undergraduate education, recruitment

Summary. **Strong linkages among 2-year community colleges and 4-year universities are likely to foster the transition of more students into higher education and enhance student diversity. Two New Mexico educational institutions, Doña Ana Branch Community College (a 2-year community college) and New Mexico State University (a 4-year university), offered a landscape construction class as a joint course offering for students at both institutions. The objective of this educational approach was to develop a system that facilitates the seamless integration of compatible curricula from a community college and a university. Course evaluations showed that 63% of students enrolled in the combined class rated the combining of a university and community college class as an above average or excellent model of education. When asked to rate whether classroom materials and laboratory activities supported learning, 94% of the class rated those materials as excellent. Eighty-eight percent of students rated the presentation of subject matter as above average or excellent when asked if the subject matter was presented in an interesting manner. Students valued the experiential learning projects and would highly recommend the course to their peers. In this redesigned course, women and minorities constituted 63% of the class, suggesting that this educational approach has the potential to retain a large number of underrepresented groups in landscape horticulture. We conclude that this collaborative approach for teaching landscape horticulture is likely to enhance horticultural education and foster a seamless educational experience for students who transition from a community college to a university. Also, this educational approach could serve as a model for curricula that combine practical knowledge with advances in science and technology.**

[1]Department of Agronomy and Horticulture, New Mexico State University, Las Cruces, NM 88003.

[2]Facilities Maintenance Technology, Technical and Industrial Division, Doña Ana Branch, Community College, New Mexico State University, Las Cruces, NM 88003.

Contribution of the New Mexico Agricultural Experiment Station, New Mexico State University, Las Cruces. We thank Carlos Rosencrans for a critical review of this manuscript. This project was supported by USDA/CSREES grant 2002-38422-12161 awarded to R.S.H. and J.M.T.

[1]Associate Professor; to whom reprint requests should be addressed. E-mail: rsthilai@nmsu.edu

[2]Professor.

Although involvement in horticulture is increasing, sustained growth in undergraduate horticulture departments across the United States seems to be unique to a few universities (Sibley et al., 2002). Enrollment in undergraduate horticulture programs is declining (Bradley et al., 2003). So, new approaches in horticulture education must be developed to arrest the decline in enrollment in horticulture programs (St. Hilaire, 2003a). While faculty at 4-year institutions may perceive that there are institutional barriers to implementing novel approaches in undergraduate horticulture instruction, students often indicate a need for more active learning.

Many community colleges have been established to provide students with active learning opportunities. Enrollment at community colleges is increasing (Roueche et al., 2002). Furthermore, community colleges have played a role in increasing student diversity in postsecondary education in American institutions (Pascarella and Terenzini, 1998). Instructional approaches that use the experiential learning opportunities available at community colleges might attract students to university undergraduate horticulture programs. Furthermore, models that foster collaboration between agriculture programs at state universities and community colleges could help minority students overcome common barriers to educational success, such as poor academic preparation, low achievement motivation, and inadequate financial support (Nichols, 2001).

A horticulture course such as landscape construction might be an excellent candidate for immersing students in an active learning environment. Landscape construction is taught at several universities and colleges (Williams, 1999) and is not unique to New Mexico State University (NMSU). At NMSU, HORT 308 (landscape construction) is a three-credit-hour course. Students are instructed in site grading and drainage, landscape material use and specifications, project cost estimating, and the construction of landscapes for residential and small business sites (New Mexico State University, 2003). Historically, this class has had a lecture and a laboratory section that ran together throughout 16 weeks of the spring semester.

Doña Ana Branch Community College (DABCC) is a 2-year branch campus of NMSU. At DABCC, landscape construction I [OEMN (occupational education maintenance) 160] and landscape construction II (OEMN 170) are offered in the Department of Facilities Maintenance Technology. Both OEMN 160 and OEMN 170 are 16-week semester courses that include traditional lectures paired with laboratory sections. In those courses, students establish a landscape from a printed plan. Students are instructed in elementary surveying, grade inter-

pretation, blueprint reading, landscape layout, and tool selection and use. Also, students install irrigation and drainage systems (Doña Ana Branch Community College, 2003). Thus, both NMSU and DABCC offer similar curricula in landscape construction. Furthermore, the two institutions are located within 1.2 miles (2 km) of each other.

Landscape construction instructors at DABCC and NMSU offered a redesigned landscape construction course to both community college and university students. The objectives of this educational approach were to: 1) develop a method to facilitate the seamless integration of compatible curricula from a community college and a university; 2) develop a way to enhance student learning in landscape construction; and 3) create a way to retain a large number of women and minority students in the higher education system.

Materials and methods

COURSE SELECTION. We examined course offerings at NMSU and DABCC for compatible curricula in landscape horticulture. Four courses at DABCC and three courses at NMSU were judged to be possible candidates for compatibility. After examining the content of each candidate course, we selected landscape construction II (OEMN 170) and landscape construction (HORT 308) as the two most compatible courses. Those two classes had an equal number of semester credits and similar course objectives. For example, one course objective that was remarkably similar to both courses was: "Given materials and instruction the student will correctly install unit pavers with 95% accuracy."

COURSE DELIVERY. After OEMN 170 and HORT 308 were selected, we synchronized the lecture and laboratory times that each of the individual courses was to be offered in the Spring 2003 semester. In 1998, 1999, and 2001, the combined enrollment in OEMN 170 and HORT 308 averaged 18 students (Table 1). However, classroom space was selected to accommodate an anticipated total enrollment of 33 students. For the initial course offering, course numbers were not altered. A new course was not created. The two courses were jointly taught as a single class with community and university students commingled in the same teaching environment. The course was organized as a 50-min lecture with 4 h of laboratory each week.

Because community college and university students were exposed to the same course material, instructors spent 6 months to modify existing course objectives; choose instructional topics; select reading materials, such as textbooks; and develop book chapter study guides, quizzes, and exams that would meet the instructional needs of both groups of students. The approach to developing the course objectives was to balance the theoretical framework needed by the university students with experiential learning mandated by the community college.

Lesson plans were collaboratively developed. The delivery of each lecture topic was based on the expertise of the individual instructors. Each instructor was responsible for half of the lecture topics, but the responsibility for each laboratory was shared. When one instructor delivered a lecture topic, the other instructor provided organizational support and assisted students with class exercises. The expertise of the individual instructors was diverse, making it possible to adequately cover the broad range of topics encountered in a landscape construction course. One of the instructors had 15 years of general construction experience. To complement the expertise of the instructors, local professionals gave three guest lectures to the class.

As lesson plans were crafted, the resources required for effective instructional delivery were developed. Historically, landscape construction projects at DABCC have focused on community-based projects, while those at NMSU are undertaken at NMSU's landscape display garden at the Fabian Garcia Science Center or on the main campus in Las Cruces. Campus construction activities must be approved by the Office of Facilities and Services. For this course, the landscape construction project selected was the installation of landscape and irrigation systems for the then recently built equestrian center at NMSU.

COURSE AND STUDENT EVALUATION. We developed a questionnaire so that the students registered in the class could informally but anonymously evaluate the course. The questionnaire was based on the formal questionnaires that students at NMSU and DABCC use to evaluate courses and instructors. The questionnaire was administered at the 15th week of class. The questionnaire consisted of five-point Likert-scaled items (Ary et al., 1996) and open-ended questions. Response categories and their corresponding values for the five-point Likert-scale items were as follows: unsatisfactory = 1; below average = 2; average = 3; above average = 4; and excellent = 5. Questions that were assigned Likert-scale values were judged to be related to instructor delivery style, instructional delivery methods, or course management. The response categories were chosen to mimic the categories that were present on formal student evaluation forms at DABCC and NMSU. A typical open-ended question was "How would you change this class to enhance student learning?"

All grading keys for student assignments and assessment techniques for laboratory exercises were developed jointly, but each instructor retained the responsibility of assigning a course grade for the students registered in that instructor's course. Formal university and community college student evaluations were administered at the end of the class. Furthermore, we tracked the number of women and minority students enrolled in the course. We administered pre- and post-tests at the beginning and at the end of the class to gauge student learning of the subject matter (St. Hilaire, 2003b). The order of questions for the post-test was changed randomly to limit the possibility that a student might remember the order of previous responses.

DATA ANALYSIS. Data were analyzed using SAS for Windows (release 8.2; SAS Institute, Cary, N.C.). Data from both community college and university students were treated as one data set. The assumption that pre- and post-scores were normally distributed was tested using the Kolmogorov-Smirnov test. Scores were normally distributed ($P > 0.1500$). A paired t test was used to compare means between the pre- and post-test scores for each student. Least square means were used to report sums of responses for each question. An independent group t test was used to test whether final student course grades when each course was taught separately were equal to the student course grades when the courses were taught jointly. A t test was used to determine whether formal student class evaluation of the HORT 308

offered in 2001 was equal to student evaluation of the HORT 308 that was jointly offered in 2003.

Results and discussion

Student enrollment in the combined class was 35. This was larger than the average number of students who historically would have enrolled in each course separately during the past three times that each course was offered at each institution (Table 1). We had one laboratory section, which implied a large number of students had to be supervised during laboratory activities. Two experienced technical assistants from DABCC and a graduate teaching assistant from NMSU were available to assist with student supervision and course management. Despite the relatively large number of students in one laboratory section, the overall faculty/staff (5) to student (35) ratio was one to seven. Since landscape construction has the risk of injury, adequate student supervision, as provided by our low faculty-to-student ratio, is needed to mitigate the enhanced risk created when inexperienced students undertake construction projects. Instructors wishing to try our method of instruction must consider planning for the added space and supervisory requirements of merged classes.

A major benefit of merging the two classes was the presence of an instructor and technical assistant with considerable general construction experience. A skilled landscape construction instructor is essential to the long-term success of class construction projects (Williams, 1999). So, instructors with limited experience in landscape construction might look to pair with more experienced teachers to ensure the long-term success of fledgling landscape construction programs.

Regardless of the experience level of the instructors, individuals who plan to use this method of instruction must cultivate a good professional relationship before starting this mode of instruction. Nichols et al. (2001) found that partnerships between a 2-year tribal college and a university could be either meaningful or nonproductive. Furthermore, Nichols (2001) warned that collaborative efforts that do not equitably empower both parties will not work.

Major equipment and facilities that were available to the combined class included: a skid-steer loader equipped with auger and rototiller attachments, compact loader, walk-behind trencher, and a fully equipped carpentry laboratory. The availability of more equipment, facilities, and students facilitated the construction of our large-scale project. The class installed the irrigation system and landscaped a 7162-ft^2 (665.3 m^2) area at the NMSU equestrian center.

Besides the enhanced capacity to undertake larger projects, the availability of a broader range of equipment prompted students to request (on informal evaluations) more training on selected equipment. Students requested more training in skid-steer loader operations. So, we developed and offered a one-credit, 100-level special topics course on skid-steer operations and safety. This special topics course was offered at DABCC in the summer II session (2 July to 8 Aug.) of 2003 and had an enrollment of 22 students. Development of a very popular entry-level class might serve as a recruitment tool if several undeclared or underclassmen register in the class (Bradley et al., 2003).

Student post-test scores improved significantly ($P < 0.001$) over the pre-test evaluation (Table 2). The maximum number of points a student could score on the pre-/post-test was 40. Although the range of individual scores was large (Table 2), the average score of 21 (53%) was less than we expected. One possible explanation for this result could be the very detailed pre-/post-test we crafted far in advance of actual course delivery. On average, students scored 35 points out of 40 (88%) on the final exam that was created at the end of the semester.

The final course grade on a 4.0 scale for students at DABCC (3.28 ± 0.76) and at NMSU (3.14 ± 0.76) was statistically similar ($P = 0.6576$). For HORT 308, student final course grades in 2001 averaged 3.18 ± 0.62, which was statistically similar ($P = 0.3252$) to the average final student course grade of 3.14 ± 0.76, obtained in 2003. In contrast, OEMN 170 students' final course grade in 1998 averaged 2.25 ± 2.06, which was lower ($P = 0.0382$) than the 2003 average final score. We attribute this difference to the failing grade awarded one student.

Universities use formal student course evaluations to improve instruction, decide on faculty promotion and tenure, and award faculty merit pay (Bollin et al., 1995). Faculty may be reluctant to implement teaching strategies that do not enhance student course evaluations. For HORT 308,

Table 1. Student enrollment in landscape construction II (OEMN 170) and landscape construction (HORT 308) for 1998, 1999, 2001, and 2003. Landscape construction II is taught at Doña Ana Branch Community College, and landscape construction is taught at New Mexico State University.

Year	Student enrollment		
	OEMN 170	HORT 308	Total
1998	5	---[z]	5
1999	---[z]	20	20
2001	---[y]	28	28
Mean for 1998, 1999, and 2001	5	24	18
2003	7	28	35

[z]Course was not offered.
[y]Course was cancelled due to low enrollment.

Table 2. Mean pre- and post-test scores (±SD) of students[z] enrolled in landscape construction II (OEMN 170) and landscape construction (HORT 308). These courses were jointly taught. Landscape construction II is taught at Doña Ana Branch Community College, and landscape construction is taught at New Mexico State University.

Mean score			
Pre-test	Post-test	Difference	*P*
8 ± 6.4	21 ± 6.1	13 ± 4.4	<0.0001

[z]Twenty-one students from the class of 35 had both pre- and post-test scores.

we did not find any difference (P = 0.6288) in students' formal evaluations of the course that was taught in 2001 (singly) and the class that was offered in 2003 (jointly). At the end of the semester, course evaluations showed that students valued the presentation skills and course delivery methods of the instructors (Table 3).

At many institutions of learning, evaluation of teachers is based on presentation skills and not on student learning (Boggs, 1998). However, one of the objectives of this project was to gauge how well our educational approach impacted student learning. Eighty-four percent of the class reported that classroom materials and laboratory activities chosen to support learning were above average or excellent (Table 4). Sixty-three percent rated the combining of a university and college class as above average or excellent and more than half the class would recommend this type of curricular course offering to other students (Table 4). None of the students in the class had been exposed to this type of learning environment. When asked whether the subject matter was presented interestingly, nearly 90% of the class reported that it was above average or excellent. Students are more likely to learn and retain the material when they find the subject matter interesting. Also, an interesting course might help to recruit students to the class (Bradley et al., 2003).

When asked whether the class was organized in a sensible manner, 16% of the class reported that the course organization was below average or unsatisfactory (Table 5). Although the majority (84%) of the class reported that class was organized sensibly, throughout the semester, the class met at different locations spread out among two campuses and three construction sites. One of the challenges we encountered was the increased communication needed to clearly indicate to students the site of the next meeting. Although meeting places were clearly outlined in the class syllabus, instructors hoping to use this method of instruction must be aware that students will need to be reminded constantly of class meeting locations if instruction occurs at several different locations.

The need for minorities in agriculture exceed the supply (Jones and Larke, 2001). In 1998, OEMN 170 had 40% minority and women students.

Table 3. Responses of landscape construction students when asked questions related to instructor delivery style. Students (n = 32) were enrolled in landscape construction II (OEMN 170) and landscape construction (HORT 308) courses that were jointly taught. Landscape construction II is taught at Doña Ana Branch Community College, and landscape construction is taught at New Mexico State University.

	Response category[z]					
Survey item	US	BA	A	AA	E	LSMeans[y]
	Response (%)					
Teachers' apparent familiarity with subject	0	0	9.4	34.4	56.2	4.5
Teachers' attitude toward subject	0	0	12.5	28.1	59.4	4.5
Teachers' attitude toward students	0	0	18.7	31.3	50.0	4.3
Teachers' ability to convey concepts about the subject	0	3.1	18.8	40.6	37.5	4.1

[z]Unsatisfactory (US), below average (BA), average (A), above average (AA), or excellent (E).
[y]LSMeans (least squares means) were based on a Likert scale of 1 to 5 where US = 1; BA = 2; A = 3; AA = 4; and E = 5.

Table 4. Responses of landscape construction students when asked questions related to instructional delivery methods. Students (n = 32) were enrolled in landscape construction II and landscape construction (HORT 308) courses that were jointly taught. Landscape construction II is taught at Doña Ana Branch Community College, and landscape construction is taught at New Mexico State University.

	Response category[z]					
Survey item	US	BA	A	AA	E	LSMeans[y]
	Response (%)					
How well did instructors choose classroom materials and/or lab activities that supported learning	0	0	15.6	40.6	43.8	4.5
Is combining a university and community college a success or failure?	6.2	9.4	21.9	28.1	34.4	3.8
Would you recommend this combined curricula offering to other students?	12.5	9.4	15.6	18.8	43.8	3.7
Did you find the subject matter presented interesting?	0	0	12.5	25.0	62.5	4.5

[z]Unsatisfactory (US), below average (BA), average (A), above average (AA), or excellent (E).
[y]LSMeans (least squares means) were based on a Likert scale of 1 to 5 where US = 1; BA = 2; A = 3; AA = 4; and E = 5.

Table 5. Responses of landscape construction students when asked questions related to course management. Students (n = 32) were enrolled in landscape construction II and landscape construction (HORT 308) courses that were jointly taught. Landscape construction II is taught at Doña Ana Branch Community College, and landscape construction is taught at New Mexico State University.

	Response category[z]					
Survey item	US	BA	A	AA	E	LSMeans[y]
	Response (%)					
Has the course organized in a sensible manner?	9.4	6.2	31.2	21.9	31.3	3.6
Did you find the textbook useful and relevant?	0	0	25.0	9.4	65.6	4.4
Do you feel you are being evaluated fairly?	0	0	25.0	21.9	53.1	4.3

[z]Unsatisfactory (US), below average (BA), average (A), above average (AA), or excellent (E).
[y]LSMeans (least squares means) were based on a Likert scale of 1 to 5 where US = 1; BA = 2; A = 3; AA = 4; and E = 5.

In 2001, 58% of the HORT 308 class was minority and women students. Minority and women students constituted 63% of the jointly offered. Although Nassar et al. (2002) found that women in the landscape contracting program at Pennsylvania State University academically outperformed men, historically, women represented only 13% of the students enrolled in that program. The fact that we obtained such high numbers of underrepresented groups in the program may be due in part that the United States Department of Education Title III program have designated both DABCC and NMSU as Minority Serving Institutions. Also, in Fall 2003, women formed 60% of the total enrollment in the College of Agriculture at NMSU (Martin, 2003) where the landscape horticulture program is housed. Furthermore, community colleges have a relatively larger proportion of minority students compared to universities. So, the integration of a community college and university class has the potential to increase minority enrollment in the combined class.

Three DABCC students inquired about the horticulture program at NMSU. Of those three students, one student subsequently enrolled in classes at NMSU and another transferred to the Agronomy and Horticulture department at NMSU to complete a 4-year degree in horticulture. Our educational approach might be good way to help community college students transition to a 4-year university. Our program was funded externally and co-managed by NMSU and DABCC. We anticipate that instructors willing to implement this teaching strategy at other institutions could encounter institutional and financial barriers. However, this educational approach could help undergraduate recruitment at 4-year institutions.

We conclude that this collaborative approach for teaching landscape construction is likely to enhance horticulture education for all students and foster a seamless educational experience for students who transition from a community college to a university. Our educational approach provides another way to train the next generation of students for the U.S. horticulture industry. Furthermore, our approach to horticulture education has the potential to recruit more students to undergraduate horticulture programs.

Literature cited

Ary, D., L.C. Jacobs, and A. Razavich. 1996. Introduction to research in education. 5th ed. Harcourt Brace, Orlando, Fla.

Boggs, G.R. 1998. Accepting responsibility for student learning. On the Horizon 6:1,5–6.

Bollin, G.G., D. Bolton, and S.B. Kletzien. 1995. Faculty attitudes toward course evaluations. J. Staff Prog. Org. Dev. 13:103–111.

Bradley, J.C., D. McConnell, M. Kane, and G. Miller. 2003. Development and implementation of a nonmajors horticultural survey class. HortTechnology 13:196–199.

Doña Ana Branch Community College. 2003. Doña Ana Branch Community College 2002–2003 catalog. Doña Ana Branch Community College, New Mexico State Univ., Las Cruces.

Jones, W.A. and A. Larke, Jr. 2001. Factors influencing career choice for African American and Hispanic graduates of a land grant college of agriculture. J. Agr. Educ. 42:38–48.

Martin, N. 2003. Women, minorities establish firm foothold in college. Sam Steel Way Alumni Nwsl. 18:1,7.

Nassar, H.F., D.J. Beattie, and D.T. Stearns. 2002. The professional experience of women landscape contracting students from the Pennsylvania State University. HortTechnology 12:509–515.

New Mexico State University. 2003. New Mexico State University undergraduate catalog 2003–2004. New Mexico State Univ., Las Cruces.

Nichols, T.J. 2001. 2 + 2 + 2 collaboration adds up to success for American Indians in agriculture. Natl. Assn. Colleges Teachers Agr. J. 45:21–24.

Nichols, T.J., P. Baird and D. Kayongo-Male. 2001. Partnerships offer promise and perils- A study of collaborations with state universities. Tribal College J. 13:20–23.

Pascarella, E.T. and P.T. Terenzini. 1998. Studying college students in the 21st century. Rev. Higher Educ. 21:151–166.

Roueche, J.E., S.D. Roueche, and R.A. Johnson. 2002. At our best: Facing the challenges. Community College J. 72:10–14.

Sibley, J.L. D.J. Eakes, J.D. Williams, and H.G. Ponder. Components of strength of the Auburn horticulture undergraduate program. HortTechnology 12:168–171.

St. Hilaire, R. 2003a. Teaching landscape construction: A new model for instruction. Stage Route News—Agron. Hort. Nwsl. 3:4.

St. Hilaire, R. 2003b. Effective teaching—A professor's view. Hort. Alumni Nwsl. 9:4.

Williams, D.B. 1999. Teaching landscape construction at the University of Tennessee. HortTechnology 9:687–689.