Comparing Student Performance in an Online versus a Face to Face Introductory Turfgrass Science Course – A Case Study

Cale A. Bigelow[1]
Purdue University
West Lafayette, IN 47907

Abstract

Traditional universities are placing increasing emphasis on the development of online courses that provide access to specialized course content such as Introductory Turfgrass Science. The purpose of this study was to determine the effectiveness of a newly created online turfgrass course by assessing the performance of thirty undergraduate Horticulture students. Two groups of students, traditional lecture or online, simultaneously received identical course content during a 16-week semester. Student performance was evaluated using quizzes, homework assignments and written exams. The mean exam grades were similar for each population, although online student scores were slightly (2-7%) lower. Similar percentages, 82 and 84 % of online and traditional students respectively, earned a final course grade > C. When evaluating online student success factors, grade point average, ≈ > 3.0, academic success in prior Agriculture courses, and actual time spent online all contributed to higher overall grades. These data indicate that this online version of the course appears to be a suitable substitute for those students unable to take the traditional lecture version but wishing to gain fundamental knowledge related to turfgrass science. Furthermore, dedicated and highly motivated students with a previous positive academic history can earn a grade comparable, > B, to those earned in other courses.

Introduction

Online education provides access to teaching institutions, information sources, content, and programs around the world to anyone with computer access. Such access is especially important to students in rural and other isolated locations. Increasingly, however, online courses are a way to provide access to specialized introductory classes for students at satellite campuses but wishing to eventually transfer to a main campus while remaining academically on-track. The potential benefits of online courses are well documented and include convenience, scheduling flexibility, cost-effectiveness, and the ability to take more courses (O'Malley and McCraw 1999; Carnevale, 2000; Dutton et al., 2002). In an effort to meet the demands of 21st century students, many traditional universities have increased the emphasis on developing the number and variety of online courses that originate from traditional main campuses and have begun to adopt a more consumer-centered educational model (Howell et al., 2003). Of particular interest is the development of specialized introductory course content taught by content experts who are actively researching current scientific questions. By providing content from experts in the field, it ensures the "Brand" of large well recognized traditional campuses and also offers the opportunity to provide regularly updated fact-based information as new discoveries in the discipline occur. Delivering distance learning courses from a large main campus to satellite campuses is not new, for example a specialized course in animal science has been demonstrated to be an effective substitute to face-to-face classes for several years (Latour, 2003). In addition, offering these specialized introductory courses delivered from a main campus may serve as a recruitment tool and attract undergraduates to specialized degree option programs like Agronomy - Turfgrass Science. Currently, there are very few web-accessible Turfgrass Science course offerings, although there is a demonstrated need for access to this content (Shoener and Turgeon, 2001).

One of the challenges associated with online learning at a main campus, is determining which students are suited to taking the online course when the opportunity for face-to-face instruction also exists. In many traditional lecture courses, prerequisites for admission already exist. For many introductory courses and those offered in the online classroom these prerequisites are often enforced unevenly. In many situations very few prerequisites are imposed and the academic track record for a student is rarely considered during enrollment. The existing research and literature suggests that there are student variables that can be measured to predict to what degree a student will complete and be academically successful in an online course. Research has shown that a variety of demographic and institutional variables are significant regarding student retention and performance (Smith et al., 2003; Wojciechowski and Palmer, 2005; Martin et al., 2006). These indicators of potential online academic success would be useful for placing students when an opportunity for face-to-face instruction also exists.

[1]Associate Professor, Dept. of Agronomy; Tel: 765-494-4692; Email: cbigelow@purdue.edu

Therefore, the objective of this study was to evaluate the performance of two populations of students taking an Introductory Turfgrass Science course, traditional lecture and online, to determine if the online version of the course provided an equivalent educational experience to the traditional lecture and following completion of the course evaluate if previous academic performance characteristics like grade point average (GPA) and performance in other introductory courses could be related to the student's final grade.

Materials and Methods

The data for this study was generated using two student populations who were simultaneously enrolled in an introductory Turfgrass Science course, AGRY 210: Fundamentals of Turfgrass Culture, offered at Purdue University in the spring semester of 2006. This course is required of all undergraduate Agronomy students in the Turf Science option and most Horticulture students, but it is also serves as general education course to any student who desires fundamental Turfgrass Science information.

The traditional lecture version of the course, AGRY 210, met for three 50-minute lectures each week for a 16-week semester. The online version of the course, AGRY 210 Y, mirrored the content presented in AGRY 210 but utilized Purdue University's "Open" campus which allows students web-access to online courses from anywhere with a computer connection. The course content was delivered using a Blackboard/WebCT Vista® course delivery platform. Once logged onto AGRY 210 Y, students encountered a comprehensive syllabus which outlined how to access the online lecture content, add any necessary computer plug-ins such as Adobe Reader®, a list of suggested supplementary readings to improve understanding of course content and the exam dates for the 16-week semester. Additionally, there was an audio-visual presentation from the instructor that welcomed the students to the course and outlined what was expected throughout the course and provided some considerations for academic success in an online environment.

The specific course content was structured using individual learning modules for each topic presented (e.g. The Cool-season grasses, Mowing, Fertilization, etc.). Contained in each module were: detailed learning objectives, online "lectures" or audio-visual content presentations created using Microsoft Power Point® and the Adobe/Macromedia Breeze Presenter® plug in. Each "lecture" or series of "lectures," depending upon content depth, were supported by printable note versions of the presentations, supplementary readings and in most cases a short online quiz to reinforce the important aspects of the learning objectives. Groups of related learning modules were released in parallel with the content being presented in the traditional lecture schedule. For both populations the student's grades were based on the following:

40% - The average of the two best of three proctored written semester exams
30% - A comprehensive final exam
15% - Weekly self-paced learning resource center assignments
15% - Weekly quizzes and homework assignments

The course was delivered to a total student population of 63 students, with 49 and 14 students in the traditional lecture and online versions, respectively. Of the 14 students enrolled online, 12 were in residence at the Purdue West Lafayette campus and two students located at satellite campuses. For the comparisons included in this manuscript, a sub-set of 19 undergraduate Horticulture students in the traditional lecture and 14 online students were used. Additionally, although 14 students took the online course, for grade comparison and evaluation of student success factors the majority of the information presented pertains specifically to the 11 undergraduate Horticulture students. On occasion some references to the performance of the total online population is discussed. As mentioned previously, final student grades for the course were based primarily, 70 % of overall, on closed book, proctored, written exam scores. On some dates there was no exam score for the traditional students as they did not take the exam because it was optional. Additionally, the final exam scores were not considered in the analysis of student performance because some students were exempt from taking the final exam because they had earned an "A" for all course work prior to the final exam.

The performance and comparison of the two student population grades were conducted using both standard descriptive statistics (e.g. means, standard deviation, etc.) for exam scores and where appropriate, the two student populations were directly compared with student's t-test at a 0.05 probability level in the SAS statistical software (SAS, 2004). Additionally, in an effort to assess factors contributing to online academic success, data such as semester in college, grade point average (GPA), performance in prior College of Agriculture courses and actual time spent online were all evaluated. For evaluation of GPA and actual time spent online, simple linear regression was used to correlate these data with final course grades on an standard A through F grading scale where A = 4.0 and F = 0.0.

Results and Discussion

The academic performance of thirty undergraduate Horticulture students in AGRY 210 Y was assessed by evaluating 19 traditional lecture and 11 online students (Table 1). When comparing the two populations the mean GPA of the two groups was very similar, 2.8 versus 2.88 while the overall student demographics were variable. For example, the traditional lecture population was 68% class 6 or junior level students compared to 55% class 8 or final semester senior level students. Data regarding

gender and age were not included in this evaluation; however, all students would be classified as traditional undergraduates.

To assess academic performance, both populations took weekly quizzes, completed periodic homework assignments. The only real difference was that the online students received lecture materials and completed all assignments online. Both groups took proctored, written exams which were identically prepared and delivered within +/- 5 days of delivery to the traditional lecture population. Results of these exam scores were not different (Table 2). In general, students performed best on the first exam, 84.9 and 89.1% and worst on the third exam 67.7 and 74.6% for online and traditional lecture populations respectively. It is unclear if student performance on the third exam was due to the difficulty of the course content or external factors such as workload/academic effort (e.g. term papers, projects, etc.) in competing courses. One other possible explanation for the overall poorer performance on exam three is that all students were allowed to drop their lowest of three exam scores. Since the third exam occurred near the end of the semester, it is plausible that many students simply did not study or prepare as vigorously for this exam as they did for the first exam.

The percentage of students earning a C or better for their final course grade was similar, 82 and 84%, for the online and traditional populations respectively (Figure 1). There were three students from each population earning an A for the course. Some educational researchers have reported that online students often earn higher exam scores than traditional lecture students (Dutton et al., 2002). This did not appear to be the case for this online course. One possible difference may be the variation in the students taking the online course, 55% final semester seniors, versus the high percentage, 68%, of juniors in the traditional lecture. This higher percentage of A's in the online course compared to the traditional lecture population could possibly be due to greater maturity and an additional year of academic experience of the senior level students.

One of the instructional challenges when offering any online course is determining who is best suited to take the course. This is important not only for student academic success but also to make sure that as few students as possible drop the course. Several researchers have reported that compared to traditional lecture courses many online or distance education courses suffer from unusually high dropout rates and a student mistakenly placed into an online course may encounter more difficulties and have reduced chances for academic success (Eisenberg and Dowsett, 1990; White et al., 1995; Frankola, 2001). Students not suited for academic success in an online course could then be enrolled in the traditional face to face lecture version where an opportunity for greater student-instructor interaction could take place.

When attempting to determine the suitability of a student enrolling in an online course and predicting student academic success, a variety of data such as overall GPA or previous performance in other courses can be evaluated (Table 3). For this assessment, GPA and prior performance in Purdue University-based College of Agriculture courses with similar or slightly larger historical enrollments were analyzed. In general, GPA was not a major indicator of success. There was, however, a numerical data trend for students with a higher GPA, ≈ > 3.0, often earning > B. By comparison, students earning a C or less generally had a GPA < 2.66. There were, however, two notable exceptions where students with a GPA > 3.0 also earned C's. A possible explanation for the performance of these students will be discussed in later. The lack of a strong relationship between student performance and GPA, R2 = 0.5928, in this course may be due to the rather small sample size. Other researchers have shown a strong correlation between academic success and GPA (Wojciechowski and Palmer, 2005) but with a larger (179) student population.

Initially the courses that appeared capable of providing the best potential correlation to AGRY 210 Y performance included Introductory Economics (AGEC 217), Introductory Soil Science (AGRY 255), Plant Propagation (HORT 201), and Woody Landscape Plants (HORT 217). When evaluating prior course performance to predict a student's grade some general trends emerged. Although four courses

Table 1. Characteristics of two populations of undergraduate Horticulture students taking a traditional (AGRY 210) and online version (AGRY 210 Y) of an introductory turfgrass science course

Course version	Number of students	Grade point average	Semester classification			
			≤ 5	6	7	8
			(# students)			
Traditional lecture	19	2.80	2	13	0	4
Online	11	2.88	3	1	1	6

Table 2. Mean student exam scores and comparison of two populations of undergraduate Horticulture students taking a traditional face-to-face and online version of an introductory turfgrass science course

Course version	Number of students	Exam 1	Exam 2	Exam 3
		(exam score percentage)		
Traditional lecture	19	89.1 ± 7.7[1]	87.7 ±7.1	74.6 ± 20.3
Online	11	84.9 ± 8.0	85.4 ± 10.4	67.9 ± 16.8
Trad. vs. online		NS[2]	NS	NS

[1] ± represents one standard deviation
[2] NS = not significant according to Students t-test at the 0.05 probability level.

were initially selected, two courses (HORT 201 and 217) had the most complete data set and therefore the best relationship with final grades. The other courses, AGEC 217 and AGRY 255, were dropped from analysis because three students had earned transfer credit for AGEC 217 and no grade was reported and two students had yet to take AGRY 255. When using the remaining courses to predict student performance most students, seven out of eleven, earned a final AGRY 210 Y course grade equivalent or better than their lowest grade in either HORT 201 or 217 (Table 3).

Table 3. Comparison of grade point average and previous course performance versus student's final grade earned in an online introductory turfgrass science course (AGRY 210 Y)

Grade point average	Course number				
	AGEC 217	AGRY 255	HORT 201	HORT 217	AGRY 210 Y
	---------- Final course letter grade (A-F scale) ----------				
2.96	T[1]	B	A	A	A
3.41	B	C	B	A	A
3.37	B	B	B	B	A
3.62	B	NA[2]	A	A	B
2.66	C	C	B	A	C
2.61	T	NA	C	A	C
3.16	B	B	A	B	C
3.00	T	B	B	B	C
2.13	D	C	D	C	D
1.70	C	F	C	D	D
2.35	D	B	B	F	F

[1]T = transfer credit
[2] NA = not available

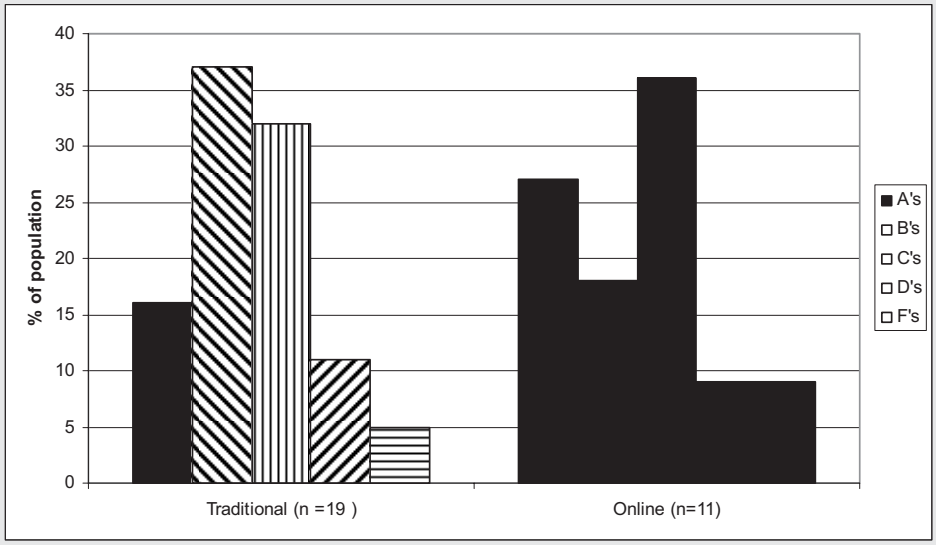

Figure 1. Comparison of final course grades for two populations of undergraduate Horticulture students taking a traditional lecture and online version of an introductory turfgrass science course

One final factor that is difficult to measure prior to allowing student enrollment in an online course is student commitment or personal motivation. One feature of many course delivery platforms is the ability of an instructor to track the exact amount of time a student spends online. Student time spent online for this course ranged from six minutes to > 24 hours (Table 4). In general, more time spent online was positively associated with a higher overall course grade, R2 = 0.7604. Students who earned a B or better in the online course spent approximately > 19 hours. Typical activities would involve downloading notes and supplementary course materials, listening to the audio-visual content presentations and taking online quizzes. One of the reasons students express a desire for access to online learning opportunities is flexibility and the potential ability to spend less time in a classroom When comparing the amount of time spent for academically successful online students, those earning > B, to the instructor-student classroom contact hours for the traditional lecture version, 41 lecture periods x 50 minutes = 34.16 hours of classroom contact time, the online students spent substantially less, nearly 20 hours, working with course content. Thus, this data supports the assertion that students can still be academically successful with less contact time. What is not easily accounted for, however, is how much time the students spent offline or out of class reading course material, working on supplementary assignments, or studying and preparing for exams, etc. By comparison, with respect to faculty workload and distance education it has been reported that the amount of time spent by faculty is comparable or slightly less (Turgeon and Thompson, 2004). With this being the first time this course was offered this was not the case.

What was curious among the online students, who took AGRY 210 Y, is that two historically stronger students, based on GPA and previous course performance, earned C's in the course. After evaluating the amount of time these students spent online, approximately five hours or less online, it was clear that compared to those students earning A's that they had not invested sufficient time in the course. They simply took the online quizzes and downloaded enough study materials to prepare for the written exams. Although these students were historically good students, GPA > 3.0, it is difficult to speculate why they were ultimately unable to earn > B for their final course grade. As AGRY 210 Y evolves, it has been suggested that building features into the course that promote

participation and encourage students to regularly log-in would be helpful. These activities might include posting comments on message boards, and/or increasing the number of online quizzes with the hope of increasing academic success. The lack of involvement by these historically stronger students in a traditional classroom setting also illustrates the potential risks associated with online courses, poor academic performance or increased drop rates, due to low student motivation in the online environment. My observation for this online course is consistent with previously reported data associated for an online undergraduate Psychology course which reported that total online activity was predictive of cyberstudent course performance (Wang and Newlin, 2000). The authors suggested that online student activity should be carefully monitored throughout the semester as any lack of early online activity may be interpreted at a reliable early-warning indicator of poor semester performance.

Just as students desire academic feedback, online instructors also welcome feedback regarding course design and implementation. Both the traditional lecture and online populations responded that they liked the course and the instructor, rating it > 4.3 on a 1-5 scale (Table 5). Additionally, they responded that the course stimulated their interest in the subject rating > 4.5. Other researchers have cited that learning is made more interesting and enriching when new technologies are incorporated into the curriculum (Shrivastava, 1999). The utilization of this novel technology to deliver the online lectures and incorporating online quizzes for this online course appears to be a suitable an equivalent educational experience to the traditional lecture. The positive student responses are also very helpful, particularly as this course potentially attracts not only traditional students but those interested in life-long learning, such as lawn hobbyists or professionals.

In conclusion, quantitative data such as GPA and previous course performance were related to student success in AGRY 210 Y and potentially could be used by the instructor to determine suitability of an online course and future student success. Where minimum standards regarding GPA or academic performance are set, students not meeting the minimum criteria could be enrolled in the traditional face to face lecture version where greater instructor-student interaction could occur. For large online courses this would help reduce student dropout and most importantly avoid some of the feelings of alienation and frustration often expressed by online students (O'Malley and McCraw, 1999). Lastly, as more undergraduates at traditional universities begin to incorporate a higher number of online courses into their academic programs even while in residence, data regarding prior online course performance and the number of times a student drops an online course could be used to determine suitability for online enrollment. This would help advisors assess whether a student is suitable for an online course and who should attend traditional lectures, particularly for introductory courses. One additional benefit to offering AGRY 210 Y is that students formed a relationship with a content expert and a commodity program, in this case the Purdue University Turf Science program. This relationship may likely continue throughout the student's adult life when they seek current fact-based information on a specialized topic like home-lawn care.

Table 4. Final course grades for fourteen undergraduate students versus time spent online in an introductory turfgrass science course (AGRY 210 Y)

AGRY 210 Y	Time Spent Online
--- Final letter grade (A-F scale) ---	--- Hours:minutes ---
A	24:31
A	24:28
A	18:55
B	20:09
C	14:23
C	10:33
C	10:30
C	5:02
C	3:31
D	10:46
D	10:38
D	4:24
F	0:07
W[1]	0:21

[1] W=withdrew

Table 5. Mean student responses to course feedback questions for two populations of students taking an introductory turfgrass science course

Course version	Number of students	Course Stimulated Student Interest	Instructor Displays Thorough Subject Knowledge	Overall Course Rating	Instructor Rating
			Student responses (1-5 scale)[1]		
Traditional lecture	48	4.7	4.8	4.5	4.8
Online	12	4.5	4.3	4.5	4.3

[1]Rating scale: Strongly agree = 5, Agree = 4, Undecided =3, Disagree = 2, and Strongly disagree = 1.

Summary

This current paper demonstrates that students can be as successful in an online version of an introductory turfgrass science course compared to their peers enrolled in a traditional lecture version which presented identical content. This is evidenced by similar scores on most exams (Table 2) and a similar

percentage of students earning a C or better for final course grades, 82 and 84% for the online and traditional populations, respectively. As institutions continue to supplement basic math, science, humanities and social science online offerings with more specialized course content taught by content experts, the technology and delivery platform used to deliver AGRY 210 Y appears to be a suitable way to meet these institutional needs. In the future it is expected that more off-campus students will request and enroll in these specialized courses. As the instructor for this course, the biggest weakness associated with this online course was that there was very little opportunity to actually get to know the students on a personal basis. Thus, the ability to challenge better students or provide supplemental instruction to weaker students was lost. For an introductory course, designed to provide a broad overview of the subject and familiarize students with the foundational principles, the learning that took place and instructor-student interaction was probably not much different than what takes place in large lecture courses. For more advanced students, however, increased instructor-student interaction would be desirable to facilitate greater instructor motivation and modify course content to meet the participant's experience level.

Literature Cited

Carnevale, D. 2000. Study assesses what participants look for in high-quality online courses. Chronicle of Higher Education 47(9): A46.

Dutton, J., M. Dutton, and J. Perry. 2002. How do online students differ from lecture students? Jour. of Asynchronous Learning Networks 6(1). http://www.aln.org/publications/jaln/v6n1/pdf/v6n1_dutton.pdf; (Accessed 16 September 2007).

Eisenberg, E. and T. Dowsett. 1990. Student dropout from a distance education project course: A new method analysis. Distance Education 11(2): 231-253.

Frankola, K. 2001. Why online learners drop out. Workforce 80(10): 53-39.

Howell, S., P. Williams, and N. Lindsay. 2003. Thirty-two trends affecting distance education: An informed foundation for strategic planning. http://www.westga.edu/~distance/ojdla/fall63/howell63.html. Online Jour. Distance Learning Administration. 6:3. (Accessed December 1, 2003).

Latour, M.A. 2003. A test comparison between teleconferencing vs. traditional classroom lectures for an introductory animal science course. NACTA Jour. 47(1): 5-7.

Martin, T.I., T.H. Friend, J.L. Williams, and G. Archer. 2006. Predictors of success in an undergraduate animal behavior course. NACTA Jour. 50: 51-56.

O'Malley, J. and H. McCraw. 1999. Student perceptions of distance learning, online learning and the traditional classroom. http://www.westga.edu/~distance/omalley24.html Online Jour. of Distance Learning Administration. 2(4). (Accessed 20 September 2007).

SAS Institute. 2004. The SAS system for Windows. v. 8.2. SAS Inst., Cary, NC.

Shoener, H.A. and A.J. Turgeon. 2001. Web accessible learning resources: Learner-controlled versus instructor controlled. Jour. Natural Resources and Life Sci. Ed. 30: 9-13.

Shrivastava, P. 1999. Management classes as online learning communities. Jour. of Management Ed. 23: 691-702.

Smith, P.L., K.L. Murphy, and S.E. Mahoney. 2003. Towards identifying factors underlying readiness for online learning: An exploratory study. Distance Education Jour. 24: 57-68.

Turgeon, A.J. and M.M. Thompson. 2004. Comparison of faculty workload in resident and distance environments: The case of a turfgrass management course. Jour. Natural Resources Life Sci. Ed. 33: 102-105.

Wang, A.Y. and M.H. Newlin. 2000. Characteristics of students who enroll and succeed in psychology web-based classes. Jour. Ed. Psych. 92:137-143.

White, E., J. Goetz, M. Hunter, and B. Barefoot. 1995. Creating successful transitions through academic advising. In M.L. Upcraft and G.L. Kramer (eds.). First year academic advising: Patterns in the present, pathways to the future (Monograph No. 18) Columbia: National Resource Center for freshman year experience and students in transition. Univ. of South Carolina, Columbia, SC.

Wojciechowski, A. and L. Palmer. 2005. Individual student characteristics: Can any be predictors of success in online classes? http://www.westga.edu/%7Edistance/ojdla/winter94/herbert94.htm Online Jour. of Distance Learning Administration 8(2):13. (Accessed 20 September 2007).