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the professional journal advancing the scholarship of teaching and learning in agricultural, environmental, natural, and life sciences

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Advanced Soil Physics Class Develops Research and Publication Skills[1]

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Abstract

Graduate-level classes are more focused, but do not always provide students with an opportunity to develop cognitive and publication skills. Therefore, the aim of this class is to let students take ownership of and responsibility for their proposed research work, complete all specified tasks by the deadlines they set, and, by the end of semester, be able to produce a report at a level of quality appropriate for presenting their work at national conferences. Overall, 50% of the students missed one deadline for completing a specified task, but fewer students missed two or three deadlines. Overall, 50% of the students presented their research work as posters and 90% presented their work as oral presentations. When master's/ PhD students were compared, the majority of the papers came from PhD students. Overall, a majority of students rated the class as superior when compared to any other class, and the class developed responsibility and the cognitive and research skills of the graduate students.

Introduction

The basic purpose of introductory classes (e.g., introductory soils) is to provide students with a broad knowledge of various disciplines to help them make informed and intelligent decisions about their future career goals. Subsequent higher-level classes strengthen their understanding of these fundamental concepts through lectures and laboratory work (e.g., some of the classes from a soils curriculum are soil physics, soil chemistry, soil morphology, and soil microbiology). Let us not forget here that, education is an opportunity, and different students avail this opportunity at different levels or scales. As an example, a student majoring in soil science receives from required courses a reasonably good insight into various soil properties and processes and their interactions. The student is also adequately introduced to laboratory and field methods of soil analysis, although hands-on experience with using various instruments is usually limited (Sammis and Mexal, 1996). Together, these theory and laboratory classes train students satisfactorily in fundamental principles, but probably not so satisfactorily in the application of these concepts to solve real world problems. Other aspects usually missed in these classes deal with training students in concepts related to scientific research, especially developing a testable hypothesis and subsequently conducting a field or laboratory based research to prove or disprove the hypothesis. There is a need to develop and execute teaching strategies for undergraduate and graduate students that are oriented toward conducting scientific research (Allard and Barman, 1994).

Teaching strategies with a research orientation can include theoretical and hands-on experience with various tools and instrumentation (Sammis et al., 2003), and can be achieved by asking students to identify and use already completed research (may be already published work) to develop an individual project. Alternately, students can work as a team and develop an interdisciplinary project. Interdisciplinary or team projects are important because there is an increasing emphasis on interdisciplinary and multi-institutional types of research (Mervis, 2002; National Research Council, 2004; Lawrence and Després, 2004). These strategies can also be combined so that a student starts at an individual level and goes on to form an interdisciplinary research project, and can improve a student's skill and leadership at an individual level as well as a team level. At both of these levels, students' cognitive and communication skills should be evaluated, and efforts should be made to improve these skills for them to be successful teachers or researchers. Accordingly, a flow chart of systems, with processes and feedback loops, can be introduced in graduate-level classes incorporating cognitive skills (Lyle and Williams, 2001), and these classes could also be goal-oriented (Ram, 1999). Students must be encouraged to use search engines to improve their understanding of their information need (Rowlands and Nicholas, 2008) to meet their goals,

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critically evaluate the gathered information, and use it appropriately for the proposal development. In the feedback loop, a student submits an original proposal for instructor feedback, incorporates constructive instructor feedback, and adds additional relevant information. The revised document is resubmitted to the instructor and the feedback loop continues.

The objectives of this research from the advanced soil physics class were to help students learn some basic tools related to water and solute transport through the vadose zone, and to develop their cognitive and communication skills. By the end of the semester, students were expected to complete the goals they had set and defined. The importance of presenting the research in conferences and publishing in peer reviewed journals was shared repeatedly with students. Students were continuously encouraged to present their research at national or international conferences, symposia, or meetings, and to submit manuscripts for publication in peer reviewed journals. In order to achieve these objectives, the student's major advisor was also involved or kept informed throughout the semester where applicable.

Methods and Materials

The advanced soil physics class is a graduate-level class in the Department of Plant and Environmental Sciences at New Mexico State University (Las Cruces, NM), and is usually taught once a year during the spring semester. Students enrolled in this class are usually perusing a Masters/PhD degree.

The students included in this research had a diverse background and were from various departments and colleges, including civil engineering, agronomy, soil science, environmental science, and range science. Although students' quantitative skills, such as computer, physics, math, and statistics skills, varied depending upon their undergraduate major, all of the students enrolled in advanced soil physics had successfully completed the prerequisite of the environmental soil physics class. Most students (~90%) had never written, submitted, or published a manuscript in a peer reviewed journal.

At the beginning of the class, students were given the expectations for passing the class. Students were always given a choice to take the class as a project/goal-oriented class or as a regular homework assignment/quiz/exam class. So far, students have chosen the option of a project/goal-oriented class. At the beginning of the class, each student was asked to develop a proposal that was related to one or more aspects of water dynamics (infiltration, retention, transport, movement, or loss). Students were asked to write and submit an initial draft of the proposal to the instructor by a given date (usually set by the instructor in consultation with the students). The draft of the proposal had to include a tentative title and a brief summary (at least two pages, single-spaced with 12-point font). The summary had to contain an introduction, hypothesis or hypotheses, clearly spelled out objectives, and a timeline for accomplishing different tasks (e.g., literature review, data collection, and analysis, etc.). All course materials, individual proposals, proposed deadlines, tasks performed, and work done by each student were posted each semester on the Blackboard learning system of New Mexico State University (http://learn.nmsu.edu) and were accessible to each student during the semester. An example of the tasks and deadlines proposed by students is presented in Table 1.

Table 1. Tasks and Deadlines Example Proposed by Students.

No.	Topics of Research	Date to submit
1	Draft Proposal Submission	End of Jan.
2	Final Proposal Submission	1st week of Feb.
3	Proposal Presentation	1st week of Feb.*
4	Review of Literature	End of Feb.
5	Field/Lab/Data Collection	March to mid-April
6	Update Presentation	3rd week of March*
7	Analysis/Modeling	End of April
8	Final Report Submission	May 5-8th
9	Final Poster Submission	May 5-8th
10	Final Presentation in Class	May 5-8th*

**Indicates that the deadline was set by the instructor.*

Usually, all the topics in this table were included each semester, but sometimes students had more specific deadlines for different types of data collection, analysis, and modeling.

Study period 2006, 2008-2010 at New Mexico State University, Las Cruces, NM.

The main philosophy behind asking students to provide oral presentations stems from the notion that, a student is a learner, and when his/her status changes from a student to a teacher (presenter) (he/she) becomes a better learner. During the semester, each student was required to make three presentations: proposal and timeline presentation (by the third week of the class), progress presentation (middle of the semester), and final presentation (oral and poster, exam week) (Leigel and Thomson, 1989). PowerPoint slides were required for making the presentation. All three presentations were time-limited (i.e., first presentation was limited to 10 minutes, second to 15, and final to 20). About 10 minutes were usually allowed for questions and answers. Students were also encouraged to ask questions and provide suggestions and help during field or laboratory work. Students were allowed to make major changes to their objectives and methodology until the date of the progress presentation (around the middle of the semester). Students were also allowed to delay their proposed deadlines for any given task before that deadline expired by sending an email to the instructor with a request and justification for extension. When a student failed to inform the instructor before a deadline expired, points were lost (up to 50% of the assigned points for the task) for missing that deadline.

Students were graded on clarity, quality, the degree of accomplishment of stated goals and deadlines, and timeliness of the presentation. Points were given for student participation for asking questions at the end of a presentation and for assisting classmates in any way. However, assistance had to be documented by the student who benefited from it. If a student had significantly contributed to another student's project work, he or she was either included as a coauthor on the presentation/paper or the contribution was otherwise acknowledged. However, how to acknowledge a student's contribution during a presentation was entirely decided by the students involved. Similarly, a student could decide whether to include the instructor as a coauthor if applicable.

Some of the attributes used for the analysis of data for this study were number of deadlines missed, oral presentations and posters presented in national/international seminars/symposia, and manuscripts submitted to or published in a peer reviewed journal. The instructor, college, or the major advisor paid for all the students' expenses, including registration fees and travel expenses for attending a national conference. Data analysis in this paper was carried out in two ways, first by semester and then by degree (Masters versus PhD). A double tailed simple t-test at 95% confidence level was performed to identify the significant interactions among years and by degree (Table 2). The data did show numerical differences among some of the attributes; however, no significant interactions were noted, likely due to the low sample size.

Results and Discussion

The number of students missing only one, two, or three deadlines per semester is presented in Table 3. About 42% of the students (out of 26 students) missed one deadline, 31% missed two, and 23% missed three. Deadlines were missed at various points in the semester, not necessarily chronologically. Also, missing a deadline actually meant that, due to certain circumstances; the deadline was moved back, although not more than one and a half weeks for most students. There were only two students during the entire duration of this study that moved deadlines back as much as a month. In one student's case it was because the drilling company was not able to drill the test pit on time. The other student reported logistic issues such as permission to access the site as the main reason for delay. Only that particular deadline was moved without moving any others, so there were no chain reactions from moving one deadline back. If the work was completed and submitted before the deadline, it was not considered missing a deadline, although no extra credit was provided for early submission.

The semester-wise number of posters presented, talks given, and manuscripts planned, submitted, and eventually published are given in Table 4. The posters and presentations were regularly made at two national/international conferences: the Annual Water Research Symposium organized by the New Mexico Water Resources Research Institute each August at Socorro, New Mexico, and the joint annual meeting of the American Society of Agronomy, Crop Science Society of America, and Soil Science Society of America each October or November. Presentations were also made at other regional meetings. The number of presentations as posters was smallest for spring 2006, but that was adequately compensated by high numbers of oral presentations. The number of oral presentations consistently exceeded the number of poster presentations, except in 2010. In general for all four years, 42% of students presented their work as a poster and 81% presented as an oral presentation. The sum of these two is greater than 100% because there were some students who presented their research as a poster in one conference and as an oral presentation at the other, although there were some who did not present at all in a national conference. Some students also added new materials or additional work done after the end of the semester to their posters and/or oral presentations.

Each year, some of the students planned to continue to update their report and complete a manuscript. About 45% of the students planned to write a manuscript for possible publication, but only 27% of the students actually submitted it for publication. Again, more information or data were included in the final version of some of the published manuscripts. Comparing the publication percentage reported in this study with the publication percentage from other similar

Table 2. Total Number of Students, Number of Students Pursuing a Master's or PhD Degree, and Number of Students Who Set Deadlines.

Semester	Total Students	Masters Degree	PhD Degree	Students Setting Deadlines
Spring 2006	5	1	4	5
Spring 2008	10	6	4	10
Spring 2009	6	4	2	6
Spring 2010	5	1	4	5
Total	26	12	14	26

Study period 2006, 2008-2010 at New Mexico State University, Las Cruces, NM

Table 3. Number of Students Who Missed One, Two, or Three Deadlines.

Semester	One	Two	Three
Spring 2006	3	2	0
Spring 2008	3	2	4
Spring 2009	1	3	1
Spring 2010	4	1	0
Total	11	8	5

Study period 2006, 2008-2010 at New Mexico State University, Las Cruces, NM, USA

Table 4. Number of Posters, Oral Presentations Made in Conferences, Manuscripts Planned for Possible Submission, and Manuscripts actually Submitted or Published per Semester.

Semester	Poster	Oral Presentation	Manuscript Planned	Manuscript Submitted/Published
Spring 2006	1	6	3	3
Spring 2008	5	9	4	1
Spring 2009	3	5	2	1
Spring 2010	4	1	2	2
Total	13	21	11	7

classes will be useful to ascertain the success of this class. Comparisons can also be made across various departments (e.g., soil, genetics, engineering, language and arts, etc.) offering classes with similar objectives. However, to the best of our knowledge, no data are available for such comparisons.

During the four years, there were a total of 12 students pursuing a master's degree and 14 pursuing a PhD degree. The master's degree students were at different stages of completion, whereas most PhD students were in the second semester of their studies. More than 95% of students had previously attended the soil physics class taught by the same instructor.

The number of deadlines missed, oral presentations or poster presentations made, and papers planned, submitted, or published are presented in the Figure 1 (by student degree). In general, student numbers were similar for both degrees. About one out of four master's degree students missed one deadline, whereas three out of five PhD students missed a deadline. The number of students missing two deadlines was similar, with about 33% and 29% of master's and PhD students missing two deadlines, respectively. However, a much higher number of master's degree students (33% versus 14%) missed three deadlines compared to PhD students.

Oral presentations made at a conference were similar for both degrees. However, more posters were presented by PhD students (86% of posters) than master's degree students (75% of posters). More PhD students planned to write a research publication (50% for PhD versus 33% for master's), and five out of seven published papers were written by PhD students. Some possible explanations could be that the PhD students were self-motivated or were expected (by their major professor/doctoral committee) to publish at least one paper prior to the dissertation defense.

The comparison of by degree data did not show any statistically significant differences. Although a higher number of PhD students missed one deadline, they still produced a greater number of posters, oral presentations, and publications compared to the master's degree students. Except for spring 2008, the class size was usually five or six enrolled students and usually one audit student (audit students were not included in the data for this study). A class size of six is considered ideal because as the number of students increases, more time is required for making presentations and for one-on-one time with the instructor, and there are more scheduling conflicts. The class also had to cover various topics and concepts related to advanced soil physics, such as representative elementary volume (or mass) (Lal and Shukla, 2004); number of samples (Nielsen and Wendroth, 2003); and models such as GS+ (Gamma Design Software, Plainwell, MI), rootzone water quality model (Ahuja et al., 2000), and hydrus-1D and hydrus-2D (Šimůnek et al., 2008). Therefore,

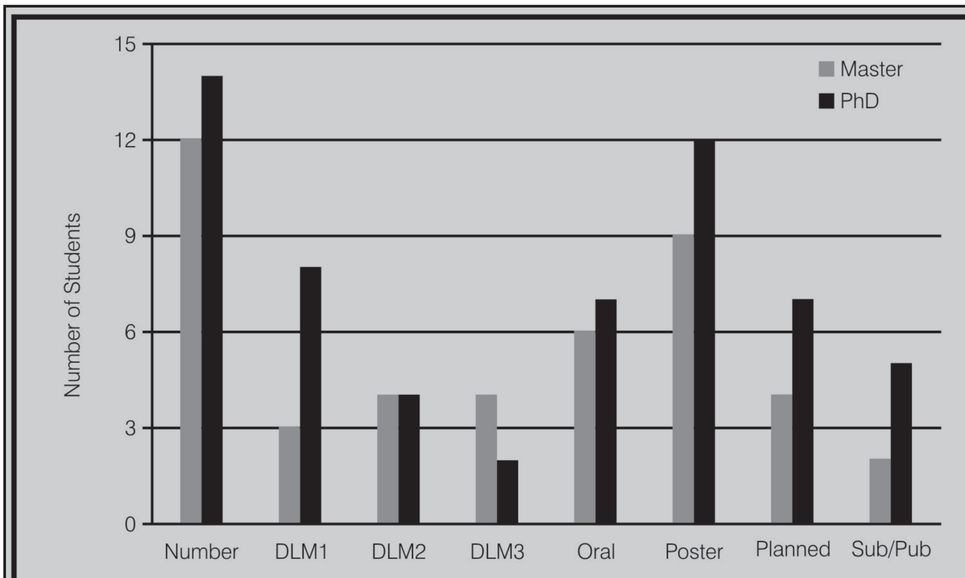

Figure 1. The number of students enrolled in the class at New Mexico State University over four years (2006, 2008, 2009 and 2010), deadlines missed, and presentations/publications by degree sought. "DLM" indicates deadlines missed, "Oral" indicates oral presentations made, "Poster" indicates poster presentations made, "Planned" indicates paper planned, "Sub" indicates paper submitted, and "Pub" indicates paper published.

a class size of five or six students was found to be optimal. During 2008, when 10 students enrolled in the class, there were four students who missed three deadlines.

The instructor distributed research papers related to the topics covered in the class. Students were also required to get electronic or hard copies, using the Internet or the library, of at least 10 additional research papers directly related to their work. Locating scholarly resources using search engines likely improved students' understanding of their information need (Rowland and Nicholas, 2008). Students were asked to write a summary as part of the review and literature section of their papers. Reading published literature trained students on how to write a research paper. The students were asked to revise their proposal and look at their timelines or deadlines carefully before finally submitting them. They were also asked to keep adding other sections, such as methods and materials, results, and discussion, to the initial proposal. Revisiting the proposal multiple times forced students to reevaluate their thought processes, and this, in our opinion, improved their cognitive and schema skills.

Students had the responsibility to meet their own set deadlines and this created a feeling of ownership and added responsibility compared to traditional teaching methods in which instructor sets the deadline. Students are not usually accustomed to set their own deadlines and take full responsibility for the timely delivery of their work in traditional teaching methods. As a result, the instructor consistently reminds students of the deadlines by which they must submit a homework assignment or take a test. Since each student has a different date of completion and submission of his/her own set task, this was a new concept for most of them that is clearly evident from the maximum number of students missing one deadline. Among the students who missed at least one deadline, the most frequently missed deadline was the first. However, as the semester progressed, most students missed deadlines due to a genuine problem. Some of the reasons students reported for delays were a failed experiment, delays in obtaining permission to conduct an experiment, inclement weather, sickness, midterm or other exams, and scheduling conflict between the student, instructor, and student's major advisor. Poor planning on the part of students was one of the factors for scheduling conflicts. One of the major disadvantages of missing a deadline was cramming the remaining tasks into a tighter schedule.

Team spirit was clearly evident in the class. Most students did not hesitate to ask questions and/or clarification from their classmates. The questions were always serious, and at no point did the instructor feel an unhealthy competition among students. Some students also acknowledged the help of fellow students to accomplish a given task. Each year, there was at least one student who was not totally in favor of giving oral presentations. However, only one student in those four years (2006, 2008-2010) missed his or her final presentation on the scheduled date.

The grades in the class ranged from A+ to incomplete. Most students liked the format of the class in general and the presentations in particular. The instructor received favorable student evaluations, and a majority of the students ranked the class as better than other classes they had attended. This type of class generally works well when the class size is low. Sometimes a low class size (of six or seven) may not be considered optimal according to traditional college/university guidelines. The student numbers in these classes could be increased provided students have already taken a similar (not so rigorous) class, which could be a project-oriented general education class. Overall, these classes demonstrated that students can be motivated to develop research and publication skills while taking ownership and responsibility of their work.

Summary

The purpose of the advanced soil physics class was to help students develop research and publication skills and improve their cognitive, communication, and planning skills while simultaneously making them take ownership of and responsibility for their work. The average class size was about six, which was also the optimal size for the class. Overall, 50 to 90% of students presented their work as posters or oral presentations in national or international conferences. About 45% of students planned to write a publication; however, 26% actually submitted and were published. Developing a proposal into a manuscript during the semester helped students enhance their cognitive skills. Since the students set their own deadlines, there was a feeling of ownership and responsibility to meet those deadlines. Posting all course materials on the Blackboard learning system ensured transparency, made students aware of each other's projects, seemed to develop a healthy competition among students, and was beneficial for most students. The results of this work show that a higher graduate-level class could be made more research- and publication-oriented.

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Evaluating Capstone Courses: Employing the Five R's Model to Analyze an Agricultural Communications Magazine Class

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Abstract

The purpose of this study was to assess students' perceptions regarding the value of an agricultural communications magazine capstone course at the University of Arkansas in an effort to describe the characteristics leading to the course's success and to pilot a clear method of evaluating capstone courses. The course evaluators used the Model for the Integration of Experiential Learning into Capstone Courses (MIELCC) as a framework for the evaluation. Students reported receiving a valuable experience on all accounts. Based on the examination of students' perceptions through the lens of the model (MIELCC), the course fulfilled students' needs for experiential learning and prepared students for their careers. Students reported having improved their levels of confidence in their communications skills and having improved important skills to prepare them for the workforce. For new and developing agricultural communications programs, the findings of this evaluation help solidify the need for a similar capstone course in the curriculum and provide a model that can guide capstone curriculum development and evaluation. The results also lead to the recommendation of modifications to the MIELCC to emphasize the importance of internal communications in the capstone experience and to introduce the concept of noise—situations when the system is hindered—in the capstone environment. This addition adds an element of realism to the model and helps account for difficulties encountered throughout capstone courses. Future studies should employ the MIELCC to examine successful magazine capstone courses in agricultural communications programs across the country in order to create guidelines for developing and improving such courses.

Introduction

As communicating with the public about issues related to agriculture, food, and the environment becomes more and more important, so does academe's ability to provide society-ready graduates who possess advanced communications skills (Andelt et al., 1997; Graham, 2001; Klein, 1990). For decades, building students' communication skills has been a priority in colleges of agriculture across the United States. Degree programs in agricultural communications exist in dozens of colleges across the country, most with a focus of providing the agriculture industry with graduates who are skilled in communications and who also have a strong knowledge and passion for issues and topics related to agriculture, food, and the environment.

Demand for work-ready graduates with strong communication skills continues to increase. According to the United States Department of Agriculture-National Institute of Food and Agriculture (2010), prospective demand for several communications-related occupations will continue to rise for the next five years. Demand for public relations specialists will increase by 24%, technical writers by 18.2%, market research analysts by 28.1%, and sales managers by 14.9%. There are more than 6,200 annual job openings available in education, communication, and government operations related to agriculture. According to the NIFA research, potential employers "have expressed a preference for graduates from colleges of agriculture and life sciences, forestry and natural resources, and veterinary medicine who tend to have relatively stronger interests and more extensive work experiences for careers in food, renewable

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energy, and the environment that those from allied fields of study" (USDA-NIFA, 2010, p. 2).

Experts in agricultural education and communications identified "build[ing] competitive societal knowledge and intellectual capabilities" as an area of focus in the academic discipline of agricultural communications (Osborne, 2007, p. 6). Undergraduate and graduate degrees in agricultural communications are awarded by dozens of Land Grant universities and other institutions with agricultural academic programs across the country. Such programs typically include experiential learning opportunities because experiential learning has for decades been the cornerstone of the Land Grant institution and agricultural education (Kerr et al., 1931; Parr and Trexler, 2011). Agriculture graduates generally have more extensive work experiences than students from other fields of study (Klein, 1990; USDA-NIFA, 2010). This fact is likely due to the pragmatic approach taken by agricultural educators at all levels.

Capstone courses are essential for fulfilling students' experiential learning needs in an agricultural communications program (Edgar et al., 2011; Sitton, 2001). By definition, a successful capstone course provides a simulated or real-life experience facilitated to students allowing them to synthesize knowledge that was previously learned, to a higher level of understanding (Crunkilton et al., 1997). Durel (1993) noted that a capstone class is a crowning experience coming at the end of a sequence of courses with the specific objective of integrating a body of fragmented knowledge into a unified whole. As a rite of passage, this course provides an experience that allows students to build life skills. Sitton (2001) noted that these courses give students the opportunity to hone in on previously gained knowledge and skills and move to a higher schema. Additionally, Andreasen (2004) stated that such courses "provide an opportunity to incorporate previously learned, often disjointed information into an interconnected contextual frame of reference from which to transition into a career or further study" (p. 52) and allow students the opportunity to "demonstrate mastery of the area's complexity" (Troyer, 1993, p. 246).

Context: The University of Arkansas Magazine Capstone Course

Faculty at the University of Arkansas, in an effort to continue building their relatively new agricultural communications undergraduate and graduate curricula, developed and offered a magazine capstone course for the first time in the spring semester of 2010. Modeling existing courses in well-established agricultural communications programs across the country, the faculty offered students in the course an opportunity to serve on the staff of a new agricultural magazine called AR Culture. This first capstone class included 11 agricultural communications students. Three graduate students served as publication managers, supervising the undergraduate students' editorial assignments, layout and design assignments, writing one feature story, and advertising sales responsibilities. Eight undergraduate students were responsible for writing two feature stories highlighting and promoting people and programs associated with the Dale Bumpers College of Agricultural, Food and Life Sciences. All students were responsible for their own photography and feature story layouts and for selling advertising and creating advertisement copy and layouts. Two thousand copies of the 52-page publication were printed professionally and used by college and university faculty and staff for recruiting, development, and public relations purposes.

At the conclusion of the course, the instructors conceived and conducted a unique evaluation of the course, which was based on pedagogical theory related to experiential learning through capstone courses. The study, originally intended to be a simple course evaluation, evolved into a project with a larger purpose: to develop a method of evaluating capstone courses that could be widely used in agricultural communications academic programs across the country.

Theoretical Framework

The underlying theories for this study included a long-standing precept about pragmatic teaching and one relatively new theory explaining how to successfully integrate experiential learning into capstone courses. Dewey's (1938) concept of experiential learning is universally known in agricultural education. Andreason's (2004) Five R's model has been cited frequently in literature related specifically to capstone courses (see Clark et al., 2010 and VanDerZanden, 2005).

Traditionally, agricultural education at both the secondary and higher education levels has continued its mode of experiential learning initially propagated by the father of American education, John Dewey (Boone, 2011). "Simply stated, experiential learning is learning through experience" (Andreasen, 2004, p. 53). Dewey (1938) observed that "there is an intimate and necessary relation between the processes of actual experience and education" (p. 7). In addition to his promotion of hands-on learning, Dewey also espoused the concept of collateral learning – the incidental learning that occurs in conjunction with experiential learning activities. "Perhaps the greatest of all pedagogical fallacies is the notion that a person learns only the particular thing he[/she] is studying at the time" (p. 29). According to Dewey, collateral learning may be the most important aspect of experiential learning activities.

Experiential learning has been used in secondary and postsecondary classrooms for decades (Roberts, 2006). Kolb (1984) expanded experiential learning through the development of a four-stage cyclical model intended to further explain the hands-on learning process. Besides Dewey, Kolb's model was guided by Lewin (1951) and Piaget (1952). Kolb's (1984) experiential learning cyclic model involves four principal stages: concrete experiences (CE), reflective observation (RO), abstract conceptualization (AC), and active experimentation (AE).

Andreasen (2004) proposed that successful capstone courses should incorporate the Five R's – receive, relate, reflect, refine, and reconstruct. The Five R's "are designed to spiral and funnel the required capstone components into a synthesis and lead to an integration of the subject matter content" (Andreasen, 2004, p. 56). The parallels between Andreason's Five R's and Kolb's Learning Cycle (1984) model and its four principal stages are obvious, demonstrating how the Five R's capstone model, also called the Model for the Integration of Experiential Learning into Capstone Courses (MIELCC), is supported by long-standing academic theory about the nature of experiential learning.

Following the MIELCC, from an educational evaluation perspective, in order for a capstone course to be considered successful, each of the five components must be achieved. Students enrolled in the capstone course must receive an activity or experience which either is contrived by the instructor or spontaneously occurs. Learners must be able to relate previously fragmented knowledge to the received activity or experience. Students will then be able to reflect upon what has been received and related in the experience for further understanding. Andreasen (2004) noted, "without structured and active reflection, the lessons available to the learner will not become as apparent and meaningful as otherwise possible" (p. 56). Learners should then be able to refine the knowledge received and move towards a higher expertise. Lastly, a new knowledge base or schema should be reconstructed by the learner. "Once synthesis and integration have resulted, the spiral of the five R's can be recycled or reused and additional knowledge processed, feedback provided, and evaluations made that will improve knowledge acquisition, retention, and learning" (Andreasen, 2004, p.56) (Figure 1).

Purpose of Study

The purpose of this study was to assess students' perceptions regarding the value of an agricultural communications magazine capstone course in an effort to describe the characteristics leading to the course's success and to pilot a clear method of evaluating capstone courses. To accomplish this purpose, the research was guided by the following questions:

1) Did the magazine capstone course meet student's needs for experiential learning?

2) According to student feedback, did the magazine capstone course contain the characteristics of a quality capstone experience as described by Andreason's MIELCC (Five R's) model?

This study was used to pilot an evaluation instrument in preparation for a larger study of similar courses across the nation.

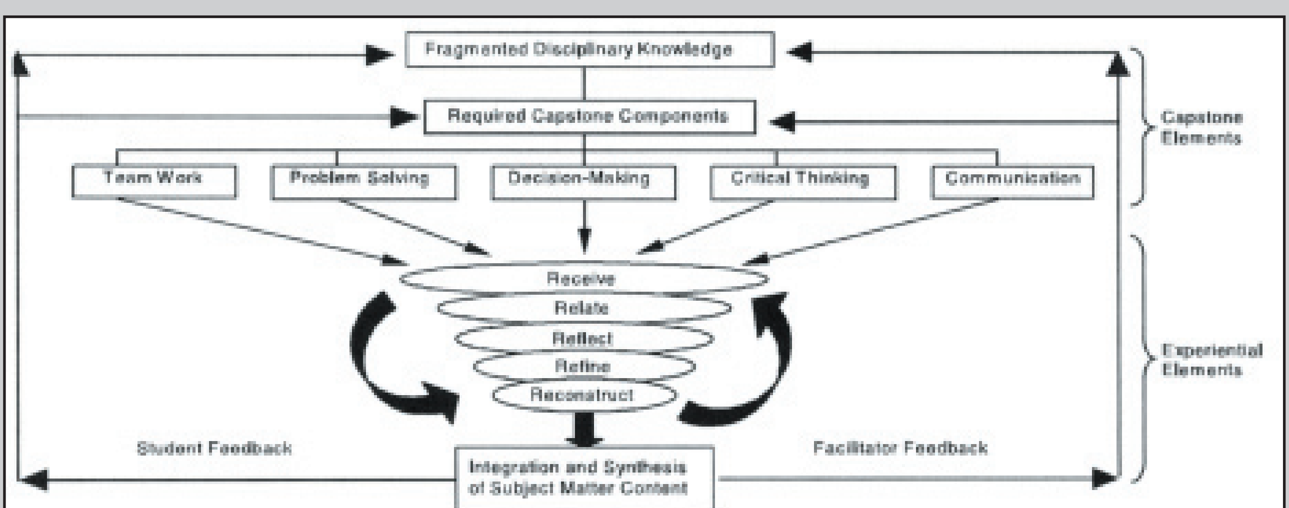

Figure 1. Andreasen (2004) Model for the integration of experiental learning into capstone courses (MIELCC).

Methods

This summative evaluation, conducted after the conclusion of the capstone course, was descriptive and followed the qualitative paradigm of investigation. Naturalistic inquiry—a research approach that allows investigators to study subjects and situations from a non-quantitative, inductive perspective—guided this study of 11 human subjects who were selected purposively because they were students in the course. The 11 subjects were undergraduate and graduate students enrolled in the spring 2010 Agricultural Publications course at the University of Arkansas. Three of the subjects were graduate students who served as magazine staff managers. Eight undergraduates were enrolled in the course and served as writers, editors, photographers, designers, and advertising sales representatives. The subjects, selected by virtue of their participation in the course represented a "typical" selection of subjects as defined by Merriam (1998) and Patton (1990). That is, they reflected the average instance of agricultural communications students participating in a magazine capstone course. Participants completed a 16-week capstone course focused on developing the University's first student-produced agricultural magazine.

An instrument was created to guide the assessment of the students experience in the capstone course following Dillman's (2007) Total Tailored Design method. Instrumentation questions were modeled after Andreasen's (2004) Five R's (receive, relate, reflect, refine and reconstruct), which represent the characteristics necessary for successful capstone courses. Faculty members who taught the course developed survey questions with the goal of determining the extent to which the course adhered to the five R's model, as perceived by the students. Therefore, content validity of the instrument was established, as the survey questions corresponded directly to the five R's of quality capstone courses. Furthermore, the survey was reviewed by a team of agricultural communications faculty at the University of Arkansas to establish face validity.

The instrument was administered to students after the completion of the course, and it consisted of six open-ended, in-depth questions prompting the students to reflect on the capstone course. Reflection is the process by which an experience is being considered, during the experience or after the experience. It is also the creation of meaning and conceptualization from experience. Reflection allows the ability to analyze and create perceptions about experiences differently than one might have done without reflection (Brockbank and McGill, 1998). Zhao (2003) defined reflective practice as "an ability to reflect on experiences, to employ conceptual frameworks, and to relate these to similar and dissimilar contexts to inform and improve future practice" (p. 2). The open-ended questions allowed for "more freedom of response because certain feelings or information may be revealed that would not be forthcoming with selected response items" (Wiersma, 1995, p. 181).

The instrument was administered electronically through Survey Monkey, a web-based survey tool. A preliminary email message was sent to the students informing them of the purpose of and need for the study. Four rounds of email reminders were sent to the students in an effort to increase response rates (Dillman, 2007). The survey structure protected student confidentiality to enhance the reliability of the responses. There was a 63.6% response rate to the survey.

The qualitative analysis was thematic in nature, employing open and axial coding techniques (Strauss and Corbin, 1998) as well as the constant comparative method (Lincoln and Guba, 1985) in an effort to develop a clear description of student perceptions regarding the capstone course. The textual analysis consisted of "breaking down, examining, comparing, conceptualizing, and categorizing data" (Strauss and Corbin, 1990, p. 61). Using the constant comparative method the researchers took one piece of data (i.e. one student statement) and compared it to other pieces of data. During this process, the researchers began to look at what made each piece of data different and/or similar to other pieces of data. This method of analysis is inductive because the researcher begins to examine data critically and draw new meaning from the data. The analysis of the respondent's content was a systematic technique that employed the compression of many words of text into fewer content categories based on explicit rules of coding (Berelson, 1952; Krippendorf, 1980; Weber, 1990).

The validity of the results was enhanced in several ways, all of which are in line with Merriam's (1998) strategies for ensuring internal validity. First, triangulation occurred, as multiple investigators examined the data and confirmed the results. Also, peer examination strengthened the results, as the data were reviewed by a group of faculty and graduate students involved in the evaluation. Thirdly, researcher biases were clarified; the fact that the primary investigators were also the course instructors is noted and must be taken into consideration by consumers of this research.

Results

Several important themes were evident among the students' responses. The first emergent theme was the perception that the pressures of editorial critiques and deadlines were realistic in the class. All survey participants also reported improved practical skills as a result of their experiential exercises. In particular, they reported feeling more confident in their abilities with layout and design software as well as with the interpersonal skills required to be successful in a publication project. Another theme—possibly the most important in terms of showing evidence of a successful capstone course—was that students reported employing these skills in subsequent internships and jobs in which they were employed during the summer following the course. Students' responses to the open-ended survey validated the worth of this course and typified each of the Five R's in Andreasen's (2004) model – receive, relate, reflect, refine, and reconstruct.

Receive

Students reported receiving an unparalleled, realistic experience. For this course, the students served on a publication staff. Their responsibilities were the same as those of a professional publications staff. The responses led to the conclusion that students in the course successfully received a real-life experience achieving the first (receive) of Andreasen's (2004) Five R's.

I feel that this course was one of the most realistic and useful learning experiences I have had in my collegiate and graduate school experience. I was able to learn to work on real deadlines, work with clients, sponsors, other staff members and more. I believe this was a very true example of what it would be like to execute a project or publication like this in the real industry world.

Another student reported…

After interning with several places and now working [in] the field, I can say the experience in the class is very similar to what will happen in the real world!

Also, a student recognized the realistic experience the course provided:

The deadlines we worked on could easily be compared to the professional real world. Our work was heavily critiqued just like our bosses will do one day.

Relate

The undergraduate students were each responsible for all aspects of two feature stories (graduate students were responsible for one story) – writing, editing, photography, and layout and design. Graduate students also assisted with managing the production staff (undergraduates) allowing them to use and build leadership and managerial skills. Each of these skills had been previously received at the university in other agricultural communications courses (i.e. agricultural communications and lab, agricultural reporting and feature writing, graphic design, etc.). Students' responses demonstrated the occurrence of relating previously fragmented knowledge to this specific culminating project – the second of Andreasen's five R's:

I did use every skill I had ever learned, and then some. I think the positive is it reminded me of the skills I had right before finishing at the University.

Another student commented…

This course most certainly allowed me to combine many of my best skills and allowed me to work on some skills that are not as strong. Such skills include[d] writing, communication both interpersonal and small group, sales, deadlines, photography, layout, sending documents to a professional printer, packaging documents, developing a theme, mission, style, layout, managing team members, editing, and more.

Most importantly, the course also allowed students to integrate several previously learned skills into one project.

I have never combined feature writing and layout and design. I really liked this aspect because it helped me write the story better [by] envisioning how it was going to layout on the page. Also, by thinking about what photos I would use helped me develop a more clear angle for my story.

Reflect

To allow student reflection (the third of Andreasen's five R's) instructors provided opportunities to review key concepts and provided time to answer questions and conduct open discussions. Each student reported being able to reflect back on the process of creating an agricultural magazine as they neared completion of the course:

Once the magazine was in-hand and I could think back on the whole process, it finally hit me what a task it is to put a magazine together!

Another student reported…

Toward the end of the semester reality set in that this will be in a magazine for everyone to see. I understood the magazine process more after being able to see the pages put together and designed to look more like a print magazine. I believe that the trip to the print shop really gave me a good idea of how everything is printed and exactly why we are completing the necessary details when designing our pages.

Refine

After completion of this publication, students appeared to sense that they had successfully created a real-life experience to draw upon in their future careers. This publication also served as a premier piece in the students' portfolios. All of the students in the course reported having some previous ideas about the production of a magazine; however, students felt that this course refined their previous knowledge and skills and moved their learning toward higher levels of expertise, achieving the fourth of Andreason's (2004) Five R's. Student responses show that they were able to refine their previously learned skills and apply multiple skills more effectively. One student responded…

I greatly developed my understanding of Photoshop, InDesign, Illustrator, basic feature writing and photography. Before this class, I had very limited skills in each of those areas. Now, I feel I have a solid grasp on those programs and skills.

Another student noted…

I think I definitely developed and improved many professional skills, especially on the behind the scenes business end. Working with other staff members, sponsors and the professional printing company to get the magazine completed allowed me to see and practice working with the professional business end of the magazine, not just design. I also learned to better manage files, time, design skills and [how to complete] a large project with many contributors.

Reconstruct

The students' ability to reconstruct their perceptions of the magazine production process and to gain awareness not only of what they learned but also of how they learned it fits well in Andreasen's (2004) five R's model of successful capstone courses. This course allowed students to fill a void in their knowledge base regarding several technical skills and allowed them to be better prepared for the workforce. One student's comment typified the responses in regard to the ability to apply the skills they developed through the capstone experience:

I worked at the (national equine breed association headquarters) this summer, and they produce three magazines. Having had this magazine experience under my belt allowed me to speak [in a] more educated [manner] and be more credible.

Another student reported that this course helped redefine his/her perceptions of the magazine production process and develop a new knowledge base:

I have a new appreciation for those who work for a magazine every day. It is a stressful job with several pressing deadlines. When I entered the course, I thought it would be a class with some work outside of class and the majority of the assignments could be completed during class. I am confident saying that I was wrong by assuming such things. I now understand that it takes a team effort to make a magazine that is professional and successful.

Discussion and Conclusions

The agricultural communications magazine capstone course administered at the University of Arkansas was a valuable experience for students, according to their responses. Based on the examination of responding students' perceptions within the framework of Andreasen's (2004) model, the course fulfilled students' needs for experiential learning and prepared them for their careers. A key theme among students was that the course was valuable because it afforded them the opportunity to hone their skills and advance their previously learned knowledge through a real-life experience. This conclusion is in line with previous literature on agricultural communications capstone courses (Edgar et al., 2011; Sitton, 2001). Also, students' responses indicated the presence of each of Andreasen's Five R's (receive, relate, reflect, refine, and reconstruct). From a qualitative perspective, it could be inferred that these two observations— that students' perceived needs were met and that the course espoused Andreason's five characteristics of a quality experiential learning capstone experience according to student responses—are linked.

Implications and Recommendations

For teaching practitioners in new and developing agricultural communications programs, the results of this study clarify that students who participate in capstone courses with integrated experiential learning opportunities perceive them to be an important component of an agricultural communications program, adding to the literature that already supported this notion (Crunkilton et al., 1997; Durel, 1993; Edgar et al., 2011; Sitton, 2001). For such developing programs, this study and its theoretical framework provide a model that could guide capstone curriculum development and evaluation. Students in agricultural communications programs need courses such as these not only because the courses fulfill their experiential learning needs but also because the courses help transform students into society-ready graduates (Andelt et al., 1997; Graham, 2001; Klein, 1990; Osborne, 2007).

For educational researchers, the results of this study add to the literature supporting the need for capstone experiences in agricultural communications curriculum and highlight the need to continue to develop and evaluate such courses nationwide. Based on the findings among this small group of students, it appears that a more comprehensive study is needed to evaluate similar magazine capstone courses in agricultural communications programs across the nation to help identify key characteristics that could lead to improvements in content and instructional methods associated with magazine production based capstone courses across the U.S. This broader study could significantly impact how capstone courses in agricultural communications are developed, delivered, and evaluated in the future. Plans for such a project are underway, guided by the results of this study, which served as a pilot project. Additionally, future research should focus on determining the professional skills needed in feature writing, photography, layout and design, and sales to help better prepare new professionals for the workforce. The researchers believe that a Delphi study with identified experts in photography, print media, and sales should be conducted to determine which skills most urgently need to be incorporated into agricultural communication courses, especially capstone courses in magazine production.

The results of this study have implications for pedagogical theorists as well. Dewey's (1938) philosophical observation that "there is an intimate and necessary relation between the processes of actual experience and education" (p. 7) remains accurate today, especially for agricultural communications programs focused on providing students with marketable skills. Andreasen's (2004) MIELCC (Figure 1), which contains the Five R's, aptly encompasses all of the experiential education components needed in order to provide a valid capstone experience for the students. However, the authors believe that the MIELCC model could be further refined for future expanded use among practitioners, theorists, and researchers. One finding in particular led the researchers to consider the possibility of adding the concept of professional criticism and feedback, which appears to have made the capstone course at the University of Arkansas more realistic. One student's comment (which supported the receive portion of the model) helped explain why criticism should be an integral part of the capstone course model:

The deadlines we worked on could easily be compared to the professional real world. Our work was heavily critiqued just like our bosses will do one day.

This sentiment led the researchers to recommend incorporating periodic feedback and critique by industry professionals and instructors into Andreasen's (2004) MIELCC model. Opportunities for feedback will vary among situations, but any feedback should enhance the students' ability to further integrate and synthesize subject matter content. Therefore, the new element of feedback and critique is indicated in the path between integration and synthesis of subject matter content and fragmented disciplinary knowledge, the characteristic is represented outside the inner-workings of the model, indicating that feedback may occur at any point in the process.

Further, the researchers believe that communication should be central in the model and noted before teamwork. Without effective communication (particularly internal communication among group members) an atmosphere of teamwork cannot exist. Teamwork is central to an environment where decision making, problem solving, and critical thinking can occur, develop, and strengthen.

Finally, the researchers were interested in accounting for the fact that part of the realism that exists in capstone courses is that the project itself does not exist in a vacuum, but instead is confounded by environmental noise. Much like the noise that exists in models of human communication, noise can be ubiquitous in the environment of a capstone course. It represents the situations when the system is hindered as a result of dilemmas such as differences of opinion, misunderstood concepts, students' and instructors' priority conflicts, unmet deadlines, distractions, and

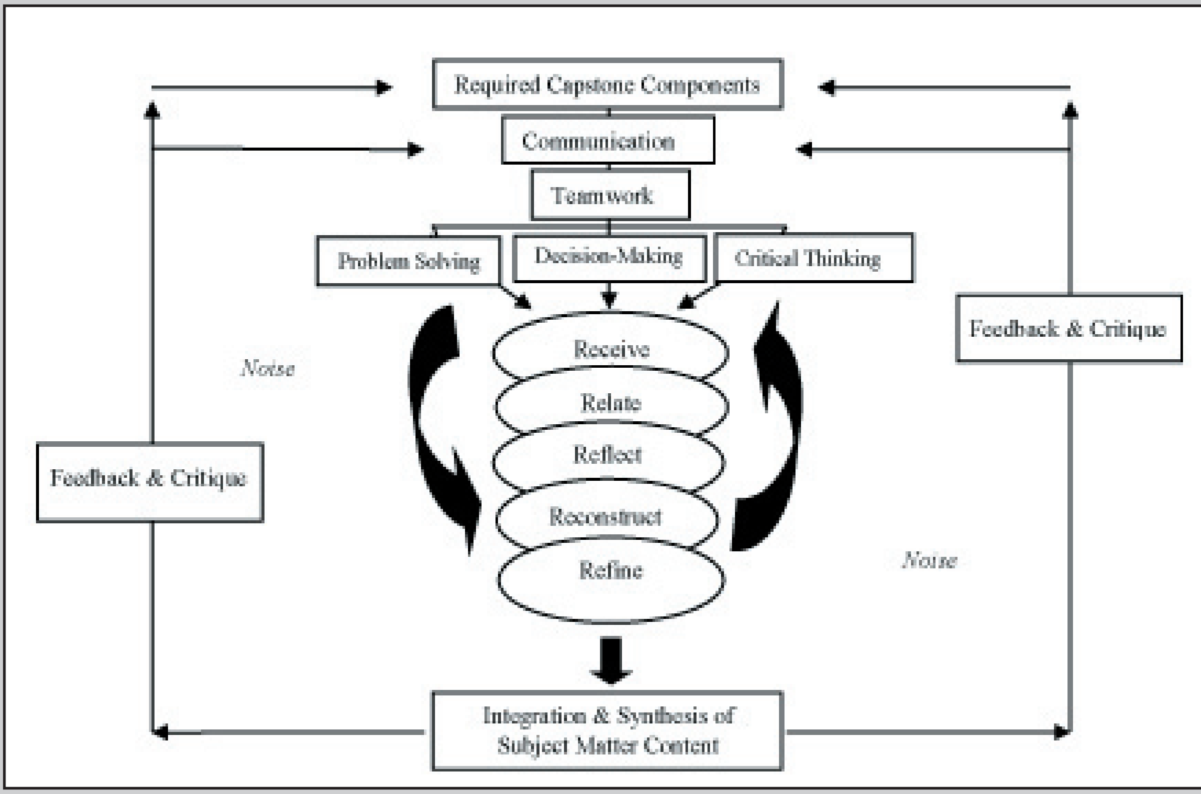

Figure 2. Modified model for the intergration of experiental learning into capstone courses (MMIELCC).

decisions that must be made between quality and timeliness in a project.

Future research will focus on employing the modified model to determine if the suggested modifications are relevant and important to its usefulness in creating and evaluating capstone courses (Figure 2). Academic growth and improvement in agriculture-related disciplines will depend on the continued development and evolution of useful pedagogical models such as the MIELCC.

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A Comparison of Web-Based and Traditional Instruction for Teaching Turfgrass Identification[1]

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Abstract

Web-based instruction is growing at a rapid rate, but the ability to effectively teach lab skills in a web-based format may be a barrier to the development of distance education courses in turfgrass management. We conducted a study to compare the effectiveness of web-based versus traditional instruction for teaching turfgrass identification (ID). An introductory horticultural science class with four lab sections and a total enrollment of 88 students was the study setting. Quiz scores showed no difference in ability to identify live specimens of six turfgrass species between students receiving web-based versus traditional instruction. However, students receiving traditional instruction performed better on knowledge-based questions, in which they were asked to name which species corresponded to a written set of ID characteristics. Results suggested that web-based students' performance on knowledge-based questions may be improved by finding ways to increase their interaction with the content. Student performance on live-specimen ID or knowledge-based questions was not correlated with time spent studying, or students' perceived importance of turfgrass identification, but it was correlated with confidence level. Our results show that web-based formats can be as effective as traditional methods in teaching students to ID live turfgrass samples.

Introduction

Distance education, and particularly web-based instruction, is growing at a rapid rate at colleges and universities worldwide. At Kansas State University, the number of credit hours offered via distance education increased more than 70% from 2002 to 2010, and the number of students enrolled in such courses increased more than 80% (Minshall, B., personal communication). The vast majority of these new courses are offered in a completely web-based format. As web-based instruction spreads into the sciences, course developers must grapple with the question of whether material traditionally taught in a "hands-on" laboratory environment can be effectively taught in a web-based format. In horticulture, turfgrass identification (ID) is an example of such a skill. Turfgrass ID is challenging because many of the structures used in the identification process are too small to be easily discerned with the naked eye (Christians, 2007). This skill has traditionally been taught in a face-to-face format in which students use hand lenses to view live plants, with an instructor present to provide guidance. As distance offerings of horticulture courses become more widespread, the effectiveness of teaching skills such as turfgrass ID in an online environment must be investigated.

Web-based instruction has some distinct advantages, for example, it allows students 24 hour access to course materials. Such access may increase the amount of time students spend studying the subject. Jeannette and Meyer (2002) found that online learners spent 20% more time studying than face-to-face students. Not surprisingly, that increased study time translates to better performance. In a study comparing student performance in online versus face-to-face sections of an introductory turfgrass management course, Bigelow (2009) found that time spent online was positively associated with course grade (R^2 = 0.76). Another advantage of web-based instruction is that online lectures allow the student flexibility to start, stop, and review lectures at any time. Miller and Honeyman (1994) demonstrated that students will take advantage of such opportunities: In an off-campus agricultural degree program, they found that 54% of students watched videos more than once.

While the online learning environment provides the student with great flexibility, student-student and

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student-teacher interaction is limited. Vavala et al. (2010) found that students in online courses lacked a sense of community. Other researchers have shown that students are more comfortable in a traditional classroom and desire more interaction with their peers and teacher (Schroeder-Moreno and Cooper, 2007). The interaction that occurs in the traditional classroom may help students persevere in learning difficult tasks such as turfgrass ID. However, despite the decreased interaction, online students' perception of learning and average course grade were not significantly different from students in traditional courses (Vavala et al., 2010).

Because turfgrass ID structures are difficult to see without magnification, web-based instruction facilitates the use of magnified images in a manner that unambiguously shows students the structures they need to learn. While reference books often contain images, they are frequently inadequate or incomplete (Kling et al., 1996), or are not organized in a way that optimizes learning for a particular class.

Computer-aided instruction has been shown to be an effective plant ID teaching tool (McCaslin and Na, 1994; Seiler et al., 2002), but when researchers have investigated the efficacy of a completely web-based approach results have been poor. Taraban et al. (2004) and Teolis et al. (2007) found that students receiving live instruction in woody and herbaceous plant ID had higher quiz scores (quizzes included both live samples and photographs) than students receiving web-based instruction. These studies used woody or herbaceous plants (our review of peer-reviewed literature revealed no research involving turfgrass ID) and web-based students did not have live plants to study. Clearly, the research shows that studying live plants leads to better performance. However, since computer-aided approaches help students learn plant ID better, it seems reasonable to combine the approaches; that is, web-based instruction would ideally be used in tandem with live samples for students to study. For distance students, that would entail providing them plants. If the course being taught via distance were woody or herbaceous plants, providing live samples would be extremely challenging because of the size and number of plants involved. But with turfgrass ID, typically only 15-20 species are taught, and distance students could be sent plugs through the mail, which they could transplant into small pots for studying. A challenge with turfgrass ID is that plants usually have much smaller ID structures which are more difficult to see than those on the typical woody or herbaceous ornamental. The objective of our research, then, was to compare the efficacy of web-based instruction with traditional instruction for teaching turfgrass ID, in a scenario where all students had access to live plants for studying.

Because the goal of teaching turfgrass ID is that students will be able to identify live plants, the criterion used to measure teaching method efficacy was live turfgrass plant ID. In addition, we investigated whether teaching method influenced students' ability to answer "knowledge" questions about turfgrass ID. Our hypothesis was that, given access to live turfgrass samples for study, students receiving web-based instruction would do as well as, or better than, students receiving traditional instruction on both live plant ID and knowledge questions. This hypothesis was based on the perceived advantages of the web-based format for enabling students to easily see and review the very small structures used in turfgrass ID, and the ID characteristics for each grass.

Materials and Methods

This study was conducted in the fall semester of 2010. The study was deemed exempt under federal regulation 45 CFR 46.101 (b) (1). Participants were undergraduate students enrolled in Principles of Horticultural Science at Kansas State University, Manhattan, KS. The course is an introduction to college-level plant science and has both lecture and laboratory components. Total enrollment in the course was 88, and the students were divided into four laboratory sections. Sixty-one percent of the students in the course were horticulture majors, 18% were other agriculture majors, and 20% were non-agricultural majors. By class, there were 52% freshman, 25% sophomores, 14% juniors, and 9% seniors. One of the laboratory sessions focused on turfgrass ID, and two instructional methods were used: traditional (face-to-face) or web-based. Two of the laboratory sections were randomly selected to receive traditional instruction and the other two sections received web-based instruction. The instructor for all sections was the same and was experienced in turfgrass ID, having taught turfgrass management for over 10 years. Students were taught to identify six cool-season turfgrass species: annual ryegrass [*Lolium multiflorum Lam.*], creeping bentgrass [*Agrostis stolonifera L.*], Kentucky bluegrass [*Poa pratensis L.*], perennial ryegrass [*Lolium perenne L.*], smooth bromegrass [*Bromus inermis Leyss.*], and tall fescue [*Festuca arundinacea Schreb.*]. These grasses were selected because correct ID required students to use a wide range of vegetative turfgrass ID characteristics, such as vernation, ligules, auricles, appearance of leaf veins, midribs, leaf tip shape, and texture (Christians, 2007). A PowerPoint presentation was developed to teach students the ID characteristics, and to show students how to view the characteristics on each grass. High quality, magnified images were used.

In the traditional sections, each pair of lab partners was provided live samples of each species in 13-cm dia. pots (reproductive structures were not present, as the goal in turfgrass management is to learn ID by vegetative structures only), a handout listing important ID terms with space to take notes on each grass, and 8x hand lenses. The instructor used the PowerPoint presentation, in combination with the live samples, to teach the ID characteristics. The students used the live samples to practice, and the instructor provided individual help when students had difficulty seeing any particular characteristic. The key vegetative characteristics for each species were summarized in the PowerPoint presentation and were reviewed by the instructor while students viewed and took notes on the live samples. After lab, the live samples were placed in a greenhouse to which the students had access from 7 am to 6 pm, 7 days a week. Additional samples of each species, growing in 0.15 m^2 flats, were also placed in the greenhouse for the students to study.

In the web-based sections, students were told to view, on their own, an online presentation to learn how to ID the grasses. The presentation consisted of a PowerPoint recording of the same presentation that was used in the traditional sections. Camtasia Studio software (TechSmith Corp., Okemos, MI) was used to record the presentation. The software enabled the instructor to add voice audio to the presentation, and to annotate the presentation with a highlighted pointer. Web-based students accessed the identification presentation, published as an MP4 file, from K-State Online (http://public.online.ksu.edu), which is a web-based learning management system used at Kansas State University. All students were familiar with the system because it had been used to post lectures, announcements, grades, etc. in the weeks prior to the turfgrass ID lab. The lab handout was also posted for the web-based students, so they could take notes. Students in the traditional sections did not have access to the recorded presentation. Web-based students had access to the same plants in the greenhouse as the traditional students did, so that they could study live plants on their own. This was intended to simulate a distance learning situation in which students were mailed live plants to study. All students were required to complete a preliminary open-notes quiz within 48 hours of their section meeting time. The purpose of the open-notes quiz was to motivate the web-based students to promptly study the recorded ID presentation. The open-notes quiz was worth 2% of the total course lab grade, and was administered through K-State Online.

During the next laboratory session (one week later), students were given a closed-book ID quiz worth 7.5% of the total course lab grade. For this quiz, students were required to ID live samples of the grasses. Each of the six grasses was included on the quiz two to three times for a total of 15 live samples. Students were told that the quiz contained multiple samples of some or all grasses, but they were not told how many samples of each grass were included. The quiz also included six knowledge-based questions in which students were given a vegetative description and asked to name the grass with that set of characteristics (e.g., “Which species has the following characteristics? rolled vernation; auricles are absent; tall membranous ligule; narrow leaf with no midrib; very prominent venation). Finally, students were asked to respond to four survey questions to assess their confidence, preparedness, and motivation level for learning turf ID (Table 1). In response to ID and knowledge questions students were required to write the common name only. Eleven students were excluded from the statistical analysis because they either did not come to class on the day turfgrass ID was taught (for the traditional group), or because they did not complete the preliminary open-notes quiz. Therefore, for the statistical analysis there were 37 students in the traditional group and 40 in the web-based group. ID quiz scores were subjected to analysis of covariance with the students’ overall course grade as the covariate. Performance on the live-specimen and knowledge-based questions between the traditional and web-based groups was analyzed with t-tests. For survey responses, means and standard errors were calculated. Pearson correlation coefficients were determined to identify correlations among survey responses and ID quiz scores. All analysis was conducted using SAS 9.2 (SAS Institute, Inc., Cary, NC, USA).

Results and Discussion

There was no difference in performance on live-specimen ID between the traditional and web-based groups (Table 2). This result was in agreement with our hypothesis that students receiving web-based instruction would do as well as, or better than, students receiving traditional instruction. However, the overall performance of students in both groups was somewhat poor, with mean scores of 57.5 and 59.2%, respectively. The low mean scores may partially reflect the inherent difficulty of turfgrass ID, and the fact that the six grasses used in the study were purposely selected because they would be difficult to discern

Table 1. Summary of Likert-type Responses to Survey Questions Asked of Traditional and Web-based Students before and during a turfgrass ID Quiz to assess their Confidence, Study time, and Motivation for Learning turfgrass ID

Survey Question	Responses(%) 1	2	3	4	5	Teaching Method: Traditional (n=37) Mean±SE	Web-based (n=40) Mean±SE
How confident are you that you will be able to correctly identify the six grasses?[zy]	0	8	29	55	8	3.7±0.1	3.6±0.1
How much time did you spend studying the PowerPoint presentation and/or your notes?[x]	0	21	43	27	9	3.2±0.1	3.3±0.2
How much time did you spend studying the live grass samples?[x]	18	60	19	1	1	2.1±0.1	2.1±0.1
How important do you fee turfgrass ID will be to you in your future career?[w]	13	22	30	16	19	3.2±0.2	2.9±0.2

[z]Students responded to this question just before taking the ID quiz.

[y]Likert-type scale used for responses to this question: 1= not confident at all-- I doubt I'll get any correct; 2= not very confident-- I might only get one or two correct; 3= somewhat confident-- I might get about half correct; 4= confident-- I expect to get most of them correct; 5= very confident-- I expect to get them all correct.

[x]Likert-type scale used for responses to this question: 1= none; 2= less than 1 hr; 3= between 1 and 2 hr; 4= between 2 and 3 hr; 5= more than 3 hr

[w]Likert-type scale used for responses to this question: 1= not very important at all-- I won't need to know it; 2= only slightly important-- it might rarely be of use to me; 3= somewhat important-- it could occasionally be useful to me; 4= important-- it will definitely help me do my job better; 5= very important-- I won't be able to do my job without it.

from one another without learning the full range of ID characteristics well.

While there was no difference in performance on live-specimen ID, we were surprised to find that the traditional group had a higher mean score on the knowledge-based questions than the web-based group (Table 2). This finding was counter to our hypothesis, stated above. We had formulated our hypothesis based, in part, on the perceived advantage of the web-based format for allowing students to easily review material. Miller and Honeyman (1994) had found that over half of students in distance courses viewed recorded lectures more than once. While we did not monitor the number of times our web-based students watched the recorded lecture, we did ask the following survey question: "How much time did you spend studying the PowerPoint presentations and/or your notes?" Responses to this question indicated that both groups studied about the same amount of time, with both groups averaging between one and two hours (Table 1). One possible explanation for the difference in performance on knowledge-based questions is that traditional students' study time was preceded by the laboratory time during which they were exposed to the material. For web-based students, their total exposure to the material was likely limited to the one to two hours (on average) of study time they reported. Web-based students' performance on knowledge-based questions may be improved by finding ways to increase their time spent studying or interacting with the material, perhaps by including interactive exercises in which they are forced to use the material and to write down key points. Bigelow (2009) previously reported that time spent online was positively associated with performance in web-based courses.

Table 2. Mean scores on live-specimen and knowledge-based turfgrass ID questions when students were taught by traditional or web-based methods

Question type:	Teaching Method: Traditional Score(%)±SE	Web-based Score(%)±SE	t-text[x]
Live-specimen ID	57.5±4.1	59.2±3.3	NS
Knowledge-based	86.0±3.7	71.7±3.9	*

[z]n = 37 students

[y]n = 40 students

[x]NS, * Non-significant or significant at p = 0.05, respectively.

It is also possible that the more structured environment for the traditional group led to better note-taking. They may also have felt more urgency in taking notes, because they did not have access to a recorded presentation for later referral, as the web-based students did. Conversely, the web-based students may have been less diligent in taking notes because they had access to the recorded presentation.

In the end, while the improved performance of the traditional group on knowledge-based questions is intriguing, we want to re-emphasize that the ultimate goal in teaching turfgrass ID is that students will learn to ID actual grass plants, and the traditional group did not do better than the web-based group in that regard.

If better performance on knowledge-based questions does not necessarily translate to improved ability to ID live plants, then it would seem that time spent studying actual grass samples would be the most important factor. There was no difference between groups in the amount of study time spent on live grass samples—both groups reported a mean study time of less than one hour (Table 1). Since there was no difference between groups in performance on live-specimen ID, it is not surprising to find that their mean study time with live samples was similar. Correlation analysis failed to show a relationship between study time with live samples and performance on live-specimen ID for either group (Table 3). However, we suspect this is due to the fact that the "study time with live samples" question yielded very few responses in the 4-5 range—97% of the responses were in the 1-3 range, with 60% of the responses being "2" (Table 1). In other words, there may not have been a sufficient range in study time among the students to detect a correlation.

Both groups were also similar in the perceived importance of turfgrass ID to their future career (Table 1), with the mean response being close to 3 (i.e., "somewhat important"). There was no correlation between perceived importance of turfgrass ID to their future career and performance on either knowledge-based or live-specimen ID.

The confidence level of the students was fairly high, with the mean response to the question, "How confident are you that you will be able to correctly identify the six grasses?" being nearly 4 (i.e., "confident—I expect to get most of them correct") (Table 1). Again, there was no difference in confidence level between the groups. Based on their live-specimen ID performance, it is probably fair to say that the students were overconfident as a group. Twenge (2006) has identified overconfidence as a common characteristic of today's college-age young people. Going into this project, we had wondered if students in the web-based group might be less confident because of their lack of direct contact with an instructor in learning a challenging task such as turfgrass ID. These results show that web-based students did not, in fact, have lower confidence in their ability to ID turfgrasses. Familiarity with the internet is another characteristic of this generation and may help explain the high confidence level of web-based students, in particular.

There were significant correlations between confidence-level and performance on both knowledge-based and live-specimen ID (Table 3). While the strength of the correlations was only moderate, they nevertheless indicate that students had a sense for how well they had learned turfgrass ID relative to their peers. This suggests that looking solely at study time to explain performance is insufficient, because students vary in their academic ability. Some students were apparently able to spend an hour or less studying live samples and learn to ID the six grasses quite well, while others were not successful in that amount of time. These differences in academic ability are probably reflected in the students' confidence-level, and therefore in the significant correlation between confidence-level and performance on the ID questions.

Table 3. Pearson Correlations of turfgrass ID Performance with Confidence, Study time, and Perceived Importance of Turfgrass ID, when Students are taught by Traditional or Web-based Methods

	How confident are you that you will be able to correctly identify the 6 grasses? [z]	How much time did you spend studying the PowerPoint presentation and/ or your notes?	How much time did you spend studying the live grass samples?	How important do you feel turfgrass ID will be to you in your future career?
Traditional Teaching				
Knowledge-based ID	0.34*	0.07	0.05	0.05
Live-specimen ID	0.43**	-0.24	0.06	0.07
Web-based Teaching				
Knowledge-based ID	0.37*	0.16	-0.06	0.27
Live-specimen ID	0.35*	0.05	0.22	0.24

[z]Students responded to this question just before taking the ID quiz.
* and ** Significant at 0.05 and 0.01, respectively.

Summary

There was no difference in performance on live-specimen ID between students taught traditionally and in a web-based format. Overall performance on live-specimen ID by both groups was relatively poor, with the mean scores falling just below 60%. This may reflect the inherent difficulty of turfgrass ID, along with the fact that the grasses used in our study were selected specifically because they were difficult to tell apart without learning and using structures that are not easily seen without magnification. In any case, our results show that web-based instruction does not put students at a disadvantage when learning to ID live turfgrass plants.

Traditionally taught students performed better on knowledge-based ID questions than their web-based counterparts. A possible reason for the higher performance of the traditional group on knowledge-based questions is that they spent more overall time interacting with the information; both groups reported equivalent study time with PowerPoints and/or notes, but the traditional groups' study time was preceded by learning time in the laboratory, which was not the case for the web-based group.

Nevertheless, improved performance on knowledge-based questions did not lead to improved performance on live sample ID, which is the goal in turfgrass ID. In addition to the difficulty factor, the relatively poor overall performance on live-specimen ID was probably related to insufficient study time with live samples, as both groups reported mean study time of less than one hour. Future studies should investigate ways to increase the quality and/or duration of students' study time with live samples.

Web-based students were just as confident as traditional students that they would be able to ID live specimens. Today's college students do not appear to be intimidated by the prospect of learning turfgrass ID in a web-based format.

In summary, our results show that students who are taught turfgrass ID in a web-based format are not disadvantaged compared to traditionally taught students, as long as they are provided live samples for study. However, there is much room for improvement in performance with live-specimen ID, and future research should focus on ways to improve this performance.

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A Short-Term Study Abroad Course in Costa Rica

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Abstract

Short-term study abroad programs are increasingly popular but their relative brevity makes it difficult to both successfully convey discipline-specific content and provide students with a meaningful cultural experience. Purdue University students participated in a 15-day course in Costa Rica in 2006 and 2008. Journals, group discussions, and a questionnaire administered at the end of the course were used to evaluate course impact on student comprehension of course material and interest in pursuing additional international experiences. Students agreed or strongly agreed that the course increased their knowledge of cropping systems and race and culture in Costa Rica and of the importance of biodiversity in agriculture. Journal entries and group discussions supported this self-assessment. At least 90% of the students agreed or strongly agreed that the course increased their interest in international agriculture and their interest in participating in another study abroad course. Seven of 19 eligible students (37%) subsequently participated in an additional international research or education program after completing the course. This paper describes the experience and provides prospective programs with a blueprint for implementing similar short-term international agriculture courses with a substantial field-work component.

Introduction

During the past decade, universities in the United States have placed great emphasis on study abroad programs as a mechanism to promote international understanding and to prepare students to compete in a global marketplace. As the popularity of these programs has grown, their average duration has decreased (Dwyer, 2004). For example, of approximately 260,000 students that participated in study abroad programs in 2008/2009, more than half were enrolled in programs that could be completed in eight weeks or less (IIE 2010a). Short-term programs are an attractive alternative for students who are unable to spend longer periods of time studying internationally for financial and/or other reasons. Also, short-term programs allow students who have not traveled internationally, flown in an airplane, or who may have never left their state to participate with less anxiety about traveling abroad. Furthermore, although the relatively brief duration of short-term study abroad programs can limit the scope of topics addressed, students can build upon their experiences by pursuing additional international activities after the initial study abroad program concludes. A key goal for short-term study abroad programs at Purdue University is to encourage students to engage in additional international experiences, preferably ones that require students to stay abroad for eight weeks or longer. Despite the popularity of short-term programs, there are relatively few articles that describe how to successfully manage a program (Sachau et al., 2010).

The need for agricultural programs to provide college students with an international perspective and greater experiential learning has been noted by several organizations (NRC 2009; APLU 2009).

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Experiential learning is not synonymous with study abroad; the experience of visiting a new culture does not necessarily lead to new knowledge (Lutterman-Aguilar and Gingerich, 2002). Experiential learning requires learners to reflect on and critically analyze their experience (Kolb, 1984). This learning may be further enhanced if students are presented with or identify a particular problem in the host country (Lutterman-Aguilar and Gingerich, 2002). Providing food and fiber to a world population that will exceed eight billion people by mid-century without further depleting natural resources, damaging ecosystems, or decreasing biodiversity represents a "grand challenge for agriculture" (Robertson and Swinton, 2005). Directly observing different strategies used to address this challenge and reflecting on the economic, social, and cultural factors that influence decisions to adapt a particular strategy may provide powerful opportunities for experiential learning.

The purpose of this research was to assess the impact of a short-term, field work intensive, course on student understanding of interactions among crop production systems and biodiversity, perceptions of race and culture in Costa Rica, and interest in pursuing additional international learning activities.

Methods and Materials

The College of Agriculture at Purdue University offers several short (2 to 4 weeks) international programs known as "Maymester" courses that give students the opportunity to travel with faculty to foreign countries. Eighteen and fourteen Purdue University students participated in a 15-day course in Costa Rica in 2006 and 2008, respectively. Students were accepted into the course based on their GPA and letters of recommendation; entry into the course was not restricted by major or by fluency in Spanish.

The course had two major phases. In the first phase, students participated in a mandatory one credit-hour course entitled: Topics in Tropical Agriculture. This course was taught at Purdue University in spring semester and was designed to provide students with a background in tropical ecosystems, agriculture in the tropics, and the culture and history of Costa Rica. Enrollment in the course was limited to students who had been accepted for the Costa Rica trip. In addition to attending lectures given by faculty, students worked in small groups (3 to 4 students) to develop presentations on natural ecosystems, government and political parties, education, history, and culture in Costa Rica. These group projects were designed to promote group cohesion, transfer the responsibility of learning from the instructors to the students, and to develop 'student experts" on selected topics who could contribute information while in country. Each group was also required to write a 15-page paper on their assigned topic.

In the second phase, faculty and students traveled to Costa Rica for the 15-day course. Costa Rica is the 10th most visited country by study abroad programs in the United States and, other than Mexico and China, is the only country outside of Europe or Australia in the top ten (IIE 2010b). Costa Rica was chosen as a destination country for several reasons. First, Purdue has a partnership with CATIE (The Tropical Agricultural Research and Higher Education Center, Turrialba, CR) that allowed us to rely on in-country expertise and connections. More specifically, we relied on CATIE to use their connections to arrange visits to farms and ranches. Second, the high diversity of both natural and agricultural systems allowed students to directly observe many different production systems in a relatively short period of time and over small distances. Third, heterogeneous cultures (indigenous, African-Caribbean, Spanish) and challenges with immigration, particularly from Nicaragua, provide a framework for discussions on race and cultural issues. Finally, because Costa Rica has a particularly strong tourism industry, receiving more than one million visitors per year with a general population of around four million, there is considerable infrastructure available for visiting groups. While this makes visiting Costa Rica logistically easy, it can also create a mindset in students that they are on vacation. To limit this impression we avoided tourist "hotspots" and stayed in hotels typically used by Costa Ricans.

Students participated in four primary learning activities while in Costa Rica: field sampling, completion of written assignments, direct interaction with farmers, and group discussions. Students were encouraged to record their daily experiences and were also required to address three topics in a journal including: the value of biodiversity in agricultural systems, their impressions of race and culture in Costa Rica compared to the United States, and a discussion of the potential benefits and drawbacks of payment for environmental services in agriculture. Journals were collected, read and critiqued every three or four days by faculty. Evening discussions among faculty and students were scheduled to allow students to write about their experiences before analyzing major topics as a group. This process followed Kolb's "learning cycle" model in which students experience an environment, reflect on their experience, and then analyze the experience (Montrose, 2002).

Systems visited included organic and conventional

Table 1. Mean Scores for Course Evaluations from Student Cohorts in 2006 and 2008 for the Costa Rica Course (Students completed the evaluations after the course ended in both years. To ensure student anonymity, the evaluations were not viewed directly by course instructors. Return rates were 50% and 79% in 2006 and 2008, respectively.)

	2006	2008
Overall, I would rate this course as[z]	4.6	5.0
This course increased my interest in participating in a Semester Abroad program or other international experience[y]	4.6	4.7
This course increased my interest in international agriculture	4.8	4.5
This course increased my knowledge of cropping systems in Central America	4.4	4.8
This course increased my awareness of trade between United States and Central America	3.9	4.2
This course increased my understanding of the importance of biodiversity in the tropics	4.7	4.9
This course increased my understanding of race and culture in Costa Rica	4.8	4.4
This course increased my understanding of "payment for environmental services" programs.	3.7	4.3
The one credit hour course taken during spring semester gave me a good background for material covered during the two weeks in Costa Rica	4.3	4.2

[z]Excellent = 5, Good = 4, Fair = 3, Poor = 2, Very Poor = 1.

[y]Strongly agree = 5, Agree = 4, Undecided = 3, Disagree = 2, Strongly disagree = 1.

coffee farms, banana plantations, ranches, cacao farms, and several forest types (mid elevation, lowland wet, dry, transitional dry). At each agricultural stop, students were given a tour by the grower/rancher and had the opportunity to interview the grower/rancher about all aspects of his or her business. Students were encouraged to ask questions in Spanish but most relied on the faculty for translations. To illustrate differences in biodiversity among systems and promote active learning, 30 meter by 30 meter square plots were sampled at each agricultural site. In the first year, 100 meter measuring tapes were used to mark plot boundaries. However, measuring tapes proved difficult to use in dense vegetation and were replaced in the second year with 30 meter sections of nylon rope. Students were divided into four groups tasked with sampling insects, trees, herbaceous plants, and birds. Prior to sampling for plants or birds, four students walked approximately 5 m apart and used sweep nets to collect insects from plants along 30 m transects within each plot. Insects were identified to order and the number of individuals recorded. All trees within a plot were counted and identified. Herbaceous species were counted and cover estimated within five randomly located 0.5 m quadrats per plot. Bird species were identified by sight and/or by sound within the plot and at 50, 100, and 200 m from the plot margins.

Student evaluation of learning can be an important measure of effectiveness (Bruening et al., 2002). Students were asked to rate the course and to provide information about the impact of the course on their interest in pursuing additional international experiences and on their understanding of material covered during the course.

Results and Discussion

All of the respondents agreed or strongly agreed that the course increased their interest in participating in a semester abroad or other international experience (Table 1). Similarly, all of the respondents from the 2006 cohort and 91% of respondents from 2008 agreed or strongly agreed that the course increased their interest in international agriculture. Nineteen students of the 32 students enrolled in 2006 and 2008 were entering their second or third year of coursework when they participated in our course. Seven of the 19 students (37%) subsequently participated in a Semester Abroad program, summer research program abroad, or in an additional Maymester course. Three students participated in eight week-long summer research programs at CATIE.

Although we recognize the limited scientific value of data obtained from our field sampling (Table 2), the congruency of our data with known characteristics of these systems supports the hypothesis that a relatively simple sampling procedure can be used as a heuristic tool in short-term international courses. Briefly, the conventional coffee and banana systems had relatively few tree and herbaceous species compared to the multi-story organic coffee and cacao systems. In the organic shade coffee system, most of the tree species occupied positions in the mid to upper canopy and

Table 2. Results of Field Sampling in Four Agroforestry Systems in Costa Rica during Early Summer in 2006

Agroforestry system	Herbaceous species[z]	No. of tree species	No. of insect species[y]	No. of bird species at four distances from field (m)			
				0	25	50	100
Conventional "sun" coffee	2 (26%)	2	32, 4 orders	0	0	1	4
Organic "shade" coffee	9 (96%)	6	74, 6 orders	0	7	3	1
Conventional banana	3 (36%)	1	104, 6 orders	1	0	0	0
Cacao	8 (46%)	5	111, 7 orders	2	3	1	0

[z]Values are the mean number of species, cumulative percent cover is in parentheses.

[y]Values are number of individuals captured.

provided substantial shade for coffee plants (Table 2). In contrast, the sun system contained only one tree species other than coffee and individuals of that species were cut below the coffee canopy. However, more coffee plants were encountered in the sun system than in the shade system (data not shown). The organic systems also contained more insect genera and more bird species than the conventional systems. These general conclusions have been reported by several research groups throughout Mesoamerica (Perfecto et al., 1996, Reitsma et al., 2001, Somarriba et al., 2004). The field work had two major benefits. First, key features of agricultural systems such as biodiversity, pest management, soil erosion, and crop productivity, which were introduced during the semester course, could be directly observed and examined by students. Second, students were asked to reflect on their field experiences during group discussions and in their journals. In our opinion, this experience substantially enriched the discussions. For example, students could draw on their own observations when discussing the costs/benefits of growing coffee in sun vs. shade systems.

Field sampling in the tropics can present several challenges. First, students must be able to adjust to the physical challenges of working in the tropics, i.e. a hot and humid environment, steep terrain, insect bites, and sunburn. We limited field sampling to no more than two hours per day and insured that students carried water, wore appropriate clothing, and used sun lotion and insect repellent. Second, during the rainy season (approximately May to November in most locations), heavy rainfall can interfere with sampling by reducing bird and insect activity and by increasing the risk of students injuring themselves on difficult slopes. On a short course, it may not be possible to revisit a site to collect data if rain prevents field sampling during a scheduled visit. This occurred in both years of our course. In most cases, only data collection was affected; we were still able to tour the site and interact with Costa Ricans. Finally, plant, insect, and bird identification can be particularly challenging in the tropics due to the sheer number of species. In our study, common trees and birds could be identified by species, but many herbaceous plants and insects could not be identified beyond order or genera. Bird species were typically identified by sight although some species could be identified by their calls. We note that identifying plants, insects, and birds was only possible because faculty with appropriate expertise participated in the course.

Students agreed or strongly agreed that the course increased their knowledge of cropping systems in Central America and of the importance of biodiversity (Table 1). During discussions and in their journal entries, it was common for students to compare agriculture in Costa Rica with agriculture in the United States. Several students suggested that, although opportunities existed to incorporate biodiversity concerns into perennial crops like coffee and cacao, annual crops like corn and soybeans provide relatively few opportunities for conserving biodiversity. These students were also concerned that a focus on biodiversity in Costa Rica or Indiana would reduce farm profitability. Most students expressed doubts that farmers in Indiana would be willing to consider biodiversity issues in developing their farm management plans because it would reduce their profits. In general, students indicated that they believed that biodiversity concerns should be taken into account by farm managers in the United States but were unsure how this could be accomplished.

A majority of students in both years agreed or strongly agreed that the course increased their awareness of trade with Central America and payment for environmental services (Table 1). Student journal entries, group discussions, and individual conversations with faculty focused on two main themes. First, they were surprised at the presence of U.S. firms, particularly fast food chains, in the larger cities. Some students were disappointed that these symbols of American life were so omnipresent but others were happy for the opportunity to eat familiar food. Second, although students understood the connections among trade, cropping systems, and biodiversity, they were evenly divided about whether they should or could change their buying habits to support more eco-friendly cropping systems. A common but not unanimous sentiment expressed was that, as “poor” college students, they couldn’t afford to pay extra for organic, environmentally friendly, or fair trade items but would be willing to do so after graduation. Some students also expressed skepticism about paying Costa Ricans for carbon credits to protect the forests in that country.

Students were generally comfortable interacting with Costa Ricans and expressed few concerns about personal safety. Students who spoke at least rudimentary Spanish appeared more likely to engage Costa Ricans than students who spoke no Spanish. However, during our stay on the Caribbean coast, all students were able to converse with locals in English. Some students indicated in their journals and group discussions that they felt particularly comfortable during this phase of the trip and attributed their comfort in part to sharing a common language with Costa Ricans along the Caribbean. Requiring fluency in Spanish might have increased the direct interaction between students and Costa Ricans. However, such a requirement would also have substantially reduced the number of students who enrolled in the course. Group discussions and journals focused on similarities to U.S. history (i.e. displacement of Native Americans, segregation of European and African descendants) and the degree to which culture and history affect or reflect economic disparities among ethnic groups. Some, but not all, students noted that the quality of services such as roads and the apparent wealth of communities appeared to decrease as they traveled from San Jose, the capital of Costa Rica, to the Caribbean coast and into the indigenous reserve. A majority of students agreed or strongly agreed that the course increased their understanding of race and culture in both years (Table 1).

Summary

Study abroad programs can be effective tools for exposing student to international perspectives on agriculture and sustainability. Purdue University and CATIE collaborated to provide undergraduate students with a short-term course in specialty crops in Costa Rica in 2006 and 2008. Results from class discussions, journal entries, personal comments, and post-course surveys suggest that the approach described in this paper met course goals for conveying discipline content, providing students with a meaningful cultural experience, and increasing student interest in additional international activities.

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A Longitudinal Study of Learner Characteristics and Experiences with a Distance Master of Agriculture Degree Program

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Abstract

This longitudinal study sought to identify trends in learner characteristics and program-related experiences in a distance-delivered Master of Professional Agriculture degree program. Between 2001 and 2009, notable progress had been made to lessen the significance of obstacles faced by off-campus graduate students. The average amount of time taken to complete the master's degree program decreased from 74.46 months for graduates surveyed in 2001 to 55.85 months for graduates surveyed in 2009. A majority of graduates surveyed in 2001 perceived three obstacles to be slightly significant to significant: "limited number of courses offered," "difficulty in balancing school, personal, and work responsibilities," and "cost of the program." However, a majority of graduates surveyed in 2009 perceived only two obstacles to be slightly significant to significant: "difficulty in balancing school, personal, and work responsibilities" and "attending sessions held on campus." Though there is still room for improvement relative to dealing with obstacles to off-campus study, efforts to improve distance learning in the College of Agriculture and Life Sciences at Iowa University have had a positive impact on graduates.

Introduction

Distance education has become an integral component of higher education program delivery, especially for career and technical education programs at the postsecondary level (Allen and Seaman, 2010; Rovai and Downey, 2010; Zirkle, 2003). In 2009, online enrollment had a 17% growth rate, whereas the overall higher education student population growth rate was just 1.2% (Allen and Seaman, 2009). Students view distance learning as a convenient way to pursue education without sacrificing the quality of learning. According to Hannay and Newvine (2006), 57% of students in their sample believed they learned more in a distance learning approach than in traditional classroom face-to-face lecture courses. In addition, almost 70% of those students indicated they preferred distance learning courses to traditional courses. Two of the biggest motivating factors for higher education institutions to offer more distance education courses are (a) providing greater access for students and (b) meeting the increased demand for more online offerings that is associated with the economic downturn (Allen and Seaman, 2010; Miller and Miller, 2005; Patterson and McFadden, 2009).

Distance education has evolved from modifying existing on-campus and independent study courses to developing degree programs that are completed partially or entirely off campus (Miller, 1995; Miller and Miller 2005). Colleges of agriculture at land-grant universities are able to increase the variety of course options available for undergraduate and graduate distance education through consortiums such as the Tri-State Agricultural Distance Delivery Alliance (TADDA) and Great Plains Interactive Distance Education Alliance (IDEA) (Mink and Moore, 2005; Schmidt et al., 2005). Advances in communication and computer technology have made these types of course offerings and degree programs possible (Miller and Miller, 2005).

Distance education students' characteristics, including their reasons for deciding to enroll in such

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programs, are complex and diverse. Students who pursue degrees through off-campus programs face a variety of obstacles not normally encountered by traditional college students (Kelsey and D'souza, 2004; Miller, 1995; Miller and Miller, 2005; Patterson and McFadden, 2009). Off-campus learners in distance agriculture courses are typically older than traditional on-campus students and generally maintain a professional career in addition to taking courses (Miller and Honeyman, 1993; Murphy, 2000; Nti and Bowen, 1998; Wilson, 1991). Employment, marital status, family responsibilities, physical distance, and expenses associated with traditional education make distance learning the most viable option for many agriculture professionals to access higher education (Hannay and Newvine, 2006). Mink and Moore (2005) determined that participants' decisions to complete a distance Bachelor of Science degree program in agricultural science and technology were influenced by family, flexibility of classes, and being place bound because of employment. Distance learners in an agricultural safety course were described as self-motivated and self-disciplined (Lehtola and Boyd, 1992).

The exponential growth of online instruction has led to concerns about program quality and completion rates. Because distance education students generally have many competing demands for their time, requiring more learner-to-learner interactions could be a barrier to completing an off-campus degree program (Hezel and Dirr, 1990; Kelsey et al., 2002; Thompson et al., 1991). Patterson and McFadden (2009) found that online graduate students were significantly more likely than campus-based graduate students to drop out. In a study of lower-level undergraduate business courses, there was a small but significant negative correlation between the amount of learner-to-learner interaction and online course completion rate (Grandzol and Grandzol, 2010). Despite the aforementioned advances in courses and degree programs, the limited number and variety of courses offerings is an often-cited obstacle to timely program completion (Miller 1995; Miller and Miller, 2005; Mink and Moore, 2005). Allen and Seaman (2010) found that 69% of academic leaders whose institutions offer online courses did not believe it is harder to retain online students.

Asynchronous delivery technologies have reduced the negative effects associated with obstacles related to time, cost, and convenience of distance education (Miller and Honeyman, 1993; Owen and Hotchkis, 1991). Gulliver and Wright (1989) suggested that because distance learners did not place a high value on interacting with other students, delivery methods that allow students to work at their own pace might increase positive perceptions of the distance education program. Drennan et al. (2005) identified positive perceptions toward technology and an autonomous learning mode as two key student attributes affecting satisfaction with distance education. Conversely, Kelsey et al. (2002) found that students participating in the Doc-at-a-Distance program valued the interaction and support they received from other students in a cohort group and were dissatisfied by isolation, inaccessible resources, technology problems, and amount of time required to complete course requirements.

Iowa State University was a pioneer in agricultural distance learning. Their master's degree program in professional agriculture dates to 1979 (Miller and Honeyman, 1993). In 1991, Iowa State University expanded the off-campus professional agriculture program to include a Bachelor of Science degree (Miller and Miller, 2005). Iowa State University's programs have been the subject of several studies that have documented program strengths, weaknesses, and strategies that have evolved to meet student needs over time. Miller (1995) studied program graduates to gain an understanding of the off-campus learning experience. In response, Iowa State University began increasing the use of asynchronous delivery methods to deliver courses associated with the off-campus agriculture degree programs. Of the adult distance learners who participated in Miller and Pilcher's 2002 study on learning strategies, 95% were enrolled in courses delivered primarily through asynchronous technology (e.g., videotape, Internet, or CD-ROM). In spring 2001, Miller and Miller (2005) conducted a follow-up study of graduates of the off-campus degree programs. When comparing graduates from 1993 and 2001, Miller and Miller found that progress had been made to lessen the significance of obstacles faced by off-campus students, with a higher percentage of graduates surveyed in 2001 completing their degrees in five years or less.

In the years since Miller and Miller's 2005 follow-up study, distance education and related educational technologies have continued to develop rapidly. Rovai and Downey (2010) argued that institutional distance education programs that are unable to successfully adapt to the competitive environment created by the economic potential of operating on a for-profit basis are at risk of failing. In the current economic downturn, institutions are seeking to increase tuition revenues by attracting and retaining more distance educations students (Allen and Seaman, 2010; Howell et al., 2003; Patterson and McFadden, 2009; Rovai and Downey, 2010). The growing demand for quality online learning, advances in technology, and evolving learner demographics makes it imperative for distance education programs to conduct periodic follow-up studies that may be used to determine priorities for program improvement.

Purpose and Objectives

This purpose of this longitudinal study was to identify trends in learner characteristics and program-related experiences in a Master of Professional Agriculture distance degree program. The objectives of this study included the following:

1. Compare alumni of the off-campus master's degree program in professional agriculture who graduated between spring 1994 and spring 2001 with those who graduated between summer 2001 and spring 2009 in terms of demographic characteristics.
2. Compare alumni of the off-campus master's degree program in professional agriculture who graduated between spring 1994 and spring 2001 with those who graduated between summer 2001 and spring 2009 in terms of program-related experiences.
3. Compare alumni of the off-campus master's degree program in professional agriculture who graduated between spring 1994 and spring 2001 with those who graduated between summer 2001 and spring 2009 in terms of their perceptions of obstacles to off-campus study.

Methods

Participants

This study was deemed exempt by Iowa State University Institutional Review Board. The population for the study consisted of all persons who earned a Master of Professional Agriculture degree from Iowa State University between spring semester 1994 and summer semester 2009. The population was studied at two points in time. The first included 30 persons who earned a Master of Professional Agriculture degree at Iowa State University between spring 1994 and spring 2001. The second included 73 persons who earned a Master of Professional Agriculture degree between summer 2001 and summer 2009. Names and contact information for these graduates were obtained through the Iowa State University Alumni Association. Lists were cross-checked for accuracy with graduation lists maintained by the Iowa State University Registrar's Office.

Instrumentation

Identical portions of the questionnaires in 2001 and 2009 were used to collect data for this study. The questionnaires contained demographic questions, questions related to experiences with the Master of Professional Agriculture program, and a scale to measure perceptions of obstacles faced by off-campus students. A panel of experts judged the questionnaire to be content and face valid. The obstacles scale had a Cronbach's alpha reliability coefficient of .78 for data collected in 2001 and .83 for data collected in 2009.

Data collection and Analysis

At the end of the 2001 spring semester, the questionnaire, a cover letter, and a stamped return envelope were sent to all (N = 30) persons who earned a Master of Professional Agriculture degree between spring semester 1993 and spring semester 2001. Approximately four weeks after the initial package was mailed, a second complete package was sent to all non-respondents. There were no additional follow-ups conducted.

During the 2009 summer semester, all (N = 73) individuals who earned a Master of Professional Agriculture degree between summer semester 2001 and spring 2009 received a brief pre-notice postcard individually signed by the co-principal investigators informing them of the study. A detailed information letter, questionnaire, and return envelope were sent three days after the pre-notice postcard. A brief reminder letter with a copy of the questionnaire and a return envelope were sent to non-respondents 10 days after the detailed information letter. Ten days later, a second reminder letter was sent to the remaining non-respondents. A final follow-up was conducted by telephone 14 days after the second reminder letter.

The response rate was 80% in 2001 and 86% in 2009. The researchers followed Lindner et al. (2001) recommendations for handling nonresponse. The protocol for comparing early and late respondents was used for the 2001 data. No statistically significant differences were found. Because the response rate exceeded 85% in 2009, control of nonresponse was not necessary (Lindner et al., 2001). The researchers concluded that results were generalizable to the target population.

Data were analyzed with SPSS v.17 software. Descriptive statistics including frequencies, percentages, means, modes, medians, ranges, and standard deviations were used to summarize the quantitative data.

Results and Discussion

Individuals who graduated from the off-campus master's degree program in professional agriculture between 1994 and 2001 ranged in age from 25 to 60. Their mean age was 41.92 (SD = 8.73). The majority

Table 1. Occupation of Master's of Professional Agriculture Graduates at the Time of Enrollment and at the Time of the Survey

	At time of enrollment		At time of survey	
Occupation[z]	2001 %	2009 %	2001 %	2009 %
Farming	16.7	14.3	13.0	9.5
Agricultural extension	16.7	17.5	26.1	17.5
Agribusiness	29.2	9.5	26.1	7.9
Agricultural education	8.3	12.7	8.3	12.7
Soil conservation	8.3	1.6	0.0	0.0
Other	20.8	50.8	25.0	60.3

[z] The numbers represent the percentage of respondents who indicated employment in each occupation. Some respondents indicated more than one occupation.

Table 2. Mean Rankings and Standard Deviations for Factors that Motivated Graduates to Enroll in the Master's of Professional Agriculture Distance Degree Program

	2001		2009	
Motive	M	SD	M	SD
Pursuing a degree	1.65	0.98	2.03	1.12
Acquiring current technical knowledge	2.78	0.99	2.93	1.07
For the enjoyment of learning new information	3.17	1.02	3.25	0.97
Career advancement	3.00	1.34	1.95	0.97

(75.0%) of these graduates were male. Individuals who graduated between 2001 and 2009 ranged in age from 25 to 65. Their mean age was 41.06 (SD = 10.86). While the majority (69.8%) of these graduates were male, there was a small increase (5.2%) in the percentage of graduates who were women.

Graduates were asked to identify their occupation at the time they enrolled in their degree program and at the time they participated in this study. Table 1 shows a decline in the percentage of graduates who reported occupations in farming, agribusiness, and soil conservation from 2001 to 2009. At time of enrollment, the percentage of graduates who reported an occupation in "other" areas increased from 2001 to 2009 by 30%. Additionally, at the time of the survey the percentage of graduates who reported an occupation in "other" areas increased from 2001 to 2009 by 35%. The number and diversity of occupations listed as "other" by graduates was great, selected examples included sales representative, postsecondary instructor, manufacturing manager, and military officer. The diversity of occupations of graduates would indicate that the Master of Professional Agriculture degree has opened various career opportunities. A further indicator of this can be seen in the percentage of graduates who credited their degree with occupational change. The percentage of graduates who credited their Master of Professional Agriculture degree with occupational changes increased from 42% in 2001 to 49% in 2009.

Graduates of the off-campus master's degree program in professional agriculture were asked to rank four motivating factors for enrolling in the program. As seen in Table 2, graduates surveyed in 2001 ranked "pursuing a degree" as the most motivating factor and ranked "acquiring current technical knowledge" second. Graduates surveyed in 2009 survey rated "career advancement" as the most motivating factor and ranked "pursuing a degree" second.

Master's degree students at Iowa University are allowed up to five years to complete their program (Iowa University Graduate College, 2011). Seen in Table 3, the amount of time taken to complete the off-campus program ranged from 11 months to 168 months for graduates surveyed in 2001 and from nine months to 288 months for graduates surveyed in 2009. Less than 20% of graduates who participated in the 2001 and 2009 surveys completed the program in less than two years. Almost half (43.5%) of the graduates surveyed in 2009 and only 16.7% of the graduates surveyed in 2001 completed the program within three years. More than half (61.3%) of the graduates surveyed in 2009 and less than half (37.5%) of the graduates surveyed in 2001 completed the program in four years. After five years, 83.9% of the graduates surveyed in 2009 and 50% of the graduates surveyed in 2001 had completed the program. Graduates surveyed in 2001 completed the program in an average of 74.46 months (SD = 0.79). Graduates surveyed in 2009 completed the program in an average of 56.85 months (SD = 0.88). Factors that may have led to the shorter completion time for 2009 graduates could be the increase in the number of courses available throughout the year. An increase in the number of course offerings during summer months may have contributed to the decrease in the amount of time take to complete the degree program. Graduate advising may have improved for these students due to greater communication through email and other online correspondence with program administrators. Another factor may have been the number of graduate credits that students were able to transfer into to the program.

After 1993, the requirement that students must attend on-campus sessions was discontinued for the off-campus master's degree program in professional agriculture. Asynchronous methods were used to deliver courses. Videotape and later web-based courses became very popular delivery tools that lessened the need for students to attend classes at specific places and times. Table 4 shows that graduates surveyed in 2009 came to campus less frequently than those surveyed in 2001. In 2001, 21.7% of graduates traveled to campus 10 or fewer times, whereas 67.7% of those surveyed in 2009 traveled to campus 10 or fewer times. A majority (65.2%) of graduates surveyed in 2001 traveled to

Table 3. Time Taken by Graduates to Complete the Master's of Professional Agriculture Distance Degree Program

Number of months	2001[z] %	2001[z] Cum.%	2009[y] %	2009[y] Cum.%
<25	12.5	12.5	19.4	19.4
25–36	4.2	16.7	24.1	43.5
37–48	20.9	37.5	17.8	61.3
49–60	12.5	50.0	22.6	83.9
61–72	0.0	50.0	1.6	85.5
73–84	12.5	62.5	3.2	88.7
85–96	8.3	70.8	0.0	88.7
97–108	8.3	79.2	1.6	90.3
109–120	12.5	91.7	3.2	93.5
>120	8.3	100.0	6.5	100.0

[z]M = 74.46, SD = 0.79. [y]M = 55.85, SD = 0.88.

Table 4. Number of Times Graduates Traveled to Campus for Reasons Related to Master's of Professional Agriculture Distance Degree Program

Number of times	2001 %	2001 Cum.%	2009 %	2009 Cum.%
0–10	21.7	21.7	67.7	67.7
11–20	43.5	65.2	22.6	90.3
21–30	8.7	73.9	4.8	95.2
31–40	8.7	82.6	0.0	95.2
41–50	0.0	82.6	0.0	95.2
51–60	4.3	87.0	1.6	96.8
>60	13.0	100.0	3.2	100.0

campus 20 or fewer times, and 90.3% of graduates surveyed in 2009 traveled to campus 20 or fewer times.

Graduates were asked to rate the significance of 13 obstacles to off-campus study using a 6-point Likert-type scale (see Table 5 for scale description). Taking the 13 obstacles together, there was little difference between the percentage (13.6%) of graduates surveyed in 2001 and the percentage (13.3%) of graduates surveyed in 2009 that rated the obstacles as slightly or moderately significant (Table 5). The overall mean for the 2001 respondents was 2.75 (SD = 0.79), whereas the overall mean for the 2009 respondents was 2.52 (SD = 0.88).

Table 6 provides a more detailed account of graduates' perceptions of the 13 obstacles to off-campus study. A majority of graduates surveyed in 2001 perceived three obstacles to be slightly significant to significant: "limited number of courses offered," "difficulty in balancing school, personal, and work responsibilities," and "cost of the program." However, a majority of graduates surveyed in 2009 perceived only two obstacles to be slightly significant to significant: "difficulty in balancing school, personal, and work responsibilities" and "attending sessions held on campus." Notably, the percentage of graduates who rated the obstacles as slightly significant to significant declined from 2001 to 2009 for 11 out of 13 obstacles and declined by 10% or more for six obstacles. These six obstacles (percentage of decline listed in parentheses) were "limited number of courses offered" (25.2%), "lack of access to library facilities" (19.3%), "dealing with a number of different departments" (13.4%), "difficulty in balancing school, personal, and work responsibilities" (11.8%), "prerequisites required for classes" (10.5%), and "cost of the program" (9.7%).

Summary and Recommendations

There were distinct changes in the characteristics of learners served by the off-campus Master of Professional Agriculture degree program between 2001 and 2009. In 2009 there was a small increase, although insignificant, in the number of graduates who were women. Between the time of enrollment and when the survey was completed, there was an increase in the percentage of graduates who were employed in "other" occupations for 2001 and 2009. In 2009 at the time of the survey fewer graduates were employed in farming, agribusiness, or soil conservation. Graduates surveyed in 2009 were primarily motivated to enroll in the program for career advancement, whereas graduates surveyed in 2001 placed more emphasis on the pursuit of a degree. In addition, a greater percentage of graduates surveyed in 2009 credited their degree with occupational change. These data indicate that distance education learners' needs for, interests in,

Table 5. Master's of Professional Agriculture Graduates' Perceived Significance of 13 Obstacles to Off-Campus Study

Perceived significance[z]	2001[y] %	2001[y] Cum.%	2009[x] %	2009[x] Cum.%
Insignificant	4.5	4.5	15.0	15.0
Moderately insignificant	36.4	40.9	41.7	56.7
Slightly insignificant	45.5	86.4	30.0	86.7
Slightly significant	9.1	95.5	11.6	98.3
Moderately significant	4.5	100.0	1.7	100.0
Significant	0.0	100.0	0.0	100.0

[z] Scale: 1 = insignificant, 2 = moderately insignificant, 3 = slightly insignificant, 4 = slightly significant; 5 = moderately significant; 6 = significant.

[y]M = 2.75, SD = 0.79; [x]M = 2.52, SD = 0.88.

Table 6. Percentage of Master's of Professional Agriculture Graduates Who Selected Slightly Significant, Moderately Significant, or Significant for Each Obstacle

Obstacle	2001 %	2009 %
Difficulty in balancing school, personal, and work responsibilities.	66.7	54.9
Limited number of courses offered.	62.5	37.1
Cost of the program.	50.0	40.3
Lack of access to library facilities.	43.5	24.2
Course offerings did not fit needs.	37.5	35.5
Dealing with a number of different departments.	37.5	24.1
Lack of scholarships.	34.7	30.7
Lack of access to other students.	29.2	32.3
Lack of access to instructors.	29.2	27.4
Prerequisites required for classes.	25.0	14.5
Accessing financial aid at the university.	21.7	16.1
Attending sessions held on campus.	20.8	63.3
Faculty did not understand student needs.	8.4	8.1

and motivations for enrolling in graduate programs are changing. If curriculum planners wish to remain competitive in attracting and retaining students to their graduate programs, they must align program outcomes to meet the learners' current and future needs.

The average amount of time taken to complete the master's degree program decreased from 74.46 months for graduates surveyed in 2001 to 55.85 months for graduates surveyed in 2009. In addition, most (89.3%) graduates surveyed in 2009 completed the degree program in less than five years. This was a significant improvement from the 50% five-year completion rate of graduates surveyed in 2001. A variety of factors may have led to such a dramatic improvement in the number students who were able to complete the program within five years. Iowa State University expects students to complete their master's degree program within five years. Although some students pursuing distance degrees may take longer to complete their program than on-campus students, these results suggest that the five-year expectation is now readily achievable. We recommend that the university continue to maintain one expectation of time to completion for on- and off-campus students.

Graduates surveyed in 2009 came to campus less often for reasons related to the off-campus degree program than those surveyed in 2001. This may have been a result of policy changes, course delivery modes, and advancements in communication technology. Additionally, graduates surveyed in 2009 expect to travel even less as indicated by their perception that attending sessions on campus was a significant obstacle. This indicates a shift in graduates' expectations for the off-campus program to be deliverable where and when they want it. We recommend that the off-campus master's degree program in professional agriculture maintain policies and practices that make it possible for students to complete their program without traveling to campus. However, some off-campus students value face-to-face contact and are willing to pursue such contact independent of program requirements. We also recommend that program administrators and course instructors be flexible enough to accommodate on-campus interactions for individuals or small groups who wish to pursue these opportunities.

Between 2001 and 2009, notable progress was made to lessen the significance of obstacles faced by off-campus graduate students. Obstacles on which the greatest degree of improvement was achieved included "limited number of courses offered," "lack of access to library facilities," "dealing with a number of different departments," "difficulty in balancing school, personal, and work responsibilities," "prerequisites required for classes," and "cost of the program." Graduates believe that faculty have done a consistently good job of understanding their needs. Several developments implemented in the eight years between surveys may have contributed to improved program performance. These developments include ongoing technology enhancements that improved the quality of course materials and communications, training for faculty and staff provided by the Center for Excellence in Learning and Teaching, expanded access to electronic publications through the university library, course development and enhancement grants provided by the College of Agriculture and Life Sciences, employment of a student support specialist to assist distance learners in the college, and the sharing of courses with other institutions through the Great Plains Interactive Distance Education Alliance.

There is still room for improvement relative to dealing with obstacles to off-campus study. Faculty, staff, and administrators may not be able to directly address the most significant obstacle, "balancing school, personal, and work responsibilities," but can address it indirectly by working to lessen the impact of other potential obstacles. We recommend that focus for ongoing improvement be directed at making sure students are not required to travel as part of the program, finding efficiencies to control program costs, and working to increase the number and variety of courses offered.

An increasing number of students have graduated from the master's degree program in professional agriculture, they have done so in a timelier manner, they report positive impacts of the degree on their employment, and they face fewer significant obstacles in pursuit of their degree. We conclude that efforts to improve distance learning in the College of Agriculture and Life Sciences at Iowa State University have had a positive impact on graduates, and we recommend that follow-up studies continue on a periodic basis to measure program impact and inform decisions concerning priorities for program improvement.

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Mentoring Perceptions and Experiences of Minority Students Participating in Summer Research Opportunity Programs

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Abstract

Literature has documented the underrepresentation of minority students in higher education and the importance of mentoring programs in retaining these students in the academy. This study examines the perceptions of mentoring and actual mentoring experiences of minority students participating in two Summer Research Opportunity Programs (SROPs) at Iowa State University. Seven mentoring functions (Clarity of Project, Challenging Assignment, Training, Contact, Assistance, Feedback and Role Modeling) were identified through the literature as being important in the mentoring relationship. Findings indicated that the students' mentoring experience was better than expected, but students also noted that mentors should devote more attention to the Clarity of Project, Training, Contact and Role Modeling functions. The findings of this study reinforce the importance of mentoring in SROPs. Implications for practice and recommendations for future research are also discussed.

Introduction

A major component of many Summer Research Opportunity Programs (SROPs) is the role of mentors (Gaffney, 1995; Kinkead, 2003). Under the guidance of a mentor, undergraduate research is seen as a scholarly activity that helps to promote scientific inquiry, experiential learning, scholarship, career development among other functions (Kinkead, 2003). Currently more attention is being paid to the mentoring that takes place for undergraduates as a way to recruit and increase retention levels of minority students in various fields; and as a tool of enrichment of the overall undergraduate experience (Jacobi, 1991).

Mentoring is a key component of most SROPs, especially programs that are aimed at increasing the presence of women and minority students in, science, technology, engineering, agriculture, and mathematics (STEAM) fields. Historically, women and minority students have not been exposed to STEAM fields as the choice of a major in college, and as a career to pursue upon graduation (Gale, 2002; Lease, 2004). There is substantial underrepresentation of minority students in STEAM and other technical fields which can be attributed to several factors, one being the lack of mentors that minority students see in these fields where traditionally there has been little representation of minorities (Gale, 2002; Lease, 2004). The majority of students that participate in SROPs happen to be students from minority serving institutions, and it is through SROPs that these students are exposed to more educational and career opportunities that they otherwise might not have known existed (Crawford et al., 1996). Because of the low rate at which minority students enter graduate school and pursue advanced

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degrees, several authors have examined the impact of mentoring on their educational and career goals (see Crawford et al., 1996; Tenenbaum et al., 2001; Thomas et al., 2007). These studies have documented an increase in retention and persistence among minority students to pursue advanced degrees, and remain in the academy when mentoring is made available to them as compared to students who may not have had a mentor (Crawford et al., 1996). Several benefits have been attributed to the mentoring of undergraduates including the enhancement of the educational experience and providing guidance related to career options (Chopin, 2002; Lopatto, 2007). Undergraduates who have an opportunity to participate in research with a faculty mentor are able to take the theory that they have learned or read about and put it into practice, as well as to reflect on the positive and negative aspects of the experience. Through this process, students are able to "do science," which entails being able to understand a research problem and determining what is needed to address the problem (Kardash, 2000).

Lease (2004) suggests that African Americans and other minority students usually have less information about educational and vocational options because they may not have been exposed to these opportunities, or had a mentor or role model to guide them in that process. Because of the lack of knowledge that these groups possess regarding various careers, mentoring is vital to the students' professional development (Thomas et al., 2007). The mentoring function in SROPs serves to guide the minority students that participate in them in an exploration of careers, and providing a "road map" to these careers through mentoring, and various activities that coordinators may plan for students (Lopatto, 2004). It is through the mentoring process that students are able to begin developing a career path as to what they may want to do with their lives upon graduating from their undergraduate institution. Career development has a broader meaning outside of solely choosing an occupation, and extends also into furthering educational goals. The interaction experienced with a mentor during a undergraduate research experience is extremely vital in the decision making process of deciding to stay in a particular field as an occupation, or to pursue graduate studies in a field (Crawford et al., 1996; Haring, 1999; Lopatto, 2007). The idea of the mentoring process through these experiences is that the student and mentor will develop a relationship where the student can go to the mentor for advice, and possibly model the career path of the mentor.

For this study, the researchers examined two SROPs at Iowa State University (ISU). Currently there are two SROPs at ISU that aim to increase the presence of minority students in the STEAM fields. First, the George Washington Carver Internship Program (GWCIP) works to increase the presence of minority students in the agricultural and life science fields, while the Alliance for Graduate Education and the Professoriate (AGEP) which is funded through the National Science Foundation (NSF) aims to increase the minority presence in the science, technology, engineering and mathematic fields. Both of these SROPs utilize a mentor/student pairing process to acclimate students to the various research settings. In both of these SROPs, students work on research projects under the guidance of a faculty mentor to produce a project that is presented at a closing symposium.

There is a particular urgency in higher education to increase the number of minority students receiving advanced degrees (Foertsch et al., 2000), and to avoid further attrition of minority students, the federal government as well as institutions of higher education are promoting a wide array of programs aimed at recruiting and retaining these students in academia (Campbell and Campbell, 1997; Jacobi, 1991). It is through the mentoring process in SROPs undergraduate students are being prepared for a future in academia, a career in their chosen discipline, or for graduate school. To date there have been few attempts to understand the perceptions and experiences of minority students participating in SROPs.

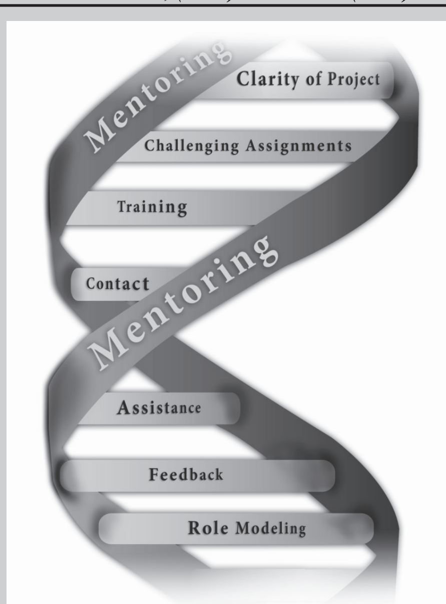
Even with governmental and institutional support of SROPs there has been little research examining the mentoring experience of minority students. Furthermore, there has been practically no research done to empirically establish various functions that should be practiced throughout the course of an undergraduate research mentoring relationship. As such, the overall goal of this study was to better understand the experiences minority students had while participating in an SROP so that improved mentoring practices could be implemented by program coordinators.

Conceptual Framework

Several studies have addressed the phenomena of mentoring, detailing various benefits, perceptions, experiences, and expectations of participating in undergraduate research (Bauer and Bennett, 2003; Lopatto, 2004; Nnadozie et al., 2001; Russell et al., 2007). However, few studies have empirically identified functions of a quality mentoring experience. Wunsch (1994) stated that "mentoring is a set of behaviors that can be defined, learned and practiced" (p.30). Based on a comprehensive review of the literature seven mentoring functions were identified which have been shown to be important in SROPs. These functions come from the work of Brzoska et al. (1987) who identified six functions essential to mentoring and Jacobi (1991) who after a review of mentoring literature identified 15 functions from various mentoring studies. Many of the functions that Brzoska cited were also cited by Jacobi, although there was one function that Jacobi cited that Brzoska did not include in his mentoring model. Isiyama (2007) provided two classifications where the mentoring functions are derived. The first of these classifications structure identifies functions of the mentoring and research experience "that contribute to the structures of the research problem or process" (p.541). The structure functions include: Clarity of Project, Challenging Assignment, and Training. The second classification of functions includes Consideration which "contributes to the emotional and social needs of the student" (p.541). The Consideration functions include: Contact, Assistance, Feedback and Role Modeling. Figure 1 provides an illustrative framework depicting the relationship between mentoring and the seven mentoring functions.

Clarity of Project is providing the student with clear and concise information as to which research project he or she will be working on. This should be done to ensure that the student and the mentor know what research activities will be performed. Often, students arrive on campus for their SROP experience with limited knowledge with many having no idea of the details of their research project. Some mentors may have more than one student working in their lab during the summer, so it is important for the mentor to have the various projects that students are working on clarified. Providing a clear idea of what research is to be conducted will allow for a better match of mentor and student.

Figure 1. Mentoring functions adapted from Brzoska et al., (1987) and Jacobi (1991).



Challenging Assignments include providing the student with a task that adds to their knowledge base and skill set. Challenging Assignments are necessary because often a student may be engaged in an activity that doesn't contribute to the intellectual growth of the student. The assignment should not be impossible, but challenge the student so that they make intellectual gains (Kardash, 2000). Students are taking part in this experience to prove to themselves that they can conduct research and to see if the possibility of graduate school or a life of research is for them (Lopatto, 2004).

Training is providing the student with any technical or specialty training that he or she receives toward the completion of the research project. This function is important because many students who participate in SROPs may have little to no experience of being in a lab or research environment (Kardash, 2000). If students are working on a project in their field of study, the training they receive shows them how theory is practiced. Gonzalez (2001) suggests that "the primary mission of the research university is not merely carrying out research but training students to do research" (p.1624). The training mentors engage in with a student will be more than just technical training. Some students may come from an institution that does not emphasize research. In this instance, the mentor will have to train the student how to perform a review of literature and other skills that are associated with scientific writing.

Contact includes the interaction that occurs between the mentor and student. The contact that a student has with his or her mentor is very important to the success of the project and mentor relationship. The Contact function consists of two sub-functions. The first sub-function is formal contact and the second is informal contact. Both types of contact help develop the bond that the mentor and student have. Formal contact can be described as contact that takes place between a mentor and a student in a structured environment. Informal contact takes place outside of the structured environment of the lab, such as during lunch, or if the mentor invites the student to his or her house for dinner (Wolfe, 2006). These interactions between the mentor and student are vital to the success of the project and to the success of the mentoring relationship.

Assistance is providing the necessary help that a student may need in completing a research project. The Assistance that is given to students in a mentoring relationship is in the form of direct or indirect assistance as well as through advice. Often, a student has more indirect assistance rather than direct assistance because in some settings the mentor may not be available to the student at all times. Often, a graduate student, lab assistant or post-doc will work more closely with the student and approach the faculty mentor when a problem has been encountered that he or she are not able to answer. Some level of direct assistance is needed even if it is just a brief meeting to check on the progress being made on the project by the student.

Feedback is a three step process which should include a pre-conference, observation, and post-observation conference (Brzoska et al., 1987). The feedback that a student receives from his or her mentor is vital to the success to the project (Wolfe, 2006). If a mentor is not providing feedback at key times of the project, several negative outcomes may occur in the relationship between the mentor and student. For example, the student may believe that he or she are headed in the right direction with the research, but come to find out the mentor may want to pursue other research goals.

Role Modeling in research settings should consist of helping the student develop professionally (Davidson and Foster-Johnson, 2001; Wolfe, 2006). The overall concept of Role Modeling is to show the student the quality traits of a good researcher. For example, if the project results in a manuscript that is suitable for publication, the mentor should help the student identify which journal the study would best fit in and help him or her prepare it for submission.

Purpose

The purpose of this study was to explore the mentoring perceptions and experiences of Summer Research Opportunity Program participants. The specific objectives of this study were to:

1. Identify the mentoring experiences of Summer Research Opportunity Program participants.
2. Identify the extent to which the seven mentoring functions were practiced by mentors in Summer Research Opportunity Programs.

Methods

Participants

The population of this study was comprised of students who participated in either the George Washington Carver Internship Program (GWCIP) (n=34) or the Alliance for Graduate Education and the Professoriate (AGEP) (n=44) at Iowa State University during the summers of 2006 thru 2008. The final sample consisted of 26 (68%) females and 12 (32%) males. Thirty (79%) of respondents identified themselves as African American or Black; 4 (10%) identified themselves as Latin/Hispanic; 2 (5%) identified themselves as Asian/Pacific Islander; 1 (3%) was Native American/American Indian and 1 (3%) identified themselves as ‘other’. Twenty-three (60%) of the students indicated they participated in the AGEP, while 15 (40%) of the students participated in the GWCIP. Thirty-two (89%) of the students identified themselves as having a major in a STEAM disciplines (e.g. computer science, agricultural education, biology, electrical engineering, etc.), while four (11%) students majored in non-STEAM majors (e.g. physical education, human sciences, education).

Research Procedures

This study used a descriptive survey design. Iowa State University’s Institutional Review Board approved the study protocol and all participants provided informed consent prior to participation in the study. The researcher used SurveyMonkey to collect data, and track respondents and non-respondents. Data were collected using the five contact steps recommended for achieving high response rates (Dillman, 2000) which included: 1) a pre-notice email, 2) the questionnaire, 3) a thank you note/reminder email, 4) replacement questionnaire and 5) a final contact. Seventy-eight questionnaires were emailed with 42 of the students responding for a response rate of 54%. The questionnaire used for this study was adapted from several studies that have measured the perceptions of the mentoring process and the satisfaction level of the mentoring process. After a review of relevant mentoring literature, instruments used by Allen (1997), Gale (2002), Lopatto (2004), and Wolfe (2006) were modified for use in this study. Participants were asked to select the most appropriate response from multiple choice or fill-in-blank items. To assess validity, the instrument was given to a panel of experts that included three faculty members from a Department of Agricultural Education and Studies at ISU. Cronbach’s alpha was used to assess the questionnaire for reliability. Internal consistency reliabilities for the perceptions of mentoring and personal mentoring experiences sections of the questionnaire were .97 and .95 respectively. The first section of the questionnaire focused on identifying the student’s initial perceptions of mentoring. This section consisted of 37 statements that assessed the extent to which the student believed selected mentoring functions should be practiced. This section utilized a four-point Likert-type scale ranging from (1= strongly disagree to 4= strongly agree). Section two focused on the actual mentoring experience of the student and to what extent selected mentoring functions were practiced. Similar to section one, 37 statements were used to measure the mentoring experiences and the extent to which the mentoring functions were practiced. Section two utilized a four-point Likert-type scale ranging from (1= strongly disagree to 4= strongly agree). Section two had four additional questions that also measured how the mentoring functions were practiced. These four questions were multiple-choice in nature. The questionnaire also utilized open-ended questions used by Allen (1997) that were modified to ascertain the students' level satisfaction with the mentoring program.

Because the participants of this study represented a specialized population no sampling techniques were used (Gale, 2002). Descriptive statistics including frequencies, means, percentages, and standard deviations were used to describe the extent to which mentoring functions were being practiced by mentors. Paired t-test analyses were used to compare the students' initial perception of mentoring with that of their actual mentoring experience.

Results

Objective 1: Identify the mentoring experiences of Summer Research Opportunity Participants.

Students were asked to rate their mentoring experience with a majority (76% collectively) indicating that their experience was much better than expected (Table 1). Students were also asked to rate their overall mentoring experience. Collectively, 73% of the students rated their mentoring experience as positive to very positive (Table 2).

Table 1. Students Rating of their Mentoring Experience (N=42)

The mentoring experience…..

Response	*f*	%
Was worse than I expected	2	5
Was a little worse than expected	7	19
Met my expectations	10	27
Was a little better than I expected	4	11
Was much better than I expected	14	38
Total	37	100

[1]*Note.* Not all responses equal 42 due to non-respondents.

Table 2. Students Overall Rating of Mentoring Experience (N=42)

Response	*f*	%
Very negative	2	5
Negative	1	3
Neutral	7	19
Positive	11	30
Very positive	16	43
Total	37	100

[1]*Note.* Not all responses equal 42 due to non-respondents.

Objective 2: Identify the extent mentoring functions practiced by mentors in the Summer Research Opportunity Programs. Students were asked to identify the extent they agreed with statements measuring selected mentoring functions. The functions of interest included: Clarity of Project, Challenging Assignment, Training, Contact, Assistance, Feedback, and Role Modeling. The challenging Assignment function had the highest mean value (M= 3.57, SD= .52) while the Training function had the lowest mean value (M= 3.12, SD= .47) (Table 3). Students were also asked to indicate the extent they agreed with statements measuring the mentoring functions during their SROP experience. The Challenging Assignment function had the highest mean value (M= 3.37, SD= .60) while the Training function had the lowest mean value (M= 2.77, SD= .67) (Table 4). A paired sample t-test was conducted to compare the means of the mentoring functions (Table 5). The mean differences for each function were all significant (p<.05) indicating a difference between a students' initial perception of mentoring and the actual mentoring that took place. Cohen's d was calculated to determine the magnitude of the mean difference. The observed effect sizes ranged from .61 to 1.58 indicating a medium to strong effect size. Both of these observed effect sizes indicate that the differences were practically significant.

Table 3. Means and Standard Deviations of the Perception of Mentoring Functions (N=42)

Mentoring Function	n	M	SD
Clarity of Project	42	3.28	.59
Challenging Assignment	40	3.57	.52
Training	40	3.12	.47
Contact	42	3.48	.63
Assistance	41	3.36	.52
Feedback	41	3.39	.53
Role Modeling	39	3.34	.68

[1]*Note.* Not all responses equal 42 due to non-respondents.
Scale: 1= Strongly Disagree, 2= Disagree, 3= Agree, and 4= Strongly Agree

Table 4. Means and Standard Deviations of Extent Mentoring Functions Were Practiced With Students (N=42)

Mentoring Function	*n*	*M*	*SD*
Clarity of Project	36	2.80	.50
Challenging Assignment	37	3.37	.60
Training	35	2.77	.67
Contact	36	2.95	.51
Assistance	37	3.08	.64
Feedback	35	3.04	.74
Role Modeling	38	2.90	.75

[1]*Note.* Not all responses equal 42 due to non-respondents.
Scale: 1= Strongly Disagree, 2= Disagree, 3= Agree, and 4= Strongly Agree

Discussion

For this study, we sought to explore the mentoring perceptions and experiences of SROP participants. We

Table 5. Paired Samples T-test Results between Students' Perceived and Experienced Functions (N=42)

Mentoring Function	*N*	*M*	*SD*	*t*	*d*
Clarity of Project-Perception	36	3.42	.37	7.54*	1.41
Clarity of Project-Experience	36	2.80	.50		
Challenging Assignment-Perception	37	3.67	.35	3.31*	.61
Challenging Assignment-Experience	37	3.37	.61		
Training-Perception	34	3.22	.39	3.50*	.86
Training-Experience	34	2.75	.67		
Contact-Perception	36	3.62	.30	7.34*	1.58
Contact-Experience	36	2.96	.52		
Assistance-Perception	37	3.46	.35	4.26*	.74
Assistance-Experience	37	3.08	.64		
Feedback-Perception	35	3.49	.35	3.71*	.76
Feedback-Experience	35	3.05	.74		
Role Modeling-Perception	36	3.49	.39	5.47*	1.03
Role Modeling-Experience	36	2.87	.76		

[1]*Note.* Not all responses equal 42 due to non-respondents.
[2]**P=0.05*

found that a majority of the SROP participants rated their mentoring experience as positive and meeting or exceeding their expectations which supports the work of Lopatto (2007) who also found that the mentoring relationship plays an important role in the undergraduate research experience. This finding is important because it implies that the mentors were engaged with their students and provided a positive mentoring experience included offered psychosocial (e.g., psychological or social support) and instrumental support (e.g., professional and career advice) (Davidson and Johnson, 2001). At the undergraduate level, this type of information is critical in helping students prepare and apply for graduate school and ultimately determining whether or not minority students continue in the STE[A]M pathway (NRC, 2011). Not only did the SROP participants indicate that they perceived Challenging Assignments as the most important mentoring function but they also indicated that this mentoring function was actually being practiced by their mentors. This finding suggests that the SROP participants want to be given Challenging Assignments, in addition to the fact that their mentors were providing them with assignments that challenge them throughout the course of the research experience. The notion of providing challenging work assignments is also important in helping to prepare minority students for the rigors of STEAM majors and careers.

There were also differences between the students' initial perception of mentoring and the actual mentoring that took place across all of mentoring functions. The largest differences observed between the students' initial perception and the extent to which the mentoring functions were being practiced occurred among Clarity of Project, Contact, and Role Modeling. To clarify, Clarity of Project involves providing the student with clear and concise information as to which research project they will be working on and should be done to ensure that the mentor and student are in agreement on what will be done during the project. Contact refers to the number and level of interaction that occurs between the mentor and student. The interactions experienced by the student and mentor are vital to the success of the project and to the success of the mentoring relationship. Finally, Role Modeling consists of helping the student to develop a professional identify. In this study, SROP participants perceived that these functions should be practiced, however, the extent to which they were practiced by the mentor occurred less often. Interestingly, the functions identified based on the largest differences between the students' initial perception of mentoring and the actual mentoring that took place support what Jacobi (1991) refers to as the foundational elements of mentoring which include: 1) emotional and psychological support, 2) direct assistance with career and professional development, and 3) role modeling.

Limitations

Our findings should be considered in light of the study's limitations. First, is the issue of generalizability. This study had a relatively small sample size, additionally; students were not randomly selected to participate in the SROP programs. Another limitation is the lack of a diverse sample of minority students. A majority of our sample was comprised of African-American students and thus would have been enhanced if a larger sample of students from other racial and ethnic groups were included. Finally, the instrument that was used to assess the perceptions and satisfaction levels of the mentoring process were adapted from other survey measures. Hence, the lack of previously established validity and reliability estimates leads to the possibility of introducing the threat of measurement error.

Implications for Practice

The findings of this study have implications for improving the mentoring process of minority undergraduate research interns. Our findings point to the promise of the seven-mentoring function as one approach of helping to facilitate the mentoring of minority students participating in SROPs. Because of the differences that were observed between the students' initial perception of mentoring and the actual mentoring that took place; it may benefit program coordinators of SROPs to explain the role and importance of the seven mentoring functions during mentor orientations in order to ensure that mentors provide the best possible mentoring experience to their students. Also implied is the idea that SROP coordinators should encourage mentors and students to develop a formal agreement that would outline what should be expected from both the mentor and student. This will allow both parties to understand what should occur throughout the mentoring relationship which introduces another level of accountability. Further implied from the findings is the notion that SROP coordinators in concert with the mentors should develop a standard definition of mentoring that is tied closely to the seven mentoring functions which could also be used to guide the mentoring relationship. Taken together, these improvements to the mentoring process may have a positive impact on the mentoring relationship (Wolfe, 2008).

Recommendations for Future Research

The findings of this research point to several important directions for future research related to the mentoring of minority undergraduate research interns. First, a study should be conducted using the seven-function mentoring questionnaire with mentors of other SROP programs to assess their perception of mentoring and the extent that the seven mentoring functions identified in this study are practiced. A study of this nature would provide information that could be used to identify gaps in current mentoring practices. This information could also be used as baseline data to help refine the current mentoring practices being used by SROP programs. Second, a qualitative study should be conducted to obtain a more rich understanding of the extent to which mentors are practicing the seven mentoring functions as well as to examine how the mentoring in SROPs could be enhanced from the student's perspective. This would provide a more in-depth understanding of the student's mentoring experience, which would ultimately help enhance the mentoring relationship. A study should also be conducted comparing mentors who have been trained to use the seven mentoring functions with mentors who have not been trained to use this approach. This approach would allow researchers to better assess the efficacy of the seven-function mentoring model with minority students participating in SROPs. Finally, although many types of undergraduate research experiences fuel interest in STE[A]M careers and higher degrees (Russell et al., 2007), another area of research to explore would be to assess the long-term impact of the seven-function mentoring model on minority students' persistence in STEAM majors and careers.

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Appraisal of Critical Thinking Skills in Animal Science Undergraduates who Participated on a Nationally Competitive Collegiate Judging Team

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Abstract

Evaluation courses have remained an integral part of collegiate animal science programs throughout the country and are a precursor for a national judging team. An evaluation course focuses on teaching students general accepted criteria for evaluating a particular animal, industry standards and rules to compare multiple animals, and emphasizes students being able to defend their judgments both written and orally. These skills are necessary for building well-rounded graduates. Participation on a judging team has been associated with developing problem solving and decision making, employer preferred life skills (Boyd et al., 1992; Rusk et al., 2002). Eight students in the Department of Animal and Veterinary Sciences at Clemson University took a standardized critical thinking exam. Four of the students had never taken an evaluation course or competed on a judging team (N) and the remaining four had taken an evaluation course and competed on a national judging team (J). All students were similar in regards to age, gender, classification and GPA. Because of the low sample size, and lack of a pretest, the tentative conclusion that we can draw from this exercise is that students who have participated in national horse judging contests subsequently demonstrate a higher level of critical thinking ability.

Introduction

It is imperative that college of agriculture graduates seeking employment possess a balanced combination of base knowledge and independent thought combined with critical thinking ability. Recent advances and restructuring of the workplace has increased emphasis on teamwork. Not only are employees expected to think creatively, solve problems, and make decisions, they are expected to perform as part of a team (Gokhale, 1995). Gokhale (1995) describes critical thinking attributes as analysis, synthesis, and evaluation of concepts. Previous research shows that senior students in a college of agriculture scored lowest on a critical thinking ability construct in comparison to basic cognitive ability and applications ability constructs (Torres and Cano, 1995). Many students are graduating with less than adequate cognitive skills that are vital to solve problems and make decisions (Torres and Cano, 1995). The college experience must prepare graduates for the experiences that lie ahead, which includes thinking critically, individually, and as a member of a team.

Participation on a horse judging team exposes a student to analytical and critical thinking, judgment, and written and oral communication skills. Students first learn general judging criteria for a particular breed. Students are taught conformation and performance standards, practice evaluating multiple animals against the breed standard, then rank the animals in order of best fit to the ideal. Students utilize known criteria to critically and independently evaluate classes, and develop written and oral justification (reasons) for judgments. Students learn to develop reasons for their assessment and give the justification to a professional in an oral presentation format. In relation to higher orders of cognition described by Bloom et al. (1956),

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participation on a judging team involves a significant amount of critical thinking: application of criteria for evaluating animals, analysis of individual classes, synthesis of criteria, and evaluation of multiple disciplines. Logically, it makes sense that an activity utilizing higher order thinking would produce a student better equipped to handle thinking critically. Researchers (Gokhale, 1995) studied individual and group exercise outcomes and concluded that students who participated in collaborative learning as a team performed significantly (P=0.001) higher on a critical thinking test. Further, students participating in collaborative learning indicated that participation as a group stimulated thinking and facilitated understanding.

Using the Watson Glaser Critical Thinking Appraisal exam (WGCTA), researchers in Missouri (Shann et al., 2006) examined critical thinking ability of undergraduate students (n=63) enrolled in a live animal and meat evaluation course. Students were given either form A or form B on the first class day (pretest) and again on the last class day (posttest); students that received form A initially received form B for the posttest, and vice versa. Course work included 16 weeks of instruction in animal anatomy; live animal evaluation and pricing; carcass grading; carcass pricing; and ranking philosophies for beef, pork, and lamb. Researchers observed an improvement in students average WGCTA score from the first to the last class day (39.9 and 55.5, respectively).

Little research has looked specifically at the relationship of judging teams and their ability to foster critical thinking processes. The objective of this study, therefore, was to quantify the critical thinking ability of students who have previously competed on an equine evaluation team and compare them to similar students who have not previously been a part of an animal evaluation team.

Materials and Methods

This study attempted to quantify the level of critical thinking ability in students who had previously participated on a national-level competitive judging team, and determine if there was a difference when compared to students who had not previously had evaluation training. The null hypothesis stated that students who had previously participated on an evaluation team scored the same on a critical thinking ability test as students who had no prior animal evaluation training. The alternative hypotheses stated that students who had prior evaluation experience scored differently on a critical thinking ability test than students who had no prior evaluation experience.

The experimental design is:

$$X\ O^1$$

_ _ _ _ _

$$O^2$$

"O^1" represents the students participating in the animal evaluation experience, "X" is the treatment which occurred on a volunteer basis (judging team experience), and "O^2" is the student group who did not receive the treatment.

Table 1. Self-reported Demographic Information for (J) Judging Team Members and (N) Control Group of Students

Student	Classification	Age Range	GPA	Gender
J 1	Junior	18-20	> 3.49	Male
J 2	Junior	21-24	2.5-2.99	Female
J 3	Junior	18-20	2.5-2.99	Female
J 4	Junior	21-24	> 3.49	Female
N 1	Junior	18-20	> 3.49	Male
N 2	Junior	21-24	2.5-2.99	Female
N 3	Junior	18-20	2.5-2.99	Female
N 4	Junior	21-24	> 3.49	Female

Population

Eight students in the Animal and Veterinary Sciences department at Clemson University participated in the project. Students (J) who competed on a national level at horse judging contests (n=4) and students (N) who had not competed on a judging team, or taken an evaluation course (n=4) were evaluated. Of the parameters listed in Figure 1, group N was identical to group J with regard to classification, age, GPA and gender. Demographic information for eight students is listed in Table 1. Group N students were identified from a pool of 83 students enrolled in one of three courses being used for an additional study in the Animal and Veterinary Sciences department at Clemson University. All testing and observation was approved by the Institutional Review Board (IRB) at Clemson University.

Instrumentation

Students filled out a questionnaire (Figure 1) designed to determine demographic information. This questionnaire was utilized to determine specific demographic information of the judging students and identified their peers whose demographic information was similar to them such that a comparison group could be made. The questionnaire identified characteristics of each student with respect to age, gender, classification, GPA, and previous judging experience. Each of these characteristics was self-reported by the student and therefore may not be completely accurate.

The Waston-Glaser Critical Thinking Appraisal (WGCTA) test, form A and B, from Harcourt Assessment provided means to objectively assess

Figure 1. Questionnaire for students taking the WGCTA exam.

Testing No.:

Please take your time to answer every question truthfully and to the best of your ability.

1. Please indicate your classification (according to known hours completed) by circling the appropriate response:
   Freshman   Sophomore   Junior   Senior
2. Please indicate your age by circling the appropriate range:
   18-20   21-24   >24
3. Please indicate your GPA by circling the appropriate range:
   < 1.5   1.5 – 2.09   2.1 – 2.49   2.5 – 2.99   3.0 – 3.49   > 3.49
4. Please indicate your gender by circling the correct response:
   Male   Female
5. Have you ever been involved in a judging program before (i.e.: 4-H, FFA, or evaluation class in college)?
   Yes   No

a student's critical thinking ability. The WGCTA provides an estimate of an individual's standing on a composite of attitude, knowledge, and skills by means of evaluating the student's ability to think critically in five categories; 1) Inference, 2) Recognition of Assumptions, 3) Deduction, 4) Interpretation, and 5) Evaluation of Arguments. Each category is weighted equally and the test is on an 80 point scale. The Inference section requires the test taker to discriminate among degrees of truth or falsity of inferences drawn from given data. Recognition of Assumptions requires the ability to recognize unstated assumptions or presuppositions in given statements or assertions. Deduction entails determining whether certain conclusions necessarily follow from information in given statements or premises. Interpretation consists of weighing evidence and deciding whether generalizations or conclusions based on the given data are warranted. Finally, Evaluation of Arguments distinguishes between arguments that are strong and relevant or weak and irrelevant. The components include problems, statements, arguments, and interpretations of data. All components are aimed at mimicking real-world situations one might encounter at work, school, or in newspaper and magazine articles. Validity and reliability have been established for the WGCTA by the respective authors with a reliability coefficient of 0.74 (Watson and Glaser, 1980). Watson and Glaser (1980) deem the exam credible to evaluate an individual student's critical think ability and compare the score to national averages. Another study that utilized the WGCTA for high school students (n=384) measured the WGCTA as yielding a reliability coefficient of 0.78 (Cano, 1993). Researchers in Texas found that the WGCTA exam remained reliable and consistent when given to undergraduate and graduate students (n=58) at Southwestern State University (Gadzella et al., 2005).

Collection

Four students who had previously participated on a nationally competitive horse judging team were identified by the judging team coach in the department of Animal and Veterinary Sciences. A concurrent study (n=83) was utilizing the WGCTA and the demographic questionnaire (Figure 1) in spring 2007. Of the 83 students tested in the alternate study, four were identified that matched the demographic characteristics of the judging students exactly, except for judging or evaluation experience (Figure 1). The four students (N) reported they had never received any animal evaluation training. Test scores from the N students involved in the additional study served as the control group with which to compare the J scores. Judging (J) students took the WGCTA on the two consecutive days that the non-judging (N) students took the WGCTA for the additional study.

Data analysis

All data were coded and analyzed using Microsoft Excel for Windows. Data were analyzed for mean and standard deviation of each category of the WGCTA and final score for both groups (J and N). Raw scores were then standardized and compared using a z-score. By standardizing scores, we can effectively distribute values around a mean of zero. The z-score allows us to compare the relative standings of values from distributions with different means. Each z-score corresponds to a point in a normal distribution and describes the deviation from the mean, or from another specific point. Final score means were compared to published national norms for college students (Watson and Glaser, 1980).

Results and Discussion

Many standardize tests regularly publish results from their broad base of test-takers with the intent of comparing scores. It is helpful to compare individual student scores and larger group scores to national averages to understand where the concerned party ranks. Group J scored higher when compared to national averages, scoring in the 60th percentile (mean=56.25) while group N scored in the 45th percentile (mean=53.5). Mean score for both groups was 54.9 ± 6.85. Z-scores for J and N were 0.197 and -0.204, respectively. This indicates that average scores for each group differed 40% of a standard deviation compared to the mean for both groups. The mean score for group J was higher than or equal to 57.8% of the individual student scores in both groups

Table 2. Mean WGCTA Scores for (J) Judging Team Members and (N) Control, including Standard Deviation and Z-score

	J	N
Inference	8.25	8.5
Recognition of Assumptions	12.5	8.75
Deduction	10.25	10.5
Interpretation	12.5	13.75
Evaluation of Arguments	12.75	12
Total score	**56.25**	**53.5**
Standard Deviation	**6.55**	**7.85**
Z-score	**0.197**	**-0.204**

and the mean for group N was higher than or equal to 41.9% of the individual student scores in both groups. Group J scored numerically higher than group N on the Recognition of Assumptions and Evaluations of Arguments portions of the WGCTA exam (12.5 vs. 8.75 and 12.75 vs. 12, respectively). All results are reported in Table 2.

Judging competitively at the collegiate level may increase critical thinking ability above peers who have not competed on a judging team. Tangible benefits of participation on a judging team are not well documented. Popular opinion is that students gain valuable skills in higher order thinking by being an active participant on an animal evaluation team, and research shows that participation in extra-curricular activities is beneficial to enhancing critical thinking ability (Gellin, 2003; Shann et al., 2006). However, more technically based science education is becoming commonplace, taking the place of hands-on experiences. While both are beneficial to the student, a clear interpretation of benefits derived from each is warranted. When asked what benefits were derived from their experience on a judging team, respondents indicated that their experience was most essential to the development of decision making and problem solving skills (Rusk et al., 2002). This study is limited by the small sample size. There were only a few students who had competed collegiately on a judging team available to take the exam. Regardless of the small sample size, these students are thought to be similar to other students who would choose to compete on a judging team. Likewise, students making up the control group (N) are believed to accurately represent animal science students. Judging teams typically involve a small number of students at any particular university and can be quite expensive to support; however, the benefits out-weigh the disadvantages.

Summary

Students participating on a competitive judging team demonstrate numerically higher critical thinking scores and score higher relative to national norms compared to their peers who have not previously had any animal evaluation training. Offering opportunities to students, including involvement on a competitive judging team, should be utilized and supported as an important aspect of higher education. Contributing to a student's knowledge by providing facts in a classroom is not enough; a student must be able to demonstrate understanding of concepts in hands-on projects, including intercollegiate competition (Kauffman et al., 1971). In order to produce students with critical thinking abilities, it is imperative to make opportunities available that will challenge them, thus creating an individual capable of independent thought and critical thinking; valuable skills for the workplace (Boyd et al., 1992). The WGCTA is an effective means to quantify critical thinking ability of students.

Conclusions and inferences drawn from this study may only apply to the limited data collected here. The study takes place utilizing eight students in a department of Animal and Veterinary Science at Clemson University.

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Perceptions of Agriculture and Perceived Enrollment Barriers to Agricultural Programs of Select Southern New Jersey High School Students

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Abstract

The purpose of this study was to assess the level of awareness of agricultural organizations and careers and perceived barriers to enrollment in agricultural programs of high school students in southern New Jersey. The students surveyed were selected based on teacher willingness to participate in the study. Therefore, the results are specific to this sample and should not be generalized to the larger population. The results showed the selected respondents were primarily female, white/Caucasian, lived in suburban areas, and had no family members involved in agriculture. Males were found to differ significantly from females in their awareness of outreach programs related to agriculture, and the same was found between whites and non-whites. The study also revealed that the selected respondents had a general lack of awareness in careers in agriculture. Three barriers emerged as the highest ranking barriers to enrollment in agriculture programs: lack of contact with program recruiters, interest in agriculture, and lack of opportunity while growing up to work on a farm. Males and females differed significantly in their perception of "image of agriculture barriers" and a significant difference was also found between whites and non-whites in their perception of "individual related barriers" to enrollment in agricultural programs.

Introduction

The significant decline in the number of agricultural education students has raised much concern in the last few decades (Mallory and Sommer, 1986; Scott and Lavergne, 2004; Wildman and Torres, 2001), while the opportunities in agriculture and agriculture-related careers are continuing to increase (Jones and Larke, 2001). The United States Department of Agriculture (USDA) estimates that between 2010 and 2015, there will be 54,400 annual employment openings for individuals with baccalaureate or higher degrees within the agriculture, food, and renewable natural resources sectors, creating a large demand for anticipated graduates with college degrees or related work experiences, (Goecker, et al., 2010). However, as opportunities in agriculture-related fields are continuing to expand, the number of individuals pursuing agricultural careers through college is steadily declining, especially within minority populations (Jones and Larke, 2001).

This decline can be attributed to many people having little agricultural knowledge due to large populations moving from rural farm areas to more urbanized areas, which supports the need for agricultural education in today's schools (Gibbs, 2005; Hughes and Barrick, 1993). Bricknell (1996) supported these views stating that "young people [reared] in urban centers and suburbia have little direct contact with agricultural lands and ways of life and thus know very little about where their food comes from and how it is produced" (p.107). Although more populations are continuing to move out of the cities, very few are moving to rural areas. As a result, there is still a gap in the knowledge and involvement in agriculture of these populations. For the populations remaining in urban areas, the gap is even larger and continuing to grow as more generations know less and less about agriculture.

Today, approximately 94% of public school students receive no formal in-school instruction regarding agriculture and natural resource systems (Talbert et al., 2007). Early development of agricultural literacy and exposure to opportunities should be implemented to broaden students' perceptions of agriculture (Scott and

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Lavergne, 2004). According to Powell, et al. (2008), agricultural literacy should be viewed as a driving force in the K-12 curriculum by thematically weaving agricultural materials through academic courses. Blackburn (1999) supported this view by stating that teaching agriculture to students at an earlier age may help develop a better understanding and perception of agriculture as students get older. With a higher level of knowledge and a more positive perception of agriculture, students may be more interested and encouraged to pursue a career in agriculture (Cannon, et al., 2009).

New Jersey, for example, currently has 39 agriculture programs offered at public middle schools (n = 2), public secondary schools (n = 17), and public vocational/technical schools (n = 20). Approximately 3,000 students in over 40 school districts are enrolled in agriculture education programs throughout the state (New Jersey Department of Agriculture [NJDA], 2010). Southern New Jersey specifically (which includes Atlantic, Burlington, Camden, Cape May, Cumberland, Gloucester, and Salem counties), has 79 public secondary schools. Out of these 79 public schools, only nine schools offer an agriculture program (New Jersey Department of Education [NJDOE], 2010). Therefore, there are a large number of students attending public schools in southern New Jersey who do not have the opportunity to learn about agriculture and are also less likely to be introduced to agriculture in an academic setting. To address this issue, New Jersey, along with other states, must provide students with greater exposure and access to agriculture programs (NJDA, 2000), agriculture courses (elective options), and/or agriculture related coursework.

Exposure to agricultural practices has been found to have an important influence on enrollment behaviors and career choices (Mallory and Sommer, 1986). Wildman and Torres (2001) found that prior experiences in agriculture provided a strong positive influence on student enrollment into agricultural programs. Introducing students to agriculture through programs such as the USDA's agricultural literacy initiative, Agriculture in the Classroom (Talbert et al., 2007), and Ag Science Fairs, can serve as vehicles for students to learn about agriculture (Blackburn, 1999; Cannon, et al., 2009; National Research Council, 1992).

Another important issue to be addressed in agri-science education is how to increase the level of awareness of career opportunities in agriculture (Wildman and Torres, 2001). Due to the lack of adequate information, many students are unaware of the wide variety of employment opportunities within agriculture-related fields (Mallory and Sommer, 1986). One of the major obstacles found in encouraging students to pursue careers in agriculture is the negative perception of the quality of work and potential of success (financial reward) in agricultural fields (Mallory and Sommer, 1986). Through their study, Jones and Larke (2001) found that students chose careers in other fields unrelated to agriculture after experiencing limited employment opportunities within fields of agriculture that suited their "ideal" career. Therefore, students need to be aware of career fields within the agricultural industry, such as biotechnology, microbiology, veterinary science, agribusiness, management, landscape design, food science, etc. (Jackson and Williams, 2003).

Each of the issues mentioned above can contribute as potential barriers to enrollment in high school and college agriculture programs. For example, although New Jersey's agriculture ranks third in the state's economic importance (New Jersey Agricultural Society [NJAS], 2010), as previously stated, only 39 secondary agriculture programs are offered throughout the state and unfortunately, only nine of those are offered in southern New Jersey (NJDA, 2010). As a result, various factors can negatively influence students in these areas from enrolling in colleges of agriculture due to a lack of knowledge and misinformation. Secondary educators and colleges of agriculture must identify these various factors that may pose as barriers to enrollment and develop recruitment strategies that focus on these factors (Jones, 1997; Jones and Larke, 2001).

This study was guided by addressing the following research questions:

1. What are the demographic characteristics of the students in select high schools in southern New Jersey?

2. Are there any differences in the level of student awareness from selected high schools of agricultural related programs/organizations by gender, race/ethnicity, family involvement in agriculture, and residential area?

3. Are there any differences in the level of student awareness from selected high schools of career opportunities in agriculture and related fields by gender, race/ethnicity, family involvement in agriculture, and residential area?

4. What are the students' from selected high schools perceived barriers to enrollment in agricultural programs and are there any differences by gender, race/ethnicity, family involvement, and residential area?

Methods and Materials

This study addressed the research questions using a descriptive-correlational research methodology (Smith-Hollins, 2009). The population for this study consisted of currently enrolled students in southern New Jersey public high schools' 11th grade and 12th grade classes. The researcher used a purposive sample that consisted of high schools within school districts that granted approval for their students to participate in the study. This sample was also chosen due to time constraints, geographic convenience, and allowed for more efficient use of limited financial resources for the study. Therefore, results of this study are specific to this sample and should not be generalized to the larger population.

The sample consisted of three high schools: two in Camden County and one in Gloucester County, New Jersey. Individual classes in the 11th and 12th grades were chosen based upon teacher participation. The final sample resulted in two classes from Timber Creek Regional High School (Camden County), four classes from Triton Regional High School (Camden County), and two classes from Washington Township High School (Gloucester County). Timber Creek Regional High School has an enrollment of 1,434 students, with 375 students in 11th grade and 313 students in 12th grade (NJDOE, 2010a); Triton Regional High School has an enrollment of 1,652 students with 380 students in 11th grade and 409 students in 12th grade (NJDOE, 2010b); and Washington Township High School has an enrollment of 2,773.5 students with 659 students in 11th grade and 706.5 students in 12th grade (NJDOE, 2011). All three schools are located within primarily suburban areas in very close proximity to urban areas as well as rural areas. None of the three schools offer an Agricultural Program or agricultural courses. All students in attendance within each class who received parental consent were invited to participate in the study ($n = 174$). The final instrument was reviewed and cleared by The Pennsylvania State University Institution Review Board and all students were provided with parental consent/child assent forms prior to being permitted to complete the instrument.

The data were gathered from the participants using a multi-part instrument adapted from a previously developed instrument to assess the perceptions of underserved populations about agriculture (Smith-Hollins and Baggett, 2007). The original instrument used in this study developed by Smith-Hollins (2009) was reviewed by a panel of experts that consisted of five faculty members and two graduate students in the Department of Agricultural and Extension Education at The Pennsylvania State University. The panel of experts reviewed the instrument to establish content and face validity. Smith-Hollins (2009) obtained acceptable Cronbach's alpha scores for each major subsection of the instrument. The survey instrument was then modified based upon the review of literature and the level of education of the respondents for this study. Part one consisted of 15 statements that sought to assess Awareness of Agriculture-related Programs/Organizations. This section was measured using a 6-point Likert-type scale ranging from 1 = Completely Unaware to 6 = Completely Aware.

Part two consisted of 17 statements that sought to assess Awareness of Career Opportunities in agriculture. This section was modified by omitting, adding, and adjusting the names of specific agricultural careers to reflect the knowledge level of secondary education students. The researcher utilized the same 6-point Likert-type scale from part one for this Awareness of Career Opportunities section.

Part three consisted of 13 statements that sought to assess perceived Barriers to Enrollment to high school and college programs in agriculture. This Barriers to Enrollment section used a five-point Likert-type scale ranging from 1 = Not at all a Barrier to 5 = Very Much a Barrier. It was also modified from the original instrument with the addition of an "Other" choice for the selected respondents to identify any factors they perceive to be enrollment barriers in agricultural programs not included in the original list of 13 statements. The results were used to rank the barriers as perceived by the selected students and analyzed between the independent variables in the same manner as sections one and two.

Part four regarding demographic characteristics of respondents consisted of eight multiple choice and open-ended-type response questions and was also modified to better serve secondary school respondents. Five multiple choice questions sought to identify general demographic information about the selected students (gender, race/ethnicity, age, residential area, and academic classification). The remaining three open-ended-type response questions sought to identify the selected students' academic interests and experiences (favorite subject, college plans and intended major, and any family involvement in agriculture).

The completed instruments were coded and analyzed using the Statistical Package for the Social Sciences (SPSS, v. 19.0, 2010) for Windows provided by The Pennsylvania State University. Descriptive statistics (frequency distributions, means, and standard deviations) were used to analyze the data. The data were further analyzed using the independent sample

Table 1. Frequency, Mean, and Standard Deviation for Selected Students' Awareness of Agriculture

Related Programs/Organizations	n[z]	Mean	SD[y]
Awareness of Natural Resources			
Fishing	89	4.9	1.2
Hunting	89	4.7	1.4
Overall Mean		4.8	
Awareness of Community Outreach Programs			
Expanded Food and Nutrition Education Program (EFNEP)	81	2.3	1.4
National FFA Organization	80	2.3	1.5
High School Agriculture Program	81	3.4	1.7
Minorities in Agriculture, Natural Resources and Related Sciences (MANRRS)	81	2.4	1.5
Overall Mean		2.3	
Awareness of Youth Education			
4-H	79	2.1	1.6
Cooperative Extension	78	1.7	1.1
Overall Mean		1.9	
Awareness of Nationally Recognized Agriculture Programs			
State/National Parks	86	4.6	1.6
United States Department of Agriculture (USDA)	86	3.9	1.6
United States Environmental Protection Agency (EPA)	85	3.8	1.7
Overall Mean		4.1	

Note. Scale: 1=completely unaware, 2=unaware, 3=slightly unaware, 4=slightly aware, 5=aware, and 6=completely aware.

[z]n=number (frequency) of respondents;

[y]SD=standard deviation.

Selected high school students' age 16-19, southern New Jersey, 2011.

Table 2. Independent t-Test Results for Awareness of Programs/Organizations by Gender

Awareness Factor by Gender	n[z]	Mean[†]	SD[y]	t[x]	p[w]
Awareness of Natural Resources					
Male	14	-.12	.66	-.52	.61
Female	45	.03	1.10		
Total	59				
Awareness of Youth Education Programs					
Male	14	.43	1.10	1.10	.06
Female	45	-.14	.95		
Total	59				
Awareness of Community Outreach Programs					
Male	14	-.48	.88	-2.10	.04*
Female	45	-.03	.97		
Total	59				
Awareness of Nationally Recognized Agriculture Programs					
Male	14	.08	1.1	.36	.72
Female	45	-.03	.97		
Total	59				

Note. Scale: 1=completely unaware, 2=unaware, 3=slightly unaware, 4=slightly aware, 5=aware, and 6=completely aware. Selected high school students age 16-19, southern New Jersey, 2011.

*p< .05, two-tailed independent t-test.

[z]n=number (frequency) of respondents.

[y]SD=standard deviation.

[x]t= statistical difference.

[w]p=probability (significant difference).

[†]Mean scores were calculated based upon the results of the Principal Component Analysis results instead of the raw data to obtain a more precise measurement of differences between the independent variables.

t-test to evaluate the independent variables: gender, race/ethnicity, and family involvement in agriculture. Given that the dependent variables were measured on an interval scale, nonparametric statistics were necessary to analyze the data (Wadsworth Cengage Learning, 2005). Analysis of variance (ANOVA) was also used to compare the multiple mean scores of scales computed by factor analysis for residential areas (Smith-Hollins, 2009). The ANOVA statistic was used to compare the mean scores among four factors generated through factor analysis (via direction from The Pennsylvania State University Statistical Consulting Center). Significant differences were pre-set at $p < .05$ based on a 95% confidence interval. Mean scores were calculated based upon the results of the Principal Component Analysis (PCA), (DeCoster, 1998) instead of the raw data to obtain a more precise measurement of differences among the independent variables. PCA was used to reduce the number of variables into smaller scales based on the pattern and strength of the relationship between each variable and each observed measure (DeCoster, 1998). Reducing the variables into a smaller subset of scales simplified the data to be used for further analysis (Smith-Hollins, 2009).

Results and Discussion

There were 89 students who completed the survey instrument, yielding a 51.1% response rate (n=174). The majority of respondents were female (68.5%), white/Caucasian (70.8%), and live/lived in a suburban residential area for the majority of their lives (77.5%). The race/ethnicity demographics of the selected respondents were found to be comparatively representative of the population of Camden County and Gloucester County where the schools were located, according to the United State Census Bureau (2010). These demographic characteristics were also consistent with the demographic characteristics found in the original study (Smith-Hollins, 2009) as well as the studies of Balschweid (2002) and Esters and Bowen (2005). The majority of the academic classifications of the respondents were juniors at 64.8% and with 33.0% being seniors. Family involvement in agriculture differed from the original study; the majority of students responded "no" (71.9%) to having any family involved in agriculture, while 28.1% responded "yes" to having any family involved in agriculture; these results support findings of Balschweid (2002).

Respondents were compared based upon gender, race/ethnicity, family involvement, and residential area. Respondents were asked to rate their level of awareness of agriculture related programs/organizations. PCA was used to reduce the number of variables into smaller, workable scales. The PCA resulted in four scales: "Natural Resources, Youth Education Programs, Community Outreach Programs, and Nationally Recognized Agriculture Programs." To obtain a broad view of the respondents' awareness of Agriculture-related Programs/Organizations, a mean score was calculated based upon the means within each scale. Overall, respondents were "slightly aware" of natural resources (Mean [M] = 4.8 out of 6 with 1 = completely unaware and 6 = completely aware), "unaware" of community outreach programs (Mean [M] = 2.3 out of 6 with 1 = completely unaware and 6 = completely aware), "completely unaware" of youth education programs (Mean [M] = 1.9 out of 6 with 1 = completely unaware and

Table 3. Independent t-Test Results for Awareness of Programs/Organizations by Race/Ethnicity

Awareness Factor by Race/Ethnicity	n[z]	Mean[†]	SD[y]	t[x]	p[w]
Awareness of Natural Resources					
White	44	.08	.13	1.10	.27
Non-white	15	1.40	.36		
Total	59				
Awareness of Youth Education Programs					
White	44	.06	1.10	.73	.47
Non-white	15	-.16	.83		
Total	59				
Awareness of Community Outreach Programs					
White	44	.11	1.10	2.10	.04*
Non-white	15	-.34	.53		
Total	59				
Awareness of Nationally Recognized Agriculture Programs					
White	44	.14	.93	1.80	.07
Non-white	15	-.40	1.10		
Total	59				

Note. Scale: 1=completely unaware, 2=unaware, 3=slightly unaware, 4=slightly aware, 5=aware, and 6=completely aware. Selected high school students age 16-19, southern New Jersey, 2011.

*p< .05, two-tailed independent t-test.

[z]n=number (frequency) of respondents.

[y]SD=standard deviation.

[x]t= statistical difference.

[w]p=probability (significant difference).

[†]Mean scores were calculated based upon the results of the Principal Component Analysis results instead of the raw data to obtain a more precise measurement of differences between the independent variables.

Table 4. Frequency, Mean, and Standard Deviation for Selected Students' Awareness of Careers in Agriculture

	n[z]	Mean	SD[y]
Awareness of Production/Business Careers in Agriculture			
Food Processing	86	4.2	1.5
Animal Breeder	86	4.4	1.4
Greenhouse/Gardening	85	4.7	1.1
Landscaping Specialist	84	4.5	1.4
Fruit and Vegetable Production	85	4.4	1.3
Agriculture Business Management	86	3.4	1.5
Agricultural Law	86	2.9	1.5
Overall Mean		4.1	
Awareness of Animal Science Careers in Agriculture			
Animal Scientist	86	4.5	1.3
Wildlife & Fisheries Scientist	87	4.1	1.6
Veterinary Medicine	86	4.4	1.6
Overall Mean		4.3	
Awareness of Traditional Careers in Agriculture			
Agricultural Engineer	89	2.9	1.6
Agriculture Science Teacher	89	3.5	1.7
Community Educator	88	3.9	1.6
Forestry Scientist	89	3.5	1.8
Dairy Production	85	4.5	1.3
Overall Mean		3.6	

Note. Scale: 1=completely unaware, 2=unaware, 3=slightly unaware, 4=slightly aware, 5=aware, and 6=completely aware. Selected high school students age 16-19, southern New Jersey, 2011.

[z]n = number (frequency) of respondents.

[y]SD=standard deviation.

6 = completely aware), and "slightly aware" of nationally recognized programs (Mean [M] = 4.1 out of 6 with 1 = completely unaware and 6 = completely aware) (See Table 1).

There was a significant difference found between males and females in the level of awareness of community outreach programs related to agriculture. (Significant differences were determined by comparison of the alpha scale of p < .05 based on a 95% Confidence Interval). Male respondents were found to be significantly more aware of community outreach programs than female respondents (t = -2.10, *p = .04) (See Table 2). Due to the low Cronbach's alpha reliability score for awareness of community outreach programs, these results should be interpreted with concern (Santos, 1999). However, males and females were both found to have "little awareness" of natural resources, nationally recognized programs, and youth education programs. Whites were significantly higher than non-whites in their awareness of community outreach programs (t = 2.10, *p = .04) (See Table 3). No significant differences were found between family involvement in agriculture and residential area.

Table 5. Selected Students' Perceived Barriers to Enrollment in Agricultural Programs

Barriers	Rank[z]	Mean	SD[y]
Lack of contact with recruiters in agriculture	1	3.2	1.3
Interest in agriculture	2	3.2	1.3
Lack of opportunity to work on a farm growing up.	3	3.2	1.4
Lack of career opportunities available in agriculture.	4	3.0	1.2
Lack of promotional materials about agriculture.	5	3.0	1.3
Lack of mentors/role models in agriculture	6	2.9	1.2
Lack of relatives/significant others involved in agriculture.	7	2.8	1.3
Lack of discussion from guidance counselors.	8	2.7	1.4
Lack of parental support.	9	2.3	1.5
Society's negative image of agriculture.	10	2.2	1.3
Lack of people of color in agriculture.	11	2.0	1.4
Ridicule by peers regarding agriculture.	12	2.0	1.2

Note. Scale: 1=not at all a barrier, 2=somewhat a barrier, 3=neutral, 4=barrier, and 5=very much a barrier. Selected high school students age 16-19, southern New Jersey, 2011.

[z]Rank = the listed barriers to enrollment in agricultural programs was ranked based on the selected students' mean scores.

[y]SD= standard deviation.

Table 6. Frequency, Mean, and Standard Deviation for Selected Students' Perceived Barriers to Enrollment in Colleges of Agriculture

	n[z]	Mean	SD[y]
Individual Related Barriers			
Lack of mentors/role models	87	2.9	1.2
Lack of relatives/significant others involved in agriculture	87	2.8	1.3
Lack of opportunities to work on farm growing up	87	3.2	1.4
Lack of contact with recruiters	85	3.2	1.3
Lack of career opportunities available in agriculture	87	3.0	1.2
Lack of discussion from guidance counselors	87	2.7	1.4
Lack of promotional materials about agriculture	86	3.0	1.3
Overall Mean		3.0	
Image of Agriculture Barriers			
Lack of parental support	87	2.3	1.5
Lack of people of color in agriculture	87	2.0	1.4
Society's negative image of agriculture	87	2.2	1.3
Ridicule by peers regarding agriculture	87	2.0	1.2
Overall Mean		2.1	
Interest in Agriculture	87	3.2	1.3

Note. Scale: 1=not at all a barrier, 2=somewhat a barrier, 3=neutral, 4=barrier, and 5=very much a barrier. Selected high school students age 16-19, southern New Jersey, 2011.

[z]n=number (frequency) of respondents.

[y]SD=standard deviation.

Respondents were asked to rate their level of Awareness of Careers in Agriculture which was reduced to three scales using factor analysis (Decoster, 1998): Production/Business Careers, Animal Science Careers; Traditional Careers. Overall, respondents were generally found to be "slightly aware" of production/business careers in agriculture (Mean [M] = 4.1 out of 6 with 1 = completely unaware and 6 = completely aware) and animal science careers (Mean [M] =4.3 out of 6 with 1 = completely unaware and 6 = completely aware), and were "slightly unaware" of traditional careers in agriculture (Mean [M] = 3.6 out of 6 with 1 = completely unaware and 6 = completely aware) (See Table 4). However, there were no significant differences found between the independent variables for any of the three scales. Scott and Lavergne (2004) also had similar findings in their study in which students were "less confident" in their knowledge of agriculture careers and how to prepare for them.

Respondents were asked to rate how much of a barrier the listed statements were to enrollment in colleges of agriculture. According to the overall mean scores, "lack of contact with recruiters" (Mean [M] = 3.29 out of 5 with 1 = not at all a barrier and 5 = very much a barrier), "interest in agriculture" (Mean [M] = 3.25 out of 5 with 1 = not at all a barrier and 5 = very much a barrier), and "lack of opportunity to work on a farm growing up" (Mean [M] = 3.21 out of 5 with 1 = not at all a barrier and 5 = very much a barrier) were ranked as the top three potential barriers to enrollment in colleges of agriculture (See Table 5).

A factor analysis was employed to reduce the variables into three scales: individual related barriers, image of agriculture barriers, and interest in agriculture (Decoste, 1998). Overall, respondents were found to have a neutral perception of individual related barriers (Mean [M] = 3.0 out of 5 with 1 = not at all a barrier and

5 = very much a barrier) as being potential barriers to enrollment, perceived "image of agriculture" as being somewhat a barrier to enrollment (Mean [M] = 2.1 out of 5 with 1 = not at all a barrier and 5 = very much a barrier), and were generally neutral in regard to "interest in agriculture" (Mean [M] = 3.2 out of 5 with 1 = not at all a barrier and 5 = very much a barrier) (See Table 6). Males and females differed significantly (t = 2.50, p = .02) in their perception of "image of agriculture barriers" (See Table 7). There was also a significant difference found between whites and non-whites (t= -2.00, *p < .05) for individual related barriers to enrollment in colleges of agriculture (See Table 8).

Table 7. Independent t-Test Results for Barriers to Enrollment by Gender

Barriers by Gender	n[z]	Mean[†]	SD[y]	t[x]	p[w]
Individual Related Barriers					
Male	24	.22	1.30	1.10	.29
Female	60	-.09	.88		
Total	84				
Image of Agriculture Barriers					
Male	24	.48	1.20	2.50	.02*
Female	60	-.19	.86		
Total	84				
Interest in Agriculture Barriers					
Male	24	-.04	.75	- .28	.78
Female	60	.02	1.10		
Total	84				

Note. Scale: 1=not at all a barrier, 2=somewhat a barrier, 3=neutral, 4=barrier, and 5=very much a barrier. Selected high school students age 16-19, southern New Jersey, 2011. *p< .05, two-tailed independent t-test

[z]n=number (frequency) of respondents.

[y]SD=standard deviation.

[x]t= statistical difference.

[w]p=probability (significant difference).

[†]Mean scores were calculated based upon the results of the Principal Component Analysis results instead of the raw data to get a more precise measurement of differences between the independent variables.

Table 8. Independent t-Test Results for Barriers to Enrollment by Race/Ethnicity

Barriers by Race/Ethnicity	n[z]	Mean[†]	SD[y]	t[x]	p[w]
Individual Related Barriers					
White	61	-.13	.94	-2.00	.05*
Non-White	23	.35	1.10		
Total	84				
Image of Agriculture Barriers					
White	61	-.09	.97	1.30	.20
Non-White	23	.28	1.10		
Total	84				
Interest in Agriculture Barriers					
White	61	-.01	.98	-.21	.84
Non-White	23	.04	1.20		
Total	84				

Note. Scale: 1=not at all a barrier, 2=somewhat a barrier, 3=neutral, 4=barrier, and 5=very much a barrier. Selected students age 16-19, southern New Jersey, 2011. *p< .05, two-tailed independent t-test

[z]n=number (frequency) of respondents.

[y]SD=standard deviation.

[x]t= statistical difference.

[w]p=probability (significant difference).

[†]Mean scores were calculated based upon the results of the Principal Component Analysis results instead of the raw data to get a more precise measurement of differences between the independent variables.

Summary

The findings showed that the selected respondents were primarily female, white/Caucasian, from suburban areas, and had no family members involved in agriculture. Males were found to be more aware of outreach programs related to agriculture than females, and white students were found to be more aware of outreach programs related to agriculture than non-white students. The findings also revealed that the selected respondents had a general lack of awareness in careers in agriculture. The selected students identified three barriers as being the highest ranking barriers to enrollment in colleges of agriculture: (1) lack of contact with recruiters; (2) interest in agriculture; and (3) lack of opportunity to work on a farm growing up. These findings indicate that the selected students lack exposure to both recruiters for colleges of agriculture and exposure to agricultural experiences and both of these barriers can ultimately have an influence on the students' lack of interest in agriculture. A general lack of knowledge and awareness of programs/organizations and available careers related to agriculture may also be the driving force behind the selected students' lack of interest in agriculture.

The selected students had a lack of "interest in agriculture" as a result of a lack of knowledge in and about agriculture. Students cannot develop an interest in agriculture without knowledge and information in the subject. Therefore, educators should integrate agriculturally related subject matter into their curricula to expose their students to concepts and practices within and around agriculture. Student interest in agriculture is a very important factor in enrollment to agricultural programs for the secondary and collegiate levels. Students selected in this study perceived the image of agriculture as being somewhat a potential barrier to enrollment in colleges of agriculture. This too is a result of a general lack of sufficient information for students to make more informed inferences about agriculture and its importance and potential for success.

There are various factors that must be addressed to increase enrollment numbers in agricultural programs for both minorities and non-minorities including: promoting a positive perception of agriculture, increasing the level of agricultural literacy and awareness, and enhancing exploration in career opportunities. Evaluation of these factors may help educators understand students' perceptions of agriculture and develop approaches to break down potential barriers to increase enrollment in secondary agricultural programs and colleges of agriculture. As more people are becoming further removed from agricultural practices and issues, educators must find innovative methods to reintroduce these disciplines to their students.

To address the issues found in this study, educators in secondary education should integrate more agriculturally related topics into the curriculum and provide more opportunities for career exploration in agricultural fields. Also, secondary agriculture programs and colleges of agriculture should develop new strategies to focus their recruitment efforts towards more "non-traditional" students and provide more opportunities for students to have contact with recruiters specifically for secondary agriculture programs and colleges of agriculture. Most importantly, New Jersey Department of Education should collaborate with teachers and administrators interested in providing agricultural education in their schools to develop a universal curriculum that includes agriculture to be used throughout the state.

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Incorporating Group Problem Solving to Improve Student Learning in an Agricultural Genetics Class[1]

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Abstract

Genetics for the College of Agriculture is traditionally taught as a lecture-only course in the Department of Animal Sciences and Industry at Kansas State University. In fall 2010, a weekly group problem-solving activity was incorporated. The course was divided into four units. Unit one covered mitosis, meiosis, Mendelian inheritance, sex-linked inheritance, and pedigree analysis; unit two addressed linkage, chromosome variation, DNA structure and replication, and transcription; unit three comprised RNA processing, translation, gene expression, mutations, DNA repair, and biotechnology; and unit four covered genomics, quantitative genetics, and population genetics. Pretests were administered before each unit in fall 2009 and 2010. Improvement from pretest to posttest was used as a measure of student learning. For units one and two, student learning improved more when a group problem-solving activity was incorporated. Student learning did not differ for unit three; learning was greater with the lecture-only format for unit four. Although learning over all units was improved with a group problem-solving activity, the material covered appeared to affect which method maximized student learning.

Introduction

Cooperative learning has long been recognized as a method to increase student learning (Johnson and Johnson, 1974; Johnson, 1975; Johnson, 1979; Blumenfeld et el., 1996). In a 1999 meta-analysis of 37 studies that analyzed student achievement in science, math, engineering, and technology, Springer et al. (1999) reported that students who participated in group activities demonstrated higher achievement than students who did not have group learning opportunities. Dietz (1993) showed that beginning statistics students were able to 'discover' on their own several proven sampling methods through the use of group activities. More recently, Amstutz et al., (2010) showed that participation in peer-led study groups increased course grades in animal science courses. The objective of this study was to determine if group problem-solving activities enhanced student learning in agricultural genetics.

Materials and Methods

This study was found to be exempt by the Kansas State University Institutional Review Board. Kansas State University (KSU) is the land-grant institution for the state of Kansas, and it has a long history of education in the agricultural sciences. At KSU, genetics is taught in the Department of Animal Sciences and Industry for the entire College of Agriculture. The class is for three credit hours, and meets three times per week for 50 minutes. The course is divided into four units. In 2009 and 2010, unit one covered mitosis, meiosis, Mendelian inheritance, sex-linked inheritance, and pedigree analysis; unit two addressed linkage, chromosome variation, DNA structure and replication, and transcription; unit three included RNA processing, translation, gene expression, mutations, DNA repair, and biotechnology; and unit four taught genomics, quantitative genetics, and population genetics.

Before 2010, genetics was taught as a lecture-only course at KSU. In 2010, one day a week on non-exam weeks was designated as group problem day. This was in place of a lecture. Material was not removed from the course, but students were asked to do more out of class reading to compensate for lost lecture time. Groups of four were assigned at the beginning of the semester. Students were allowed to pick group members via an online survey if they chose. If not, groups were randomly assigned. Every week, a problem set that related to the topics of the week was posted on the online content management system. Students were expected to work the problems together outside of class, either by meeting in person or electronically. On group problem day, the instructor would randomly call a group number, and one member

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of that group would work the problem for the class. The instructor assigned points to the group based on correctly solving the problem. They were not given points simply for participation. The total number of points a group could potentially receive for problems throughout the semester was the same as for a unit exam. Part of those points were assigned based on the group members' evaluation of the participation of each member in the group.

In both 2009 and 2010, a pretest was given to each student at the beginning of each unit. The pretest consisted of questions from the previous year's unit exam. Two incentives were offered for students to participate in the pretest. First, if they completed the pretest, students were allowed to keep it as a study guide for the upcoming unit exam. Second, to encourage effort, students were given participation points for attempting all the questions. It was emphasized to the students that they would receive maximum participation points only if the instructor could tell that they had given a good effort on all the questions. Improvement from pretest to posttest was used as a measure of student learning.

Data analyzed included pretest score, posttest score, and the improvement in scores from the pretest to the posttest for all four unit exams. The dataset includes all students that completed all four unit exams in 2009 (n = 88) and 2010 (n = 80). Students were removed from the data if they failed to complete one or more of the unit exams (posttests), but not for missing a pretest. In each year, each student completed four posttests, but may have completed less than four pretests; therefore, each unit had different numbers of observations. Improvement from pretest to posttest was calculated within unit only for those students that completed both pretest and posttest for that unit. Pretest scores, posttest scores, and improvement from pretest to posttest were analyzed using the generalized linear model of SAS (Cary, NC) with year, unit, and year by unit interaction as fixed effects.

Results and Discussion

Students in 2009 averaged better scores on the pretest than students in 2010 (Table 1). Pretest scores were higher for units one and three than for the other units (Table 1). This indicates that those units contained more material that the students had learned in prerequisite classes. Unit one contains mitosis, meiosis, and Mendelian genetics, which are common topics in general biology classes. Unit three is transcription, translation, and gene expression, which would be expected to be less familiar to students, but pretest scores indicate that those topics are receiving some coverage in general biology classes. Unit two had the lowest pretest scores. This was somewhat surprising because DNA structure and replication, which should be covered in general biology, is included in this section; however, linkage analysis is also in unit two. This is a topic that most students have no experience with prior to class, and virtually all students receive zero points on those questions on the pretest. There was a significant interaction between year and unit in pretest scores ($P = 0.0391$) (Table 2). For units one, three, and four, students from 2009 scored approximately five points higher than students from 2010 ($P < 0.02$), however, for unit two, there was no difference in pretest scores between years ($P = 0.4699$).

There was no difference between students in 2009 and 2010 in posttest scores ($P = 0.3749$) (Table 1). This result indicates that, even though 2009 students were more knowledgeable coming into the class as demonstrated by their pretest scores, both years reached a similar level of understanding of the material. Posttest scores for the different units paralleled the pretest scores. Students had higher scores on units one and three than on units two and four (Table 1). Interaction between year and unit in posttest scores was significant ($P < 0.0001$) (Table 2). For units one and two, 2010 students performed better on the posttest, but 2009 students performed better for units three and four.

Overall improvement from pretest to posttest was greater in 2010 than 2009 (Table 1). These results indicate that students improved their scores and learned more when group problem solving was incorporated into the class. This agrees with results reported by Amstutz et al., (2010); Johnson and Johnson (1974); and Springer et al. (1999); however, there was a large difference in improvement in the different units. The least amount of improvement was shown in units one and three (Table 1). Most material in unit one (mitosis,

Table 1. LSMeans and Number of Students for Pretest Scores, Posttest Scores, and Improvement from Pretest to Posttest in 2009 and 2010 Averaged over Four Units, and for the Four Units Averaged over Years

	Pretest		Posttest		Improvement	
Year	n	LSMean	n	LSMean	n	LSMean
2009	332	34.88^a	356	70.37^a	332	35.73^d
2010	315	31.49^b	336	69.25^a	315	38.22^e
Unit	n	LSMean	n	LSMean	n	LSMean
1	168	39.91^a	173	71.77^d	168	32.14^a
2	156	23.28^b	173	66.41^e	156	43.69^b
3	163	39.89^a	173	73.41^d	163	33.83^a
4	160	29.65^c	173	67.60^e	160	38.23^c

[abc]LSMeans within a column with different superscripts are different ($P < 0.01$) using a generalized linear model.
[de]LSMeans within a column with different superscripts are different ($P < 0.05$) using a generalized linear model.

meiosis, Mendelian genetics) should have been covered in the prerequisite general biology class, or even in high school biology classes. As mentioned before, unit two contains linkage analysis, which most students have never learned before. Most students get zero points on those problems on the pretest, and then do much better on those problems after going over them in class, which accounts for the large amount of improvement in unit two. There was also a significant (P < 0.0001) interaction between year and unit. For units one and two, improvement was greater when group problem solving was incorporated into the class, which is similar to literature reports; however, for unit four, improvement was greater when class consisted of lecture only (Table 2). For unit three, improvement did not differ between years, which may indicate that students benefitted from the group work earlier in the semester but adapted to the lecture and teaching style by the end of the semester. Another explanation could be the material for the units. Mitosis/meiosis, Mendelian genetics, and DNA structure/replication, which are covered in units one and two, are commonly introduced topics in general biology classes. Students may have been better able to teach each other the more advanced details of those concepts in a group setting because they had some familiarity with the basic material. Unit four covers primarily the more advanced topics of genomics, quantitative genetics, and population genetics. Few students have previous exposure to these topics, so they were less able to draw on previous experience to help each other, which might account for the fact that the group work was not as helpful. The increased class time spent explaining these topics in the lecture-only format may have been more helpful than group time. Another possible explanation is the evolution of the group work over the semester. Toward the end of the semester, instructor observation indicated that more groups were dividing the problems and working them individually, as opposed to meeting and working through them as a group. This may negate the benefits of group work for those students. Perhaps providing some in-class time for groups to coordinate would encourage more collaboration.

Table 2. LSMeans, Number of Students, and Significance for Pretest Scores, Posttest scores, and Improvement from Pretest to Posttest for Units 1-4 in 2009 and 2010

	Pretest Scores				
	2009		2010		
Unit	n	LSMean	n	LSMean	P-value[z]
1	88	42.41	80	37.41	0.0070
2	78	22.59	78	23.97	0.4699
3	82	42.44	81	37.33	0.0066
4	84	32.08	76	27.22	0.0105
	Posttest Scores				
	2009		2010		
Unit	n	LSMean	n	LSMean	P-value[z]
1	89	69.48	84	74.05	0.0652
2	89	63.29	84	69.54	0.0117
3	89	75.58	84	71.23	0.0783
4	89	73.02	84	62.18	0.0001
	Improvement				
	2009		2010		
Unit	n	LSMean	n	LSMean	P-value[z]
1	88	27.40	80	36.89	0.0001
2	78	41.33	78	46.05	0.0496
3	82	33.26	81	34.40	0.6281
4	84	40.93	76	35.53	0.0232

[z]P-values from a generalized linear model.

Summary

Although group problem-solving activities improved student learning through the entire semester, the amount of improvement appears to be dependent on the subject matter. Students improved more with group problem solving in units containing material that was most likely introduced in prerequisite courses. With new material, group problem-solving activities did not improve student learning. Changes in group dynamics through the course of the semester also may have diminished the effectiveness of the group problem-solving activity.

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Exploring the Teaching Beliefs of Excellent Undergraduate Professors

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Abstract

The world is rapidly changing and the next generation of college graduates will need to be prepared to solve complex global problems. Effective teachers in colleges of agriculture are a key piece of the solution to this issue. The purpose of this study was to explore the teaching beliefs of excellent college professors so that novice teachers may learn from their accomplished peers. This study used faculty in the Academy of Teaching Excellence at University of Florida as a case study. Based on the Teacher Belief Scale, the majority of professors were classified as enablers, meaning that this group was high in Sensitivity and high in Inclusion. Examining the teaching philosophy statements of this group showed that the majority of professors expressed high Sensitivity and at least a neutral level of Inclusion. When comparing the two measures of beliefs, it was concluded that these excellent professors are consistently expressing beliefs of Sensitivity, but inconsistently representing beliefs of Inclusion. Based on this study, novice teacher should aspire develop high levels of sensitivity and at least moderate levels of inclusion.

Introduction

The world is rapidly changing and the next generation of college graduates will need to be prepared to solve complex global problems (National Research Council, 2009). Recognizing this need, the National Research Council (2009) issued a call for changes in the curricula and teaching in colleges of agricultural and related sciences. They specifically noted that many professors need to update their teaching methods and curricula. They did, however, acknowledge that there are numerous examples of professors who have already embraced new pedagogies and are preparing society-ready graduates. These instructors can serve as models to help others evolve.

The main goal for a teacher, in any capacity, is student learning. The formal teaching/learning process typically involves interactions between the teacher, learners, content, and the learning environment (Dunkin and Biddle, 1974). Students are more engaged in the learning process when they feel their faculty are involved in the collective process of education (Umbach and Wawrzynski, 2005). One component of this complex process that effects teacher involvement is the beliefs the teacher holds about the learning process. A successful teacher has a clearly defined teaching philosophy outlining their core values as an instructor. Understanding the teaching beliefs of excellent teachers can allow novice teachers to develop into excellent teachers by modeling the beliefs and behaviors exhibited by their accomplished peers. This could help increase student engagement within the learning process.

Review of Literature

The Theory of Planned Behavior (Ajzen, 1991) proposes that a person's beliefs influence their intentions, which in turn influence their behaviors. The classroom behavior of teachers ultimately affects students' achievement (Fang, 1996). Teaching involves two domains: (a) teachers' thought processes, and (b) teachers' actions and their observable effects. Understanding teacher's thoughts and actions will give us a better understanding of how these two components interact to increase or inhibit student performance (Clark and Peterson, 1986).

Ajzen's (1991) Theory of Planned Behavior serves as a theoretical frame for this study. For this study the major concepts of attitudes, subjective norms, and perceived control are operationalized as internalized beliefs, or teacher beliefs (Ajzen, 1991). Additionally, concept of motivation or intention is operationally measured from espoused philosophy.

According to Heimlich (1990), sensitivity and inclusion are the two key dimensions that describe the teacher's beliefs related to their thoughts and actions. Sensitivity relates to the understanding of the group (learners) needs, while inclusion refers to the amount of control the students have over their learning within the instructor's classroom. Combining the two dimensions categorizes teachers into four groups: (a) Experts have

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low sensitivity and low inclusion; (b) Facilitators have low sensitivity and high inclusion; (c) Providers have high sensitivity and low inclusion; and (d) Enablers have high sensitivity and high inclusion.

Heimlich's (1990) assertion for these two key dimensions stems from the belief that a teacher's success relates to their ability to be sensitive to the cultural interactions within the learning environment; as well as, the teacher's ability to relinquish control. He also asserted that the measurement and subsequent intersection of these two dimensions will indicate a preferential teaching style (Heimlich, 1990). As described, Heimlich (1990) stated that the teacher outcomes or activities associated with each dimension change the focus from teacher to learner (inclusion), and from content to process (sensitivity) as you increase on either axis. These dimensional beliefs' are further validated as predictors by Clark and Peterson (1986) stating that teacher beliefs are a vector for perception, process, and action related to classroom activities.

Utilizing this convention, Heimlich (1990) found 95% of adult educators in Ohio are highly sensitive and 95% are highly inclusive. When applied to preservice teachers in agricultural education Cano, Garton, and Raven (1992) found that 56% of preservice teachers were both highly sensitive and highly inclusive, 20% were only highly sensitive and 20% were only highly inclusive. Whittington and Raven (1995) conducted similar research assessing teaching beliefs of student teachers and found 87% of student teachers were both highly sensitive and highly inclusive.

"Personal Documents are a reliable source of data concerning a person's attitudes, beliefs, and view of the world" (Merriam, 1998, p. 116). Educators who write a teaching philosophy want to document those beliefs, values, and approaches (Goodyear and Allchin, 1998). To combat the void of scholarly works related to statements of teaching philosophy, their role, how to compose them, or how to evaluate them as personal statements, Goodyear and Allchin (1998) compiled and synthesized literature to develop a standing source on teaching philosophies.

From their work, we know that "articulating an individual teaching philosophy provides the foundation by which to clarify goals, to guide behavior, to seed scholarly dialogue on teaching, and to organize evaluation" (Goodyear and Allchin, 1998, Introduction, para. 2). When a professor enters a teaching setting, he or she has a predetermined philosophical framework (or teaching philosophy) that guides his or her practice (Coppola, 2002).

Developing a teaching philosophy has explicit benefits for professors, including that the teaching philosophy can be used to stimulate reflection on teaching (Chism, 1998), it can be used as a point for examining teaching practices (Coppola, 2002), and the statement sets principles which guide behaviors (Goodyear and Allchin, 1998). It is widely acknowledged that most educators struggle with developing a written teaching philosophy. "This is likely due to the fact that their [professors] ideas about this are intuitive and based on experiential learning, rather than on a consciously articulated theory" (Chism, 1998). Additionally, Goodyear and Allchin (1998) noted:

In preparing a statement of teaching philosophy, professors assess and examine themselves to articulate the goals they wish to achieve in teaching. The process helps the teacher clarify the "why" of teaching as a foundation for the "what" and "how" of teaching, by answering the question: "Why are you teaching?"(Roles of Statements for Professors, para. 1)

Components of a quality philosophy statement include conceptualization of teaching and learning, goals for students, implementation and design, growth plan, and evaluations (Chism, 1998; Coppola, 2002).

A potential means for improving the learning environment and facilitation of learning for the benefit of the learners, is for educators to understand their predilections toward a teaching style (Heimlich, 1990). By delineating the beliefs, a model can be established. According to the components of the social learning theory presented by Bandura (1977) most behaviors are learned through modeling. The effectiveness of the model is directly correlated to the functional value of the behaviors and the status of those modeling within the social group. Models are more likely to be adopted when the outcome, student achievement in this case, has value within the system. It is also stipulated that the level of association within a social setting delimit the modeling opportunities (Bandura, 1977).

Methods

The purpose of this study was to explore the teaching beliefs of excellent college professors to determine if a relationship exists between teacher beliefs and philosophy statements. The objectives of the study were as follows:

1. Describe the teaching beliefs of excellent college professors.
2. Describe the expression of inclusion and sensitivity within teaching philosophy statements of excellent college professors.
3. Compare teacher beliefs and teaching philosophy statements of excellent college professors.

This study used a three-phase case study of faculty in the Academy of Teaching Excellence in the College of Agricultural and Life Sciences, at the University of Florida. This group includes professors elected to membership based on receiving awards and recognition for teaching. The target population was all members of the Academy currently employed at University of Florida, totaling thirty-three professors since 2008 (N = 33).

In Phase I, twenty-two members of the academy (n = 22) elected to participate and thus constituted the case. In this phase each professor completed a researcher modified Van Tilburg/Heimlich Teacher Belief Scale (Heimlich, 1990) administered through an online questionnaire. Data were collected using the Tailored Design Method (Dillman, 2000).

The Van Tilburg/ Heimlich instrument is a 22-item questionnaire. Items relate to the two dimensions: sensitivity and inclusion (Heimlich, 1990). Items agreed to are scored based on a predetermined value for each item and total items answered. This discerns a score for both dimensions. Heimlich (1990) defines three levels to each score: low (0 - 6.0), neutral (6.0 – 8.0), and high (8.0 – 11). Numeric scores are plotted on a grid with defined quadrants to label the respondents Teacher Belief Scale type. For the delineation of quadrants, Heimlich (1990) uses a breakdown of 0-6 as low, and 6-11 as high for each dimension; no neutral is used.

The Van Tilburg/Heimlich instrument was validated by interviewing researcher-identified adult educators, analysis for statements qualitatively, correlating statements to concepts, and then having an expert panel evaluate the statements for clarity and application (Heimlich, 1990). A second validation was made where a population ranked the items based on a Likert type scale relating each statement to either side of the domains Sensitivity, or Inclusion (Heimlich, 1990). The response frequency was measured, and using a binomial test (α =.05 a priori) the statements were categorized or eliminated (Heimlich, 1990). The reliability of these items was determined by a principle component factor analysis using orthogonal varimax rotation (Heimlich, 1990).

In Phase II, respondents were asked to provide their teaching philosophy statements. Of the sample population, eleven members (n = 11) elected to continue their participation in the study and provided the statements. The qualitative content analysis was assessed according to the characteristics Holsti (1969) asserted for modern content analysis. The characteristics of procedural, rule-based, and systematic process are descriptive of this study (Holsti, 1969). As the analysis was conducted, rules for assessment were developed under ex post facto conditions in concordance with the naturalistic paradigm as defined by Lincoln and Guba (1985). The Goetz-LeCompte (1981) continuum was a theoretical frame for this study's typological analysis. Typologies are devised on some external basis (an a priori theory) and are then applied to new sets of data (Goetz and LeCompte, 1981). Analysis involves the aggregation of qualitative information within the given categories (Lincoln and Guba, 1985). The aggregation of the items in the philosophy statements were analyzed for items based on the predetermined dimensions of Inclusion and Sensitivity as operationally defined by Heimlich (1990).

"Since the investigator is the primary instrument for gathering data, he or she relies on skills and intuition to find and interpret data from documents," (Merriam, 1998, p.120). In concordance with Merriam's statement, three criteria were developed to assess a score for the content analysis for each dimension. Each dimension was evaluated for (a) quantity of items stated, (b) strength of items in relation to the dimension, and (c) explicit nature of the items stated based on definition of each dimension. Criteria two was the limiting factor of the evaluation because of the inherent biases of the researcher. The scores were low, neutral and high, mirroring the score breakdown established by Heimlich (1990) for the instrument.

A criticism of qualitative research techniques relates to the "highly subjective and therefore unreliable nature of human perception" (Merriam, 1998, p. 95). Merriam (1998) also defined one major researcher concern as "measuring the frequency and the variety of messages" (p. 123) due to subjectivity. Assumptions and interpretations of the qualitative content analysis are limited by the researcher's views and biases. The researcher for this study was scored as an Enabler on the instrument; scoring a 9 for Sensitivity, and a 7.9 for Inclusion. Subjectivity within data analysis derived from the experiences of the researcher being trained as an Agricultural Educator and having taught secondary Agriscience education. Several beliefs of the researcher as an educator must be noted as well: (a) the primary stakeholders of education are the students; (b) education should be objective based related to student outcomes; and (c) education is a paradox of fluid activity that can be planned but is rarely executed as planned.

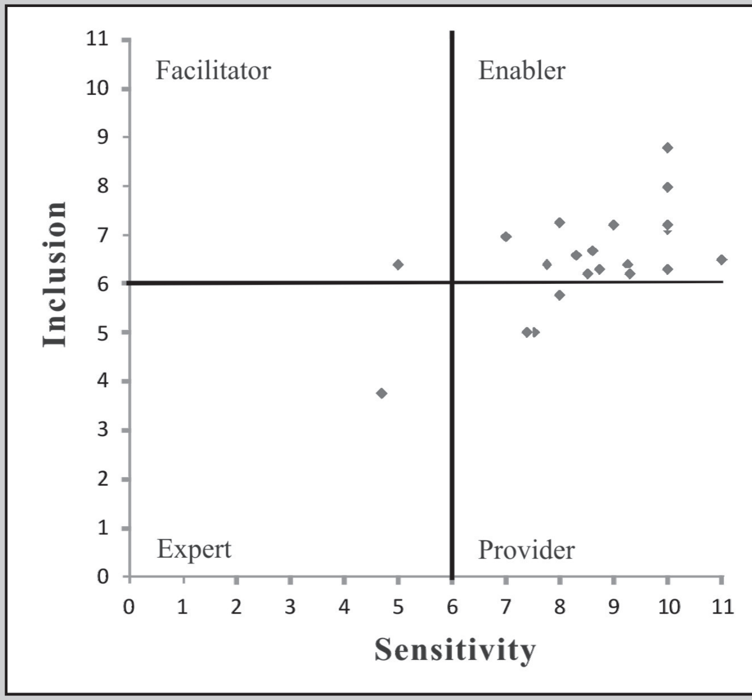
In Phase III, a comparison between the Teacher Belief Scale scores and results from the content analysis was conducted to discern if scores exhibited based on the instrument match the personally-reported views of the respondents via their philosophy statements. As stated by Lincoln and Guba (1985) deductive analysis begins with reference to a body of empirical data. Both scores established the empirical data required to compare scored and stated views of each dimension.

Results and Discussion

Objective 1 – Describe the teaching beliefs of excellent college professors.

Respondents were scored on two axes, sensitivity and inclusion. Based on the plotted scores (see Figure 1), respondents fell into one of four categories: expert, facilitator, enabler, and provider. It was found that of the sample 77% (n = 17) were scored as "enabler," 14% (n = 3) were scored as "provider," 4% (n = 1) were scored as "facilitator," and 4% (n = 1) scored as an "expert." The mean calculated score for Sensitivity was 8.5, and for Inclusion the score was 6.5. Both scores are calculated on a range from 0 to 11.

Figure 1. Scatterplot of Teaching Beliefs of Excellent Teachers.



Individual scores for Academy members according to the Heimlich/Van Tilburg Teacher Beliefs Scale. Teacher Belief categories are labeled by quadrants.

The majority of faculty in the Academy of Teaching Excellence in the College of Agricultural and Life Sciences at University of Florida are classified as enablers (Heimlich, 1990). This means that this group is high in Sensitivity and high in Inclusion. These findings mirror the data collected by Heimlich; he found that 69% of his respondents also scored within the enabler category.

Objective 2 – Describe the expression of inclusion and sensitivity within teaching philosophy statements of excellent college professors.

Respondents' teaching philosophy statements were qualitatively analyzed for themes of the dimensions Sensitivity and Inclusion. Each respondent was scored based on three criteria: quantity of items, strength of items, and explicit nature of items within their statements. The findings for each respondent are reported individually. Key examples are highlighted for both Sensitivity and Inclusion in Tables 1.

Respondent 1. Statements show a neutral level of Sensitivity and a high level of Inclusion. Examples demonstrating Sensitivity from respondent 1's philosophy statement include "There are, however, multiple student needs…," and, "…my teaching methods must be flexible, adaptable, and dynamic within any given setting…" The following statements demonstrate student Inclusion: "…the focus of the classroom is on students challenging themselves to answer…" and, "Specific classroom activities include… a Socratic approach to teaching in which I lead open, in-class discussions…"

Respondent 2. Statements showed a high level of both Sensitivity and Inclusion. The following statements demonstrate the dimensions: "…focused on the concepts of accessibility, and relevance and involvement." and, "…sensitivity to the student's family, employment and other obligations."

Respondent 3. Respondent 3 demonstrated high levels of Sensitivity and Inclusion with many statements made regarding both factors. Sensitivity was demonstrated with phrases such as, "class personality," "personal rapport," and, "empathy. Statements made include "My goal is to have a classroom in which students feel comfortable, accepted, and challenged." and, "I try to incorporate strategies that appeal to a variety of learning styles. Evidence for Inclusion was

Table 1. Key Statements of Teaching Belief Dimensions

Respondent	Statement
Sensitivity	
1	"There are, however, multiple student needs, learning styles and learning objectives that are more effectively met with other approaches."
4	"…to better understand their [students'] needs, career objectives, and develop a relationship of mutual respect."
5	"I enter each situation with a desire to understand others first…"
Inclusion	
3	"…students learn best when they have a personal stake in the course content."
7	"I require my students to conceive their own research questions and study designs, with faculty guidance…"
9	"…focuses on involving students as much as possible in the learning process."

found in statements, "…students learn best when they have a personal stake in the course content." and, "… student evaluations have helped me to define some of my personal strengths."

Respondent 4. Statements showed a high level of Sensitivity and a low level of Inclusion. Sensitivity was demonstrated with the following statements: "First, I care for my students…," "…students in my classes represent a mosaic of different learning styles." and, "…better understand their personal needs…" Inclusion was demonstrated with the following statement: "…students choose and complete self-directed projects…"

Respondent 5. Respondent 5 demonstrated a high level of Sensitivity and a neutral level of Inclusion. Evidence used to support Sensitivity was found in the following statements: "I enter each situation with a desire to understand others first…," and, "I update material to complement the needs of our students…" Inclusion was demonstrated with the statements: "…activities which supplement the lecture content, including opportunities for peer review and team work." and, "My assignments provide students the option of … making development decisions about their assignments."

Respondents 6. Respondent 6 demonstrated a high level of Sensitivity and a low level of Inclusion. No statements were made related to the dimension of Inclusion within the philosophy statement. The following statements were made related to Sensitivity: "To account for different learning styles,…," "To me, caring for the student means that I know everyone by name…," and, "…I ask them [students] about their broken leg, or sick grandmother, or genetics course."

Respondent 7. Statements showed a high level of Sensitivity and a high level of Inclusion. Statements made demonstrating Sensitivity include the following: "Every person in intellectually and emotionally unique,…," "…aptitudes, personality types, learning styles and levels of emotional maturity all vary among students…," and, "…intended to bring to bear the diversity of expertise, skills and styles pertinent to the research questions being asked." Statements made demonstrating Inclusion include the following: "… more personalized and unconstrained by classroom context." "…tailoring educational experiences…"and, "I require my students to conceive their own research questions and study designs…"

Respondent 8. Respondent 8 demonstrated a high level of Sensitivity and a low level of Inclusion. Statements made showing evidence of Sensitivity include: "I care about students as individuals…," "Learning names personalizes…" and, "…a clear message to the students that you care about them." Only one item was made related to Inclusion: "I am committed to…interactive lectures…"

Respondent 9. Statements showed a low level of Sensitivity and a high level of Inclusion. No statements were found related to Sensitivity. Inclusion was demonstrated by statements such as the following: "…on involving the students as much as possible in the learning process." and, "Students will have the opportunity to explore topics on their own…"

Respondent 10. Respondent 10 demonstrated a neutral level of Sensitivity and a low level of Inclusion. The statements made by the respondent was contextualized with the phrase "I" do this or that 42 times. The severity of "I" statements demonstrates a focus on the respondent, not on the students. Evidence for Sensitivity is represented by the following statements: "I spend time learning who my students are, not only their names, but their interests, hopes, and concerns." "…make every effort to be available for my students outside the classroom."

Respondent 11. Statements showed a high level of Sensitivity and a neutral level of Inclusion. Statements made to support Sensitivity include "The first is to understand the needs of students…" "…responds to the student's learning style…" and, "My goal is to incorporate a variety of modalities…" Inclusion is supported with the following statements as evidence: "…to tailor learning opportunities to those…" "… creating a learning environment and individual learning opportunities…"

Overall Category. Based on the researcher-developed qualitative analysis scoring, the respondents exhibited the following results for the two dimensions: 73% (n = 8) scored high Sensitivity, 46% (n = 5) scored high for Inclusion, 18% (n = 2) scored neutral in both dimensions, while 9% (n = 1) and 36% (n = 4) scored low for Sensitivity and Inclusion respectively.

The sample population exhibited the following categorical breakdown based on the qualitative scores: 27% (n = 3) was categorized as an Enabler, 9% (n = 1) was categorized as a borderline Enabler/ Provider, 27% (n = 3)was categorized as a Provider, 9% (n = 1) was categorized as a Facilitator, 9% (n = 1) was categorized as a borderline Facilitator/Expert, and 18% (n = 2) was categorized as a borderline Expert/ Provider.

The majority of faculty in Academy of Teaching Excellence in the College of Agricultural and Life Sciences at University of Florida demonstrated high Sensitivity within their philosophy statements. Additionally, the majority of faculty demonstrated at least a neutral level of Inclusion within their philosophy statements. These scores mean this group espoused a high level of receptivity and understanding of students' needs in the classroom, while also giving at least some control to the students over their education within the instructor's classroom as defined by Heimlich (1990). According to Ajzen (1991) these faculty, based on these espoused intentions, have a strong predictor to understand student needs and provide their students with some level control over their learning process as defined by Heimlich (1990).

Objective 3 – Compare teacher beliefs and teaching philosophy statements of excellent college professors.

Utilizing the a priori categorization of scores from the Van Tilburg/Heimlich Instrument scores and the developed content analysis assessment comparisons can be drawn. In the dimension of Sensitivity 73% (n = 8) respondents scored the same on both components. Thus, three of the respondents, 27%, demonstrated a lower level of sensitivity to student needs in the content analysis as opposed to the Teacher Belief Scale score. For the dimension of Inclusion it was found that 27% (n = 3) respondents scored the same on both components, 36.5% (n = 4) scored lower on content analysis compared to the Teacher Belief Scale score, and 36.5% (n = 4) scored higher on the content analysis as opposed to the Teacher Belief Scale score for the level of inclusion of student in the learning process. A direct comparison for each respondent can be found in Table 2.

Upon a side by side comparison of Teacher Belief Scale scores and content analysis for faculty in the Academy of Teaching Excellence in the College of Agricultural and Life Sciences at University of Florida, it was found that the strength of scores for Sensitivity were mirrored on the Teacher Belief Scale and content analysis. Greater variability was shown for Inclusion scores for the faculty. As shown, the majority scored different on the Teacher Belief Scale than the content analysis. It is concluded that faculty are adequately expressing and representing beliefs of Sensitivity within philosophy statements. It is also concluded that faculty are not accurately representing beliefs of Inclusion.

Table 2. Comparison of Instrument and Content Analysis Scores

	Van Tilburg/Heimlich Teacher Belief Scale			Philosophy Statements		
Respondent	Sensitivity	Inclusion	Category	Sensitivity	Inclusion	Category
1	High	High	Enabler	Neutral	High	Fac/Exp
2	High	Neutral	Enabler	High	High	Enabler
3	High	Neutral	Enabler	High	High	Enabler
4	High	Neutral	Enabler	High	Low	Provider
5	High	Neutral	Enabler	High	Neutral	Ena/Pro
6	High	Neutral	Enabler	High	Low	Provider
7	High	Neutral	Enabler	High	High	Enabler
8	High	Neutral	Enabler	High	Low	Provider
9	Neutral	Low	Provider	Low	High	Facilitator
10	High	Neutral	Enabler	Neutral	Low	Exp/Pro
11	High	Neutral	Enabler	High	Neutral	Ena/Pro

Summary

An understanding of intentions, as proposed by Ajzen (1991), is central to understanding motivations and predicting behavioral outcomes or achievements. Based on the content analysis we can infer that faculty in the Academy of Teaching Excellence in the College of Agricultural and Life Sciences at University of Florida will demonstrate behaviors at a high level related to understanding and addressing the needs of their students. This inference is further validated due the similarity in both Teacher Belief Scale and content analysis scores. Continuing this conjecture, faculty will exhibit moderate behaviors related to affording students control over their learning process. This is based on the variability of scores for the Inclusion dimension within the content analysis.

This population of faculty, as well as the outcome of the behaviors, satisfies components of Bandura's (1977) social learning theory. Fulfilling these components will enhance the functional value of the modeled behaviors related to the dimension of Inclusion and Sensitivity. It is also implied that students and faculty in the College of Agricultural and Life Sciences at University of Florida value teachers that are sensitive to student needs and inclusive of all students since members of the academy were selected through a student nomination and peer evaluation process, which further validates this population based on Bandura's 1977 descriptions. Based on the findings, it is recommended that new instructors should strive to model these behaviors in practice. Additionally, it is recommended that faculty focus on understanding the two dimensions as defined by Heimlich (1990). This understanding should focus on metacognitive assessment of personal attitudes and norms related to the dimensions. This would further enhance the final behavioral outcomes based on the internal understanding of the theory of planned behavior (Ajzen, 1991).

The results of this study only apply to the small group of faculty examined in the case. Teaching beliefs of faculty not in the academy should be examined to see if similarities exist. Additionally, this study should be replicated at other universities and in other disci-plines to see if similar results are found. Finally, teacher beliefs and behaviors are inputs in the learning process. Teaching beliefs should be compared with student performance (learning) to determine if relationships exist.

To allow for a more specific assessment of undergraduate college professors the Teacher Belief Scale should be evaluated and potentially redefined according to the original dimensions. Heimlich (1990) applied the Teacher Belief Scale to adult educators in Extension Education. The items should be evaluated and potentially exchanged for more pertinent or valid items for the population, and the setting. Additionally, new items should be added to address contemporary trends in the educational system. If addressed, this could account for variances between Teacher Belief Scale and content analysis scores for the Inclusion dimension.

To further the description of behaviors of the faculty, the researcher should conduct in-class observation of the professors. This would finalize the case study, as well as describe the final component of the theory of planned behavior (Ajzen, 1991). With a final behavioral analysis, a true model can be made for the behaviors of excellent professors. Research should assess faculty behaviors on several factors: self-reported and student assessments, as well as an outcomes or student achievement component. Reiterating the initial conjecture, the main goal for a teacher, in any capacity, is student learning.

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Effect of Supplemental Online Resources on Undergraduate Animal Science Laboratory Instruction

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Abstract

The objective of this study was to determine if supplemental online resource (SOR) availability in a distance education (DistEd) format could enhance student learning. Students (n=137) in an undergraduate animal science laboratory course completed an anatomy pretest and pre-survey to assess their experience with, and attitudes towards, SOR. Supplemental Online Resource modules were made available for randomly selected laboratories. Two laboratory practical exams were administered and included questions from labs for which SOR was made available as well as labs that had no SOR. Questions from the pre-test were included in the exams and used to generate "posttest" scores. Student learning and performance was evaluated using a hierarchical design that included test scores, SOR availability and their interactions. Results are presented as mean±SEM. Posttest scores (87±2%) were higher (P<0.0001) than pretest scores (34±2%), indicative of student learning. On Laboratory Practical 1, students scored higher (P=0.0012) on questions from laboratories with SOR compared with laboratories without SOR (80±1% and 75±1%, resp.). In contrast, on Laboratory Practical 2, there was no effect of SOR supplementation on student scores (83±1% and 83±1%, for SOR and no SOR, resp.). A majority of students (93/137, 68%) surveyed indicated that SOR was at least somewhat useful for improving their grade.

Key Words: anatomy, online, supplemental online resources, undergraduate

Introduction

Through the use of computers, instructors have been able to design and create programs and materials suited to students' learning needs (Holt et al., 2001). These types of programs and materials have been referred to as computer assisted learning (Holt et al., 2001), computer assisted instruction (Schittek et al., 2001), web-based materials (Granger et al., 2006) or supplemental online resources (SOR). The use of SOR may enhance the learning opportunities for topics that may not be taught or expressed as well with traditional methods (Schittek et al., 2001). Supplemental Online Resources may also enhance student learning by allowing students to learn at their own pace, as well as permit interactions between the student and content or learning material (Schittek et al., 2001).

Mahmud et al. (2011) conducted a quasi-experimental study showing dissection videos to first-year undergraduate medical students and analyzed their test score performances. It was concluded that while the videos did not significantly improve the students' final examination scores, the majority of the students preferred regular use of the videos to assist with studying and review. Those results were also true for first-year students who used instructional anatomy videos as a supplement to their gross anatomy course (Saxena et al., 2008). Students found that the videos were a useful preparatory tool that had the capability to enhance student anatomy performance if used (Saxena et al., 2008)

In evaluating the use of SORs in the form of practice quizzes within the Animal Science discipline, Grizzle et al. (2008) examined whether or not exam grades were influenced by the number of times a practice quiz file was accessed and used in preparation for taking an examination in an undergraduate reproductive physiology course. While the use of the practice quiz files did not influence exam grades, the authors concluded that the use of online resources offered students a means of review after the lecture and traditional dissection laboratories were completed (Grizzle et al., 2008).

The purpose of this study was to determine the effectiveness of SOR on student learning in an undergraduate domestic animal anatomy laboratory. The hypothesis was that student learning would be enhanced when using the available SOR material compared to learning without the availability of SOR.

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Materials and Methods

Approval was obtained from the University's Institutional Review Board, and all participants provided written informed consent prior to the start of the study. No identifying information was used in the data analysis, and participation in data collection was entirely voluntary.

Anatomy of Domestic Animals (ANS 206) is a required course for all students in the Department of Animal Science at North Carolina State University. Students who register for this lab meet once a week for two hours. In each laboratory lesson, students were introduced to the gross anatomy of a major organ system, using one or more of the domestic animal species as examples for study.

The present investigation was conducted in the fall and spring semesters of 2009-2010. In fall 2009, 72 students were enrolled in ANS 206, with 68 females and four males. Seventy-eight percent of the students were sophomores, 4% were freshman and 18% were juniors and seniors. In spring 2010, 65 students were enrolled in ANS 206, with 54 females and 11 males. Thirty-five percent were freshman, 35% were sophomores and 29% were juniors and seniors.

Individual laboratory lessons were organized in a manner similar to that reported by Bing et al. (2011). In the present study, all laboratories were in face-to-face format, but alternating laboratories had SOR available to students. In order that each laboratory content topic had SOR material made available over the two semesters in which the study was conducted, the presentation style (SOR, No SOR) was switched between the fall and spring semesters. For example, if Laboratory 1 had a SOR module made available in the fall, then there was no SOR module made available for Laboratory 1 in the following spring (Table 1).

Each laboratory began with an introductory presentation made by the instructor, which was followed by students viewing models and performing specimen dissections. After each laboratory lesson, students were given assignments (some to be worked on individually and others designed for groups) and/or quizzes to be completed by the following week. The quizzes each week were presented in one of two formats: self-testing video quizzes that could be attempted multiple times to help students review the information presented in the laboratory and graded quizzes prepared and administered using the Blackboard Vista online learning system (Blackboard, Washington, D.C.).

Table 1. Availability of SOR Materials for Laboratory Lessons in Fall 2009 and Spring 2010

Laboratory	Laboratory Topics	Availability of SOR materials	
		Fall 2009	Spring 2010
L1- Body Water and Diffusion	body water, osmosis, and diffusion	SOR	No SOR
L2- Brain and Senses	structures and functions of the sheep brain and cow eye	No SOR	SOR
L3- Bone and Joints	comparative skeletal anatomy-horse, goat, dog, cat and rabbit	SOR	No SOR
L4- Cardiovascular System	external and internal cardiac anatomy of the sheep; describe blood flow	No SOR	SOR
L5- Muscles	skeletal muscles of the horse	No SOR	SOR
Lab Practical 1 Covered Labs 1-5			
L6- Respiratory Physiology	anatomy of the respiratory system (sheep); inspiration and expiration	SOR	No SOR
L7- Blood	principal components of blood; explain procedures for blood sampling in pigs	No SOR	SOR
L8- Endocrinology/ Blood Typing	major endocrine glands and tissues of the body; identification and function of major hormones produced	No SOR	SOR
L9- Urinary System	external and internal features and functions of the sheep and cow kidney	SOR	No SOR
L10- Digestive System	anatomy and function of the digestive system; comparative anatomy of ruminants and nonruminants	No SOR	SOR
Lab Practical 2 Covered labs 6-10			

SOR- supplemental online resources

The SOR modules were created using Blackboard Vista and Adobe Dreamweaver (Adobe Systems, San Jose, CA). Each SOR module had an introductory web page presenting the overview and objectives of the laboratory lesson, recorded video demonstrations of specimen dissections with narration, animation, captions, and video demonstrations from various commercial sites that could be accessed by web link. Students were allowed to return to the SOR material throughout the semester for further clarification of laboratory objectives as well as to review for their laboratory practical examinations during the course of the semester.

A pre-survey was administered on the first day of class and was used to collect demographics, information on prior knowledge or experience with SOR material and students' opinions regarding SOR material. A pretest consisting of 10 questions was also administered on the first day of class and was used to determine how much prior knowledge students had about anatomy. A post-survey, given on the last day of the semester, was used to collect general feedback on the course and gather opinions as to whether or not the SOR material provided during the semester was useful.

Two practical examinations were given

during the course. Laboratory Practical 1 was given mid-semester and covered material from laboratory lessons 1-5. Laboratory Practical 2 was given at the end of the semester and covered material from laboratory lessons 6-10. The examinations were given in-person and consisted of material from the covered laboratory lessons, regardless of whether SOR was made available to those lessons or not. The practical examination consisted of identification stations where students had to name the structures presented or identify their function and a short answer section that consisted of definitions or explanations. The 10 questions included in the pretest were also included in the appropriate Laboratory Practical examination. Performances on these 10 questions were considered the students' "posttest" scores.

Tracking data was obtained from Blackboard Vista, over the entire semester. This Blackboard feature allowed the course instructor to track the number of sessions a student logged into, the number of files viewed by the student, as well as the amount of time spent online viewing the SOR material. The tracking data was broken down and analyzed by each section of the semester associated with each Laboratory Practical examination.

All statistical analyses were conducted using SAS (SAS Inst. Inc., Cary, NC). Paired t-tests were performed on pretest and posttest scores to assess overall student learning for both the fall and spring semesters. Within each Laboratory Practical exam, two relative exam scores were calculated for each student. The first relative exam score was calculated by dividing the number of correctly answered questions derived from all laboratory exercises with SOR availability by the total number of questions derived from all laboratory exercises with SOR availability. Similarly the second relative exam score for each student was calculated by dividing the number of correctly answered questions derived from all laboratory exercises with No SOR availability by the total number of questions derived from all laboratory exercises with No SOR availability. A hierarchical design was used to determine if there was a difference in student performance in each laboratory practical examination based on the availability of supplemental online resources (SOR) across two semesters of data. Semester is considered a 'between-subject' factor because students (our subjects) in a class for a given semester are subjected to similar academic conditions characterized here as "semester." Scores are characterized by their source (named SOR availability): questions from labs with SOR availability and questions from labs with no SOR availability. The factor SOR availability is considered a 'within-subject' factor, since each student has both scores. The statistical model for performance data from Laboratory Practical 1 or 2 included the main effects of semester (fall, spring), SOR availability (SOR, No SOR) and their interactions as fixed effects, and students within each semester as random effect measuring the experimental error. Linear regression analysis was performed on tracking data (sessions logged on, files viewed, time spent online) and student performance on Laboratory Practical 1 and 2 using the Proc REG command of SAS. Tracking data was also compared between students who thought the SOR was useful vs. not useful in an unpaired t-test. Data from the post-survey regarding students' opinion on SOR usefulness were analyzed using a Chi-square test. Statistical significance was accepted at an alpha level of $P<0.05$.

Results and Discussion

An overall increase in posttest compared to pretest scores was observed for both semesters (Figure 1). The students in fall 2009 (Figure 1a) had an increase ($P < 0.0001$) in posttest scores compared to pretest scores (86% ± 2% vs. 30% ± 2%, respectively). Similarly, posttest scores for students in spring 2010 (Figure 1b) were increased ($P < 0.0001$) compared to pretest scores (85% ± 2% vs. 39% ± 3%, respectively). While there was no effect of method of presentation on pre- and posttest performance, there was significant increase in learning regardless if SOR was available or not ($P<0.0001$), suggesting that learning occurred through both methods.

On Laboratory Practical 1, there was a semester effect ($P=0.02$) such that spring semester performed better than the fall semester (80±0.1% vs. 75±0.1%, respectively) (Figure 2a). There was also an effect ($P<0.0001$) of SOR availability such that students performed better on material that had SOR available than with material that didn't have SOR available (80±0.1% vs. 75±0.1%, respectively) (Figure 2b). On Laboratory Practical 2, there was no semester effect ($P=0.11$) such that fall semester performed similarly to the spring semester (85±0.5% vs. 81±1%, respectively) (Figure 2c). There was no effect ($P=0.84$) of SOR availability for either fall or spring semesters for Laboratory Practical 2 (83±0.1% vs. 83±0.1%, respectively) (Figure 2d).

For the post-survey results, in both semesters, more students agreed that the SOR was useful than disagreed with this statement. While spring semester had numerically more students who agreed that SOR was useful (49/60, 82%) compared to students in the fall semester who agreed that SOR was useful (44/64,

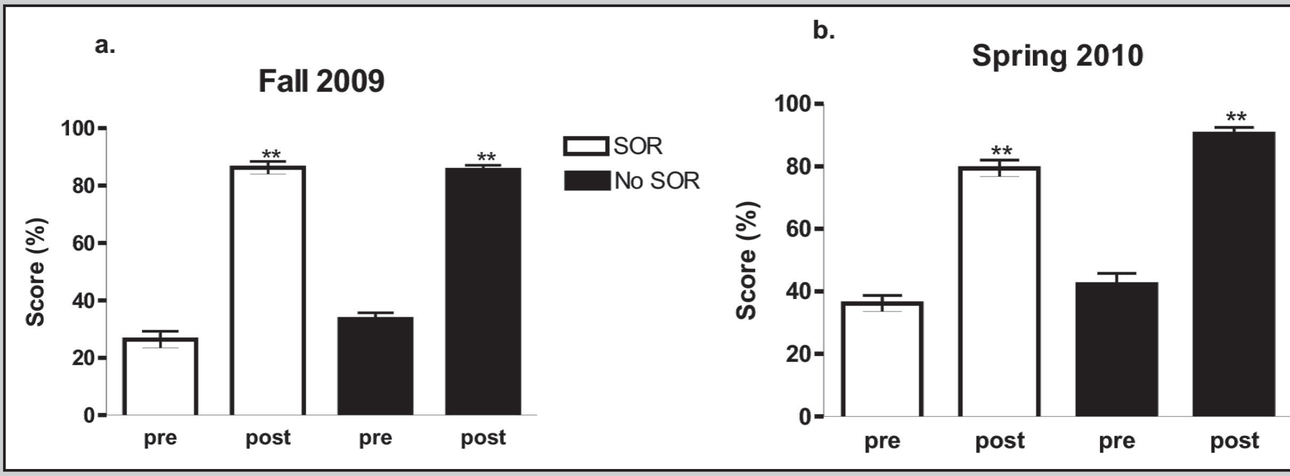

Figure 1. Effect of presentation material on pre- and post-test scores. SOR: supplemental online resources.
***- P<0.0001 pre- vs. post-test scores.

69%), there was no significant difference between semesters (P=0.10).

The relationship between the tracking data and performance on Laboratory Practicals 1 and 2, expressed as Pearson correlation constant values (r), are shown in Table 2. Between the first day of class and Laboratory Practical 1, there was a significant difference (P<0.0001) in the average number of SOR sessions the students in the fall semester logged onto compared to that for the students in the spring semester (33±12 vs. 44±17, respectively). From Laboratory Practical 1 to Laboratory Practical 2, there was also a significant difference (P<0.01) in the average number of sessions logged onto for the fall compared to the spring semesters (37±15 vs. 31±14, respectively). There was no significant correlation between the number of sessions logged onto and the examination grade for the students in the fall semester on Laboratory Practical 1 or Laboratory Practical 2. There was, however, a significant correlation between the number of sessions logged onto and the examination grade in the spring semester for Laboratory Practical 1 (P= 0.005) and Laboratory Practical 2 (P= 0.003).

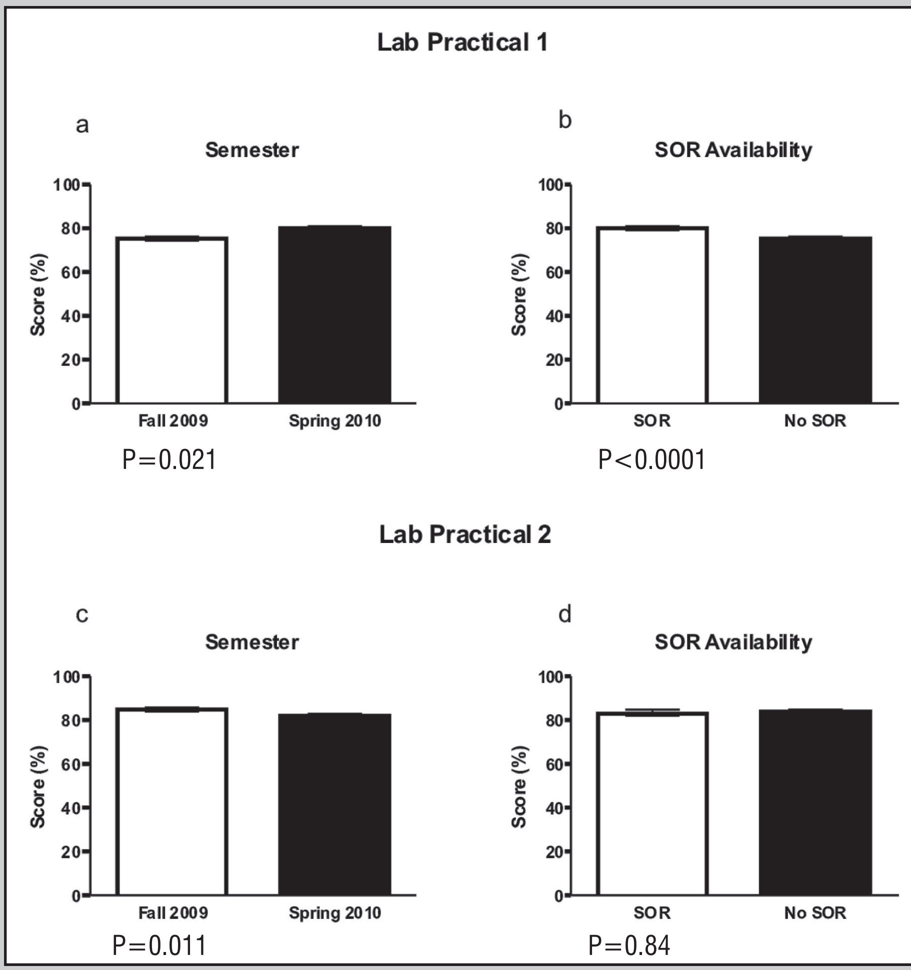

Figure 2. Semester and SOR availability effect Laboratory Practical 1 (a,b) and Laboratory Practical 2 (c,d) exam score. SOR- supplemental online resources.

The average number of files viewed differed (P<0.0001) from the first day of class to Laboratory Practical 1 for the fall compared to the spring semesters (58±28 vs. 40±20, respectively). From Laboratory Practical 1 to Laboratory Practical 2, while the fall semester students viewed an average of 30±14 files compared to the spring semester students who viewed an average of 28±15 files, there was no significant difference in the average number of files viewed between the semesters. There was no significant correlation between the number of files viewed and the examination grade in the fall semester for either Laboratory Practical 1 or 2. There was no significant correlation between the number of files viewed and the examination grade in the spring semester on Laboratory Practical 1 but there was a significant correlation between the number of files viewed and the examination grade on Laboratory Practical 2 (P<0.05).

The average number of time spent online, in minutes, from the first day of class to Laboratory Practical 1 was 446±174 minutes for fall semester and 432±434 minutes for spring semester, but showed no significant difference in time spent online between the semesters. From Laboratory Practical 1 to Laboratory Practical 2, the total time spent online differed significantly (P<0.0001) between the fall semester students and spring semester students (433±175 vs. 250±148, respectively). Fall semester showed no significant correlation between the amount of time spent online and examination grades on Laboratory Practical 1 or 2. Spring semester showed no significant correlation between time spent online and examination grade on Laboratory Practical 1, but there was a significant correlation between the amount of time spent online and their examination grade on Laboratory Practical 2 (P= 0.003).

It was of interest to determine if students who thought the SOR was useful were also those who used it more. Therefore, unpaired t-tests were conducted on tracking data for students who indicated that they had found SOR useful compared to those who did not find it useful. In fall 2009 those who found SOR useful also opened significantly more files than those who claimed SOR was not as useful, perhaps suggesting those who deemed SOR not useful didn't actually take full advantage of this resource.

The aim of any new teaching resource should be to produce effective teaching and learning materials that match or even exceed conventional methods (Devitt and Palmer, 1998). The present study found that SOR complemented student learning and was overall found to be useful by students.

Grizzle et al. (2008) stated that the use of a virtual laboratory offered students a means of review after lecture and traditional dissection laboratories to reinforce what had been learned; however, its use may not influence exam grades. It was also suggested that low-scoring students benefit from SOR more than students with higher scores, due to the differential effect that computer use has the tendency to increase motivation, self-confidence, self-discipline and knowledge within individuals (Gathy et al., 1991; Holt et al., 2001). In the present study, SOR availability only impacted exam score on Lab Practical 1. The SOR material associated with the lessons evaluated in Lab Practical 1 may have been more educational and useful to the students than the SOR material associated with the lessons evaluated in Lab Practical 2. Alternatively, the actual content of the lessons associated with Lab Practical 1 may have been more amenable to effective SOR supplementation than for the lessons associated with Lab Practical 2.

Table 2. Pearson Correlation Constant values (r) for Relationship between Lab Practical Exam Scores with Sessions Opened, Files Viewed, and Time Spent for Fall 2009 and Spring 2010

	Fall 2009		Spring 2010	
	Lab Practical 1	Lab Practical 2	Lab Practical 1	Lab Practical 2
Sessions	0.0024	0.0029	0.1188*	0.1364*
Files Viewed	0.0003	0.0193	0.0617*	0.0561
Time (min)	0.0025	0.0102	0.0056	0.1299*

** P-values < 0.05*

Although students in the fall semester logged into more SOR sessions, viewed more files and spent more time online compared to students in the spring semester, there was no significant correlation shown between the actions of the fall students and the examination grades obtained for either Laboratory Practical 1 or Laboratory Practical 2 during the fall semester. For students in the spring semester, however, there were significant correlations between the files viewed and time spent online with the examination grade on Laboratory Practical 1. Similarly, for Laboratory Practical 2, there were positive correlations with the exam results for the number of sessions logged onto and the time spent online. Thus, SOR material made available during the spring semester laboratories may have had a higher measure of relevance to the topics being presented compared to that for the fall semester laboratories.

Developing a web-based program that is to be used as a supplement to the dissection laboratory may have the potential to become a critical resource as well as a partial substitute for dissections (Granger and Calleson, 2007). Although students in other studies found SOR materials to be efficient, easy to run and useful to help prepare for laboratories and examinations, it was suggested that SOR should be used as an addition to traditional lectures and laboratories as opposed to replacing traditional laboratory methods (Holt et al., 2001; Granger et al., 2006). Over half the students in each semester from the present study stated in their post-survey that they felt the SOR was useful in improving course grades and should be made available for all laboratory lessons.

Summary

In summary, there was significant increase in posttest scores for both semesters regardless of SOR availability. On Laboratory Practical 1, there was a semester effect in which spring semester scored higher than fall semester and a SOR effect in which students in both semesters scored higher on material with SOR than no SOR. On Laboratory Practical 2, there was a semester effect in which fall semester scored higher than spring semester; however, there was no SOR effect for either semester. The fall semester students showed no correlation between the number of sessions logged onto, the number of files viewed or the amount of time spent online and the examination grades for both Laboratory Practical 1 and 2. The spring semester students exhibited different outcomes. While there was only a significant correlation between the number of sessions logged onto and the examination grades on Laboratory Practical 1, the spring semester students showed a significant correlation between the number of sessions logged onto, the number of files viewed or the amount of time spent online and the examination grades for Laboratory Practical 2. The results of this study demonstrate that SOR availability may be a useful learning tool and an effective way to allow students to review course material as needed on their own time. Nonetheless, it may be necessary to further explore the use of SOR effectiveness as it relates to usefulness for examination preparation, student perception, and student tracking.

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Using Reflection to Gain Insight into the Student Teaching Experience

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Abstract

This study examined student teacher' perceptions related to the student teaching experience. Using a focus group process, the student teachers were asked to reflect on their expectations of the experience, how they applied previous learning from university coursework to the experience, and what could be could be done to improve the preparation of students for the experience. Because of the importance of instruction, FFA, and Supervised Agricultural Experience in teaching agricultural education, the three components of a complete agricultural education program were used as the context for the reflective session. A semi-structured set of questions were used in the focus group to gather participant responses. The session was audiotaped and transcribed. The transcription served as the primary data source. Secondary data consisted of field notes written by one member of the research team. Content analysis was used to interpret the data. The results indicated that the student teaching experience was not what the participants thought it would be in many ways, especially the time commitment involved in preparing for the teaching and learning process. The participants provided insights for improving the preparation of future student teachers and recommendations are included.

Introduction and Theoretical Framework

Teacher education programs have an important role in preparing quality teachers to enter the teaching profession. In 2002 The National Council for the Accreditation of Teacher Education (NCATE) stated that teacher candidates must know the subject matter they plan to teach and be able to explain important concepts related to the subject matter. While content knowledge is important to good instruction, others researchers (Ball, 2000; Cruickshank et al., 1996, Schwartz, 1996, Smylie et al., 1999) echoed NCATE's belief that teachers must understand their respective content area, but they also added that the teacher candidates must also be able to teach the content well. Thus, the teacher preparation program must build both content and pedagogical knowledge of the students.

Roberts and Dyer (2004) identified characteristics of an effective agriculture teacher that went beyond content and pedagogy. Specific characteristics for agricultural educators included; having a sound knowledge of the FFA, actively advises the FFA chapter, effectively prepares students for Career Development Events and other FFA activities, and has a sound knowledge, actively supervises, and encourages Supervised Agricultural Experience (SAE) projects. They concluded that effective characteristics of teachers in these areas must either exist prior to being admitted to the teacher education program, or they must be taught during the program. One way to do this, according to the authors, was through providing experience-based learning opportunities. Student teaching is often the culminating experience-based learning opportunity provided to teacher education students.

Dewey (1938) believed that the basic element required for learning was experience. However, Dewey also believed that reflection was a key component in making an experience worthwhile. While student teaching provides this experience, many researchers of experiential learning agree with Dewey in that for the learner to get the most benefit from an experience, more must occur than just the experience. Models of experiential learning entail more than just the actual experience (Dewey, 1938; Juch, 1983; Kolb, 1984; Enfield et al., 2007). Experiential learning literature indicated that experiential learning is a process, not just an activity. Thus, many experiential learning models are depicted as a cycle in which the learner is involved. Kolb (1984) put forward a model of experiential learning that included four steps; Enfield

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et al. (2007) cited a five-step model as being used in much of the current 4-H curriculum.

While each of the models varies, there are also commonalities between each; most notably that each includes some form of experience, reflection, and application. The student teaching experience can be seen as both experience and application, depending on the view which one takes at any point in time during the student teaching process. Student teaching could be the application of what was learned in the pre-service coursework. It could also be viewed as another actual experience that should be reflected upon, and learning from that experience, and subsequent reflection, should be applied to future teaching situations. For the cycle of experiential learning to be unbroken, between experience and future application, there needs to be some context in which to reflect upon what has happened in the experience.

Reflection on the learning goals of a particular class session is a point of assessment for teacher effectiveness. Reflection allows the teacher, or student teacher, to determine what worked and what should be changed in a lesson. The same can be said for reflection on the total agricultural education program. A teacher that reflects on the entire program demonstrates professional commitment in determining how the agricultural education program, as a whole, can be improved. Within agricultural teacher education programs, one frame from which to reflect upon the student teaching experience is through that of the complete agricultural education model (classroom/laboratory instruction, FFA, Supervised Agricultural Experience) as outlined in Talbert et al. (2007). A complete agricultural education program is one that encompasses classroom/laboratory instruction, Supervised Agricultural Experience, and FFA (Talbert et al., 2007).

Roberts and Dyer (2004) and Ewing and Foster (2010) researched characteristics of effective agriculture teachers. Roberts and Dyer found, using a Delphi study that more characteristics of effective teachers were identified and agreed upon in the category of classroom instruction when compared to the other seven categories. Supervised agricultural experience and FFA were two other categories that surfaced through the study. Ewing and Foster asked administrators with new and beginning agriculture instructors to rate the importance of teacher effectiveness in the areas of classroom/laboratory instruction, FFA, and SAE. Administrators ranked characteristics of effective teaching for the classroom/laboratory instruction higher in importance compared to both FFA and SAE characteristics. However, these three areas work together to provide secondary agricultural education students the opportunity to experience hands-on application of learning in very different contexts, while accomplishing the learning goals within the content area. An agricultural education teacher preparation program that focuses on these three aspects of agricultural education has a foundation on which to prepare teachers in agricultural education.

By building reflection into the teacher preparation coursework, early field experiences, and the student teaching experience, evaluation opportunities are provided to students. The process of experiential learning can be utilized to explore the teacher candidates' experiences related to their preparation and the actual student teaching experience (Figure 1). This model, developed through the current research, highlights the three components most often referenced

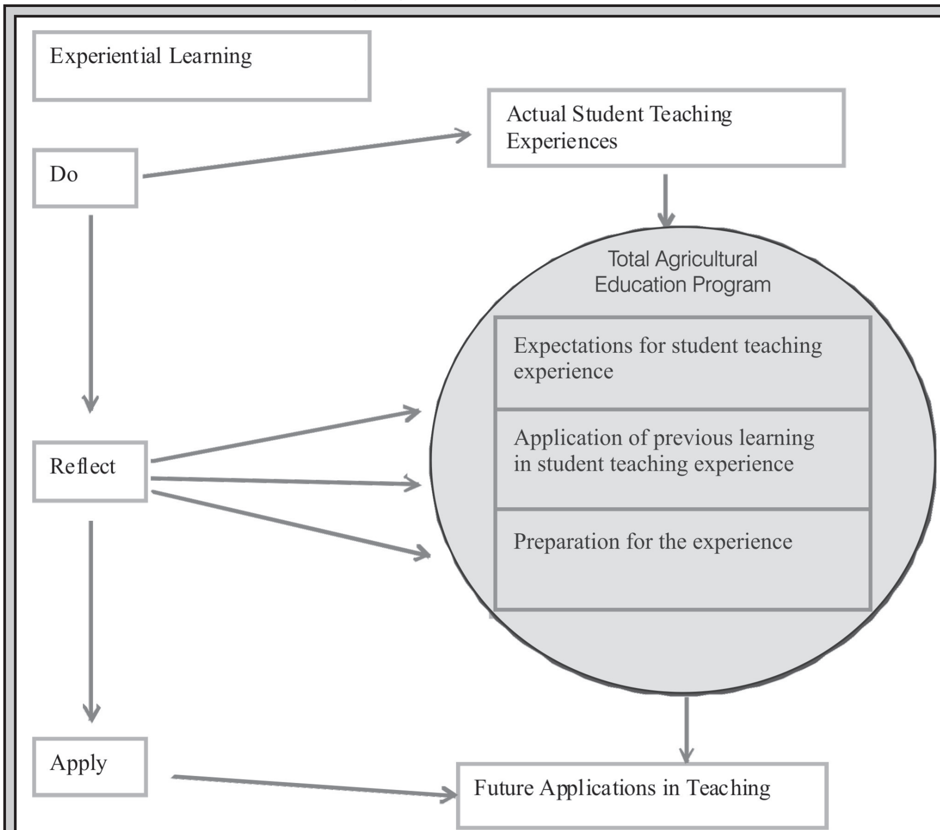

Figure 1. Using the three components of the agricultural education model to promote reflection of the student teaching experience.

in experiential learning models; an actual experience (do), reflect (reflection), and apply (future application). Roberts and Dyer (2004) and Ewing and Foster (2010) evidence the importance of being skilled in the three areas of the total agricultural education program. A teacher candidate's ability to reflect on these components allow for growth for future applications within the experiential learning cycle.

Purpose and Research Questions

The purpose of this study was to gain insight into the student teaching experience through group reflection. The study sought to answer the questions:

1. What were the participants' expectations for the student teaching experience?
2. How did the student teachers apply what they learned through coursework during the student teaching experience?
3. Based on the student teachers' experience at the cooperating schools, what can be improved in the preparation program to more adequately prepare student teachers for the experience?

Methods

Pure objectivity is an illusion (Lincoln and Guba, 1985). To take human interaction out of research may very well keep researchers from rich information (Erlandson et al., 1993). A naturalistic researcher recognizes that one cannot insulate the results from researcher "contamination," and instead trusts in the confirmability of the findings (Erlandson et al., 1993). It is important to note that, in this case, the researchers have intimate knowledge of the context under study, as university faculty members (and former student teacher), which most certainly informs the inductive reasoning and data analysis of this study.

The researchers used purposive sampling, a technique that intentionally seeks out participants because of certain qualities. In this case, the research targeted young people who had completed pre-service teaching assignments. The participants were identified because of their enrollment in the pre-service course at The Pennsylvania State University. This study focused on twelve individuals who had completed the student teaching experience just days prior to the focus group session.

When a group of people is brought together and asked the same questions at the same time in order to collect data it is called a focus group. The purpose of focus groups is multi-fold. Focus groups can serve to introduce concepts that may be foreign to a research team; they can serve to help group members remember events, and they can be used as a method of triangulation (Denzin and Lincoln, 2000). In the case of this study, the focus group was held during the wrap-up session following the student teacher experience. Members of the group were seniors in the Agricultural Education curriculum at The Pennsylvania State University, made up of both genders, and a median age of 22 years. The focus group took approximately 1 hour and 30 minutes to complete, during which time participants were asked questions regarding their student teaching experience using a semi-structured set of questions. The focus group was audio taped and transcribed, serving as the primary data source. Secondary data consisted of field notes written by one member of the research team.

The basic idea of the study was to understand how student teachers in agriculture made sense of their experience. Latent content analysis was used to interpret the data, meaning that the analysis was extended to interpretations of the symbolism underlying the data (Berg, 2001). An open coding methodology was used by the team to begin to make meaning of the data (Berg, 2001). Open coding allows researchers to: "ask the data a specific and consistent set of questions, analyze the data minutely, frequently interrupt the coding to write theoretical notes, and never assume the relevance of traditional variables like age, race, gender, etc." (Berg, 2001 p. 251). It is important to note at this time, that it was for this reason that the population under study is not more richly described, demographically. .

Trustworthiness of the study was an important part of the research team's methodology. The research team established credibility via peer debriefing and member checking. Peer debriefing, in the case of this study, took the form of a number of reviews of all content analysis by an outside member of the Agricultural Education profession throughout the research period. Member checks occurred throughout the focus group as the research team verified data and initial interpretations with the persons under study. Additionally, typed transcripts were compared with the audiotapes for accuracy. To establish transferability the researchers used thick description and purposive sampling. Purposive sampling, as discussed above allows the researcher to study individuals or contexts that will provide rich and pertinent detail. Thick description is often misunderstood. Berg (2001, p.33) describes this description as "sufficiently detailed descriptions of data in context and reports the data with sufficient detail and precision." To establish dependability, an audit trail of codes to transcriptions of the focus group and methodological and reflective journaling were used to establish dependability and confirmability.

Categories were developed and discussed to ensure consistency.

Results

Using the three contextual areas that demonstrate a complete agricultural education program as espoused by Talbert et al. (2007) to provide a referent frame, and guided focus group reflections as a vehicle, the researchers have sought to answer three guiding research questions. The results of the study will be presented in order of research question.

The researchers asked the participants to reflect back on their expectations for the student teaching experience. Expectations may have included those they held for themselves as student teachers, their cooperating teachers, cooperating sites, and work expectations. Several individuals shared expectations that they held for themselves.

I looked at it [the student teaching experience], as being a time to prove yourself.

I also think to me it was important to do a good job because if you screwed up it's not like no one will ever know. …the extra pressure drove me to strive to do better.

A few students shared their expectations of their cooperating teachers or their cooperating sites.

I know that the cooperating teachers are busy but they need to have a class on what they need to do, because I walked in not knowing what to do and expected them to be more helpful in helping me get things straight.

I'm not saying my experience was horrible, but I think I learned more of the things not to do and how to prepare for bad situations when I expected that I would learn new ways that I should run my classroom [from my cooperating teacher].

I guess I knew it, but not every Ag Department is the same. I still sort of expected everywhere to have at least some things in common, but that's not the case.

Many students had expectations of what it would be like to be "on the job."

I expected my days to start earlier.

I remember as a high school student constantly being at the high school for FFA stuff or whatever, but for some reason I didn't expect that this time around as a student teacher. That wasn't the case, I was always there right at 7 and I left anywhere between 6 and 7 every night.

One thing I expected was that I would do my work at home more. I definitely found that going home to work didn't work because there were always other things going on and other distractions.

Research question two was designed to get the student teachers to reflect on their university coursework and how they might have applied it, positively or negatively, during their student teacher experience. Only a few students articulated perspectives from both sides when asked to reflect on their application of prior coursework.

I kind of floundered at first, but then she [cooperating teacher] said to me, do what you want to do, and maybe run ideas by me first, but it's yours. I got to apply what I learned to, I guess to teaching.

I started trying to hand out lesson plans I'd done [during coursework] left and right when I first started. It didn't apply. I made them, and then they didn't fit with the students, it didn't fit with what I got through in class. I had to completely change.

I tried different forms of different things, different materials we'd done in [course number], tried to do really active and moving around just to see how students interacted with me.

Research question three asked the students to reflect, on the preparation that they received for their student teaching experience, and how that preparation might be improved. Several students discussed the preparation that they received for their classroom/ laboratory instruction and how they might improve that instruction for future students.

I would suggest that they [future students] start writing lesson plans now. During all of these [course name] classes that prepared us, we could have probably had more curriculum development. It doesn't have to be just lesson plans either [that are prepared prior to the experience], I mean unit plans, anything like that. I mean the more practice the better.

They need to teach you record keeping at [name of pre-service site]. Also, we don't spend enough time on our own. You take three weeks to prepare lesson plans for three days…and you don't understand how long until it takes to do until you have to do it on one night.

Other students discussed the preparation needed prior to arriving at the pre-service site.

It's a good idea to require a certain number of hours [observing] in that school prior to student teaching. So by the time that you go student teach you've already been there hours and hours and hours.

While we tried to do some of that [getting to know the community] in the course, there's no way sitting here at Penn State University and even with going to do the visits that I could really get to know the area like my cooperating teacher.

Conclusions and Recommendations

The participants' expectations of the student teaching experience were both personal and programmatic in nature. Participants highlighted the importance of this experience in regards to preparation for future interactions within the Agricultural Education profession (Roberts and Dyer, 2004; Ewing and Foster, 2010). They also stressed the importance of preparation for the student teaching experience. However, there seemed to be some disconnect in the understanding of what really occurs in at typical school day and the amount of time a teacher needs to spend preparing to teach a topic that is unfamiliar.

To alleviate some of these concerns:

• Pre-service candidates should be encouraged to seek out opportunities to visit multiple agricultural education programs prior to, and in conjunction with, their early field experience opportunities.

• Increased opportunities that challenge students' planning abilities should be provided prior to the student teaching experience.

• Continued emphasis should be placed on the importance of the student teaching experience to the development of high quality teachers.

• Clear guidelines and expectations need to be communicated to all student teachers and their cooperating teachers in regards to the experience and a detailed plan of work should be provided to keep all involved in the field experience "on the same page."

Participants struggled to describe how they applied what they learned in their coursework to the student teaching experience beyond a few connections to lesson planning and teaching methods. In fact, only one student commented on changing their strategies following a "failure." Why did the student teachers have difficulty connecting their previous coursework with the experience of student teaching? Was this because participants had problems with either content knowledge or pedagogy during the student teaching experience? Were they afraid to share what they might have seen as a professional shortcoming? Did they not recognize the "failures" and need for changing tactics? Or did they change based on previous knowledge and not realize that change had occurred?

• Pre-service candidates should be encouraged to reflect both on content and pedagogy (Ball, 2000; Cruickshank, et al., 1996; Schwartz, 1996; Smylie et al., 1999) and the ways in which their previous understanding was applied on a daily basis in the classroom or laboratory and during the Supervised Agriculture Experience and FFA contexts.

• Assignments should be developed for student teaching that specifically focus on enhancing teaching based on previous content and pedagogical knowledge and how it was applied in a particular situation and then extend this assignment to a future application of teaching.

The student teacher recommendations for the preparation of future groups were focused on curriculum and logistical issues. Participants, in recognizing that the time commitment required for good teaching was considerably different than their expectations commented on several perceived deficiencies in the current preparatory program. To address some of these concerns a more "real world" problem approach should be adopted during the preparation leading up to the student teaching experience

• Pre-service candidates should be provided with more opportunity to prepare lesson plans within a real time context. For example instead of the three week preparation to do a three day plan, students should be provided with a more realistic model, perhaps one week or less to develop a three day plan.

• Teacher educators should assign team lesson planning to encourage student teachers to learn to lean on the agricultural education family network that is available to them.

Throughout the reflection with the student teacher participants, there was no discussion about their role as potential FFA advisor or supervisor of SAE projects (Roberts and Dyer, 2004; Ewing and Foster, 2010). Is the preparation provided for these roles adequate, whereas for the classroom it is less so and thusly the focus is on classroom preparation? Were there no opportunities for the student teacher candidates to take on these roles during the field experience, and so there truly was nothing to report during the reflection?

Preparation curricula should be reviewed such that each component of the complete Agricultural Education program (Talbert et al., 2007) is adequately addressed in theory and in practice, thusly reasonably preparing pre-service candidates for all of their potential roles while in the field.

The researchers also realize that this is the tip of the iceberg in terms of research discovery. The team recommends that further research be done along this line of inquiry:

• A second round of reflection should be done with the individuals from this group that are actively teaching to discover what they have now implemented in their permanent positions that they might have learned while student teaching.

• Guided reflection as a method of debriefing student teachers should be studied to glean further what helpful information might be discovered to improve teacher preparatory programs.

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An Experiential Learning Model of Faculty Development to Improve Teaching

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Abstract

This article introduces a model for faculty professional development. The National Research Council (2009) indicated that graduates of colleges of agriculture must be prepared to work in a complex world using skills such as critical thinking, problem solving, teamwork, and leadership. However, critics of higher education have insisted that many college graduates do not possess these desired skills and are increasingly underprepared to enter the workforce. To help better prepare students, instructors should focus on effective teaching strategies that engage students and promote learning. However, most faculty members are hired for their expertise in research and have little preparation in pedagogical techniques. Therefore, faculty development programs that teach instructors effective instructional methods are necessary. This article proposes an experiential learning model of faculty development, which consists of three stages, including planning, delivery, and evaluation. The model utilizes field experiences, reflection, and peer observation to help college instructors learn how to implement and use various instructional methods. The experiential learning model presented in this paper could help college of agriculture instructors become more effective in their teaching, thus meeting the call to improve undergraduate learning.

Introduction

The world around us is rapidly changing. Increasing globalization of businesses, constantly changing technologies, and a continually growing world population are a few of the issues we face (National Research Council, NRC, 2009). Moreover, in the midst of these concerns, we face the unique challenges of climate change, creating renewable energies, and feeding the increasing population (NRC, 2009). To combat these and other issues, we will need highly educated leaders, scientists, and a workforce capable of thinking critically and solving the complex problems faced by society.

The burden of preparing this next generation of leaders, scientists, and workers for the challenges that lie ahead rests on the shoulders of America's colleges and universities (NRC, 2009). The key to solving society's problems will be the human capital that colleges and universities produce, that is, graduates entering the workforce (NRC, 2009). The Kellogg Commission (2000) dubbed this "the promise of American public higher education" (p. 9). Namely, higher education has an obligation to serve as the bridge between the public and the knowledge needed to solve complex issues (Kellogg Commission, 1999). Therefore, the question that must be asked is, are college graduates being adequately equipped for the challenge?

Many believe college graduates are not prepared for the future and have insisted on changes in undergraduate education (Barr and Tagg, 1995; Bok, 2006; Boyer, 1990; National Commission on the Future of Higher Education, 2006; NRC, 2009). The NRC (2009) called for changes in the way undergraduates are taught, citing specifically global integration, new science, consumer influence, environmental concerns, and demographic and political shifts as factors contributing to this need. In 2006, The National Commission on the Future of Higher Education suggested that American college students are receiving a substandard education, while Bok (2006) opined that universities cannot continue to rely on methods that have worked in the past, but need to place greater importance on innovation and educational quality. Both the National Commission on the Future of Higher Education (2006) and the Association of American Colleges and Universities (2002) proposed that graduates are underprepared for the workforce, lacking skills such as writing, critical

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thinking, and problem solving. These claims are compelling and highlight the need to change the way undergraduates are educated.

The most appropriate place to start looking at how to transform undergraduate education is to examine teachers. McLaughlin et al. (2005) argued that teachers are the link between the student and the content to be learned. What is more, the teacher's primary role is to engage students with the information they are learning (Smith et al., 2005). Effective postsecondary instructors have been found to utilize techniques to help students engage with the material and reach higher levels of achievement (Pascarella and Terenzini, 1991). Research has shown that student-centered teaching strategies, such as use of active and experiential learning activities, are critical to student learning in the classroom (Barr and Tagg, 1995; Chickering and Gamson, 1987; McKeachie, 2002). Therefore, it is important to focus on the quality and type of teaching strategies to help improve the learning of undergraduates.

In light of this, one may suggest that the solution to the problem is to hire professors who are highly qualified in their teaching. However, this proves problematic as the majority of faculty members at colleges and universities are hired on the basis of their proficiency in research as opposed to teaching (Adams, 2002; Harder et al., 2009). Boyer (1990) proposed that teaching is typically viewed by most in universities as a simple routine task that can be easily mastered. As a result, most faculty members are hired into positions where the tenure and promotion policy hinges on research performance while placing little consideration to the teaching aspect of the profession (Harder et al., 2009). The irony is that institutions of higher education are meant to be places of learning, but there has been a lack of emphasis on teaching (Harder et al., 2009).

Consequently, faculty professional development programs in the area of teaching are a necessity in colleges and universities (Myers and Roberts, 2004). Brent et al. (1999) agreed that professional development programs are a sufficient way to help newer faculty transition into the professorial role. Supovitz and Turner (2000) summarized the need for faculty professional development in teaching, stating "The implicit logic of focusing on professional development as a means of improving student achievement is that high quality professional development will produce superior teaching in classrooms, which will, in turn, translate into higher levels of student achievement" (p. 965). To bring about these types of changes, faculty development programs must be effectively implemented. In line with this, the Association of Public and Land-grant Universities (2009) suggested that programs need to be based on research in teaching and learning to improve the effectiveness. The Kellogg Commission (1999) additionally suggested that faculty development programs need to be implemented using active learning strategies. Finally, Schlager and Fusco (2003) stated that faculty professional development must be context-specific, learner-focused, and have practical applications for teachers.

Purpose

The purpose of this philosophical article was to propose a solution to the aforementioned problems by creating a faculty professional development model based on the experiential learning process that could be implemented by faculty professional development organizers. This model specifically focuses on a method to promote the development of effective teaching among university faculty members.

Theoretical Framework

The overarching theoretical framework for this study was constructivism. Constructivist theory posits that people learn through a process of constructing meaning utilizing their prior knowledge combined with their experiences (Merriam et al., 2007). Differing views of constructivism exist; however, there are three analogous tenets among the various views (Doolittle and Camp, 1999). The first of the three tenets is that active cognitive processing is required by the learner. McLaughlin et al. (2005) posited that learners must be actively, mentally engaged in the learning process for meaningful learning to occur. Secondly, all knowledge construction requires an interpretation of reality (Doolittle and Camp, 1999), whether knowledge construction is adherence to existing realities, creation of realities by the learner, or socially constructed realities. Lastly, experiences are a key element of constructivism. Roberts (2006) indicated that student engagement in experiences plays a vital role in students' knowledge construction. The combination of the three aforementioned tenets of constructivism provides a good base for experiential learning, which will be discussed in the next section.

Conceptual Framework

Many theorists have suggested that all learning begins with an experience (Dewey, 1938; Jarvis, 1987; Kolb, 1984). This process of learning from experiences is typically referred to as experiential learning and is epistemologically linked to constructivism because experiences provide the foundation for knowledge construction (Roberts, 2006). Beard and Wilson (2006, p. 2) defined experiential learning as "the sense making process of active engagement between the inner world of the person and the outer world of the environment," while Kolb similarly called experiential learning "the process whereby knowledge is created through the transformation of experience" (1984, p. 41). Additionally, Dewey argued people learn best when experiences are meaningful and directed. Experiential learning theorists agree that experiences are central to the learning process.

As a result, Roberts (2006) examined several existing experiential learning theories to create the Model of the Experiential Learning Process (Figure 1). In his model, Roberts posited the experiential learning process is cyclical and starts with an initial focus leading to an initial experience. After learners have their initial experience, the second phase is reflection, where through active cognitive processes learners reflect on their initial experience. Generalization is the third step in the experiential learning process, whereby learners must make an interpretation of the newly learned material and decide how this information fits with previously learned information. The cycle then comes full circle back to experience, where learners can experiment with the newly learned material.

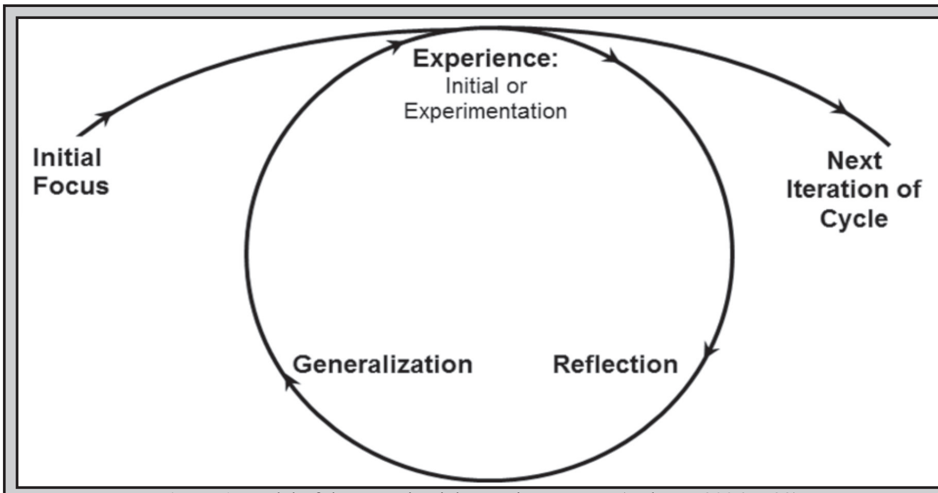

Figure 1. Model of the Experiential Learning Process (Roberts, 2006, p.22).

Development of the Experiential Learning Model of Faculty Development in Teaching

For the purpose of this article, which was to create a model for faculty professional development based on the experiential learning process, Roberts' (2006) Model of the Experiential Learning Process was merged with the Adult Learning Model for Faculty Development developed by Lawler and King (2000). The resulting faculty development model was named the Experiential Learning Model of Faculty Development in Teaching.

Because student engagement and achievement depend upon effective teaching strategies (McKeachie, 2002), the purpose of the Experiential Learning Model of Faculty Development in Teaching is to introduce instructional methods to faculty members who are inexperienced and/or desire to improve their classroom instruction. Understanding instructional strategies and methods is an important part of improving classroom instructional performance. In fact, Wilkerson and Irby (1998) argued that instructional skills should be introduced before instructional theories. The purpose of this is so faculty members can hone their skills, thus giving them a practical base on which they can connect the theory. More importantly, Myers and Roberts (2004) argued that faculty professional development should model the teaching methods being taught, because, as Richardson (1990) suggested, teachers tend to model their teaching behaviors after the way they were taught. It is for this reason that experiential learning was chosen as the conceptual framework for this model. Experiential learning provides faculty members with opportunities to experience and experiment with different teaching methods, which according to Richardson, should lead to greater skill development in teaching.

Along with Roberts' (2006) model, the Lawler and King (2000) model was chosen as a component of the Experiential Learning Model of Faculty Development in Teaching, as it provides a good complement to experiential learning. Lawler and King believed that individuals responsible for faculty development seldom view faculty members as adult learners. Therefore, Lawler and King (2000) framed their Adult Learning Model for Faculty Development around the following six principles of adult learning: "create a climate of respect; encourage active participation; build on experience; employ collaborative inquiry; learn for action; and empower the participants" (p. 21-22). These principles in Lawler and King's model align well with the precepts of constructivism and experiential learning, thus making their model a logical choice.

In addition to being constructed around adult learning principles, the Lawler and King (2000) model also contains four stages, consisting of preplanning, planning, delivery, and follow-up. Lawler and King created a list of pertinent questions for the professional development organizer to ask at each stage of program development. The questions are designed to help guide the creators of the professional development program through the planning process.

The first stage of Lawler and King's (2000) model is the preplanning stage. Here, the goals, needs, and climate of the organization are accounted for and the direction of the faculty development is determined. The pertinent questions posed by Lawler and King for the preplanning stages are:

• What overall purpose does faculty development serve?

• What purpose does this specific faculty development program serve?

• In what ways does the institution's mission align with this faculty development?

• Are there existing resources to support faculty development?

These four questions should help guide the organizers of faculty development in shaping the purposes and direction of their professional development program.

Lawler and King's (2000) second stage is the planning stage, which deals with the logistics of faculty development. The pertinent questions associated with the planning stage are:

• What steps will this faculty development project require?

• What personnel will be needed?

• How will the support, delivery, scheduling, and marketing for the faculty development be organized?

These questions should help planners with the organizational and logistic aspects of planning faculty professional development.

The third stage of the Lawler and King (2000) model is the delivery stage. This stage is concerned with the actual implementation of the professional development program. There are four questions Lawler and King posed pertaining to this stage:

• Does the delivery stage build upon the preparation?

• What means of promoting the program are most useful?

• Does our faculty development align with adult learning principles?

• What method of monitoring the faculty development will be used?

Finally, the last stage of the model is the follow-up stage. This stage is where concerns are addressed, considerations for future faculty development are made, and reflection on the entire process is conducted. Pertinent questions for planning this stage include:

• What is the plan for evaluating the faculty development program?

• How will ongoing support be provided to sustain the learning?

• What can be gained from reflecting on our role in the faculty development?

The Experiential Learning Model of Faculty Development in Teaching (Figure 2) utilizes Lawler and King's (2000) model to frame the programming aspects of the faculty development, while Roberts' (2006) experiential learning model is implemented during the delivery portion. The remainder of this article will discuss in detail the Experiential Learning Model of Faculty Development in Teaching.

Planning Stage

The first phase of the Experiential Learning Model of Faculty Development in Teaching is the planning stage. For this portion of the model, the preplanning and planning stages of the Lawler and King (2000) model have been condensed. The reason for this is that the context of the experiential learning model

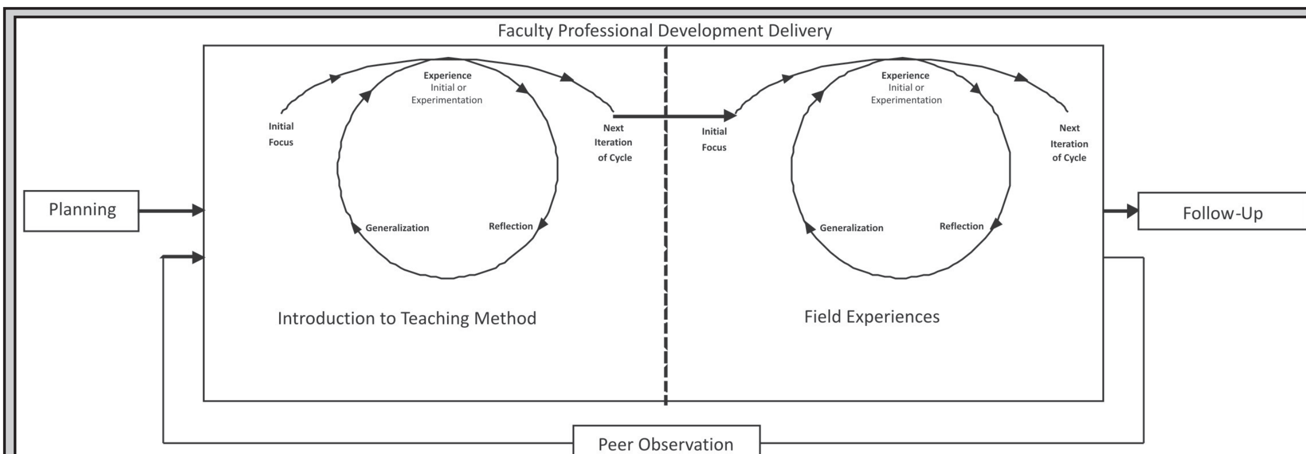

Figure 2. Experiential Learning Model of Faculty Development in Teaching (adapted from Lawler & King, 2000, and Roberts, 2006).

(e.g. teaching and learning) answers the first two preplanning questions, thus eliminating the need for the preplanning stage. What is more, the concept of teaching improvement in a university should address the third question concerning the mission of the organization. The last preplanning question in relation to resources is important and should be considered very early in the process, because resource availability will guide many later decisions. Likewise, the three additional planning stage questions of what will happen, who will be involved, and how to organize are important to the planning process. However, the answers to these questions will be institution specific, depending on the direction of the faculty professional development.

Delivery Stage

The second stage of the Experiential Learning Model of Faculty Development in Teaching is the delivery portion. This is where Roberts' (2006) Model of the Experiential Learning Process is implemented. The delivery phase is designed with the intent of the experiential learning component taking place over several sessions as opposed to one long session. This provides the faculty development participant multiple experiences and experimentation with specific teaching methods, congruent with the cyclical nature of Roberts' (2006) model. Moreover, research has shown that professional development is more effective if it takes place over a longer duration (Birman et al., 2000; Garet et al., 2001; Supovitz and Turner, 2000).

During the delivery stage, the specific instructional methods taught will be determined by the faculty development planners, and the instruction should be planned to fit the desired learning outcomes. Loucks-Horsley et al. (1996) argued that experiential, learner-centered methods of instruction allow participating faculty members to actively discover and implement the information being taught leading to a deeper understanding. For this reason, learner-centered experiential instructional approaches to professional development are more effective than the traditional teacher-centered approaches (Myers and Roberts, 2004). Keeping this in mind, three strategies which can help deepen the learning by faculty participants are field experiences using different teaching strategies, reflection on field experiences, and peer observation. A description of each of these strategies will be provided in the following sections.

Field Experiences

Field experiences are effective ways to enhance a faculty teaching development program. Richardson (1990) posited that field experiences are an important part of the "learning-to-teach process" (p. 12), and Kaufman (1996) further opined that field experiences improve teacher learning through hands-on, minds-on experiences. Additionally, Knowles' (1984) andragogy theory stated that experiences play an important role in teaching adults and, Roberts' (2006) Model of the Experiential Learning Process, which served as the framework for the delivery portion of this model, exerted that experiences are key to the learning process. The use of field experiences in the model at hand provides an outlet for experimentation by faculty learners.

Therefore, a typical faculty field experience should mirror Roberts' (2006) experiential learning cycle. First, participants in the faculty development should be taught certain instructional techniques such as inquiry-based instruction, cooperative learning, or other various active learning strategies as the initial experience portion of the process. Instruction in these methods should utilize modeling of the particular method being taught (Myers and Roberts, 2004). Depending on the timing of the program, many faculty members will be teaching courses while participating in faculty development, so the next step would require participants to use each method in their own classroom, which would constitute the field experience. Accommodations such as teaching to peers or guest lecturing could be made for faculty members who do not teach a class during the course of the faculty development program, or perhaps professional development organizers might wish to limit participation to faculty members with teaching appointments.

Reflection on Field Experiences

After the experience, the next major component of experiential learning is reflection (Kolb, 1984; Myers and Roberts, 2004; Roberts, 2006). Reflection on a field experience is more than determining whether or not a particular teaching method was effective. Adler (1991) suggested that reflection requires teachers to study, evaluate, and respond to their individual teaching situations to enhance their skill development. In addition, Gore (1987) expressed reflection as an important factor in the continued growth of teachers as a means of developing open-mindedness to looking at new ways of teaching. Reflection should help faculty members develop an understanding of why certain methods work. Examples of reflection activities in a faculty development course could be reflection journals, self-reported evaluation based on video self-observation of teaching, and group discussions about the effectiveness of certain instructional methods. Additionally, organizers of faculty development might use guided questions as one way of helping faculty members reflect upon their teaching. A few sample guided questions could include: (a) what aspects of your teaching went well, (b) what aspects of your teaching might you change (c) why do you think this activity went/did not go well, and (d) how did your students react to this activity? These are only a few examples of guided questions; faculty professional development organizers could create a list tailored to their situation.

Peer Observation

Learning occurs in social contexts (Vygotsky, 1978); therefore, peer observation should prove useful in helping faculty members develop a deeper knowledge about teaching strategies. Kaufman (1996) posited that peer collaboration should be used when training teachers because it helps them with their learning as well as contributing to the learning of others. Sparks (1986) found that peer observation of teaching significantly improved teaching performance in three ways. First, peer observation helped improve morale and ushered in a sense of team spirit. Second, evaluation of others may have helped teachers see their own faults, and third teachers were able to receive new ideas from watching others in the classroom.

A faculty development course based on the Experiential Learning Model of Faculty Development in Teaching would require faculty participants to observe and evaluate a colleague's classroom teaching followed by a debriefing session between the evaluator and their colleague about the experience. This would serve two purposes for the faculty development participant (evaluator). First, it would help them generalize the knowledge learned in the faculty development course because they would see the teaching methods used in different contexts. This step aligns with Roberts' (2006) model, as generalization follows reflection in the experiential learning process model. Additionally, it would help evaluators reflect on their own teaching practices.

Follow-up/Evaluation

The last phase of the Experiential Learning Model of Faculty Development in Teaching is the follow-up/evaluation stage. Myers and Roberts (2004) argued evaluation is an essential component of faculty professional development. Kirkpatrick (1998) offered three reasons that substantiate the need for evaluation: (a) evaluation provides justification for the program and personnel involved; (b) evaluation shows the needs for future faculty development; and (c) the effectiveness of the program can be measured along with suggestions for improvement. In addition, Kirkpatrick suggested that evaluation should occur at four levels, the first of which is participant reaction. Participant reaction provides professional developers information concerning participants' thoughts about the faculty development. The second level of evaluation suggested by Kirkpatrick is actual learning, which tells professional developers what skills and knowledge were acquired as a result of the faculty development. The third level of evaluation examines behavior changes as a result of the faculty development, while the last level of evaluation, results, seeks to determine the actual impact of the faculty development. Evaluation can occur in a variety of ways; however, evaluation should be included in faculty development programs as a means of assessing effectiveness.

Conclusion

Societal changes, including growth in technology, population, and globalization, have prompted the need for improvements in the way undergraduates are equipped for the workplace (NRC, 2009). Research shows a need to improve classroom instruction, with faculty professional development as the means to accomplishing this (Myers and Roberts, 2004). Adhering to adult learning, constructivist, and experiential learning theories, faculty professional development should engage the participants and provide them learning experiences from which to construct their knowledge. Effective faculty professional development programs focus on the faculty learner, providing practical, context-specific experiences that can help teachers increase their repertoire of instructional methods (Myers and Roberts, 2004; Schlager and Fusco, 2003). Additionally, faculty development experiences should utilize the instructional methods being taught (Myers and Roberts, 2004) because as Richardson (1990) suggested, teachers' teaching behaviors tend to model the way they were taught.

Roberts' (2006) Model of the Experiential Learning Process was merged with Lawler and King's (2000) Adult Learning Model for Faculty Development to create the Experiential Learning Model of Faculty Development in Teaching. This new model combines the programmatic aspects of Lawler and King's model with an experiential learning based delivery. The three stages included in the model are planning, delivery, and follow-up/evaluation. In the planning stage, the purpose and logistics of the faculty development are determined, and during the delivery stage participants are instructed on how to use various teaching methods. Three specific strategies that correspond to Roberts' (2006) experiential learning process were introduced in the delivery stage to help reinforce the teaching of instructional methods. These three strategies were field experiences, reflection on field experiences, and peer observation. The final stage of the model, the follow-up/evaluation stage, is where the "success" of the program is determined. Participant reactions, actual learning, behavioral changes, and impacts can be measured during the last stage to determine the overall effectiveness of the faculty development program.

The Experiential Learning Model of Faculty Development in Teaching should be beneficial in helping organizers of faculty development arrange and implement faculty professional development programs. Recommendations for the model would include, introducing the model to faculty development organizers, as well as testing the efficacy of the model in designing and implementing faculty professional development. Implications are that campus teaching centers may benefit from the model. Campus teaching centers typically provide support for teaching to faculty members, and this model may offer one method for teaching centers to provide faculty professional development.

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The UNIVEX Net as an Instructional System for Extramural Courses and In-Service Training in Agriculture

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Although the chance visitor to the campus may perceive it as a conventional classroom, it is in reality a classroom devoid of the conventional four walls. The instruction that takes place here is conveyed to several community colleges and educational centers throughout the state of Illinois. Thus, the state truly becomes the campus. How this takes place is the story of the UNIVEX Net as an instructional system for extramural courses and in-service training in agriculture in Illinois.

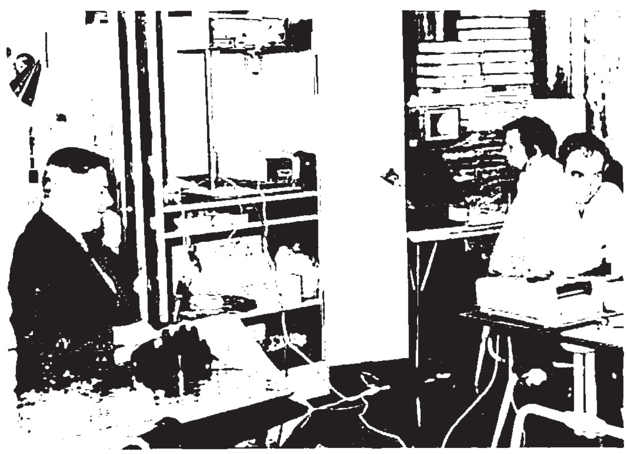
Based on the assumption that knowledge is not passed from teacher to learner as are bricks, the devices used in this system are designed to facilitate the flow of knowledge without the physical travel on the part of either the instructor or the learner.

Developed by the University of Illinois Division of University Extension, the UNIVEX Net is an instructional system that provides extramural courses by telephone to educational centers throughout Illinois. Each center instantaneously receives both written and voice communication from the instructor. In addition, each student in the off-campus class has the ability to write and speak to the instructor or his classmates at different locations. Thus, all elements of a normal classroom are present except the physical presence of the instructor.

Using this system, 22 faculty members of the College of Agriculture have taught courses on the Net since the effort was started in the fall of 1968.

A System Defined

One point needs to be clarified. Most systems acquire the name of the media or hardware of the system. Media are not instructional systems but the tools by which the instructor and his institution can facilitate the greatest of all acts of communication . . . that of an instructor with his student and between the student and his instructor. It is this act of communication that we should attempt to research, not the hardware. However, we must recognize that the hardware facilitates the development of complex instructional systems which heightens the impact of the instructor in controlling the instructional system of which he is a part.



Multi-media are available at the educational centers on the UNIVEX NET like this one at Kishwaukee College, Malta, Ill. In PORK PRODUCTION 303, Don Higgs, left, head of agricultural instruction at the college, demonstrates the audio capability while vo-ag instructors enrolled in the course, at the right, demonstrate the use of the auto-tutorial carrel, which enables the student to teach himself, and the VERB unit, which enables the student to write back to the instructor. In the center is the projection system which throws the written images from VERB onto a classroom screen for the students to study.

If "instructional" can be defined as those elements which promote learning and "system" defined as the many components unified as an entity to make possible a process, then an instructional system can be defined as that entity which makes possible the process of education for any given subject matter.

A basic assumption can be made that there is nothing in an instructional system, of and by itself, which produces improved learning by the participant. If poor instruction is fed into the system, it is still poor instruction when it reaches the student. If the learner is not capable of learning, the system can do nothing about his capabilities.

How Systems Can Be Studied

It is difficult to divide an on-going instructional system into meaningful variables. If this is attempted in a typical

Professor Bud Harmon in the UNIVEX NET location at Urbana communicates with students in six locations via the NET during his course on pork production. His VERB unit for writing is built into a desk top. The small microphone is the same one used by the astronauts.

Agricultural law professor H. W. Hannah, and former associate dean of instruction, found no difference between student performance on the NET and his campus students. He believes it is an excellent tool for in-service training in agriculture.

experimental design, the system itself is destroyed and the sum of the parts are much different than the whole. Another limiting factor is that learners and teachers will not be manipulated like varieties of corn, pigs or cattle in order to create the proper experimental design to measure the contribution of such variables as the hardware, software and the learning environment.

Thus, the researchable questions must deal with a system at work. Research tools must be limited to those useful in conducting field research and case study research. Conclusions from such investigations must be limited to a specific system, perhaps to a particular kind of classroom and to a particular kind of student, for a particular mode of instruction and for a specific instructor. Thus, the results are not expected to be generalizable to other instructional systems. However, they may be useful as guidelines in evaluating the performance of other systems.

It is not necessary to develop a new test instrument for the study of each new system. Since teacher evaluation instruments have been validated across a large population of students these same instruments can be used as a starting point to collect data about the system. Others support this rationale. Tyler[2] indicates:

> Students can report on their interest in the course, on their understanding of what is expected of them, on their satisfaction with achievement in the field, on the amount and extent of their study, and the like. There are, of course, other important aspects of teaching which the students are not in good position to judge, such as the soundness of the objectives, the validity of the reference material provided, the relevance of the approach. On the whole, however, it has been found that the summation of student judgements obtained from a questionnaire is positively correlated with other evidences of effectiveness of teaching . . .

It is in Wientge's[4] documentation of "Adult Teacher Self-Improvement Through Evaluation of Students" that the research value of rating scales can be seen. His use of such rating scales in an instructor rating form lead to the conclusion that the Illinois Course Evaluation Questionnaire developed by Richard Spencer and Lawrence Aleamoni[1] would be a logical research instrument. Wecke[3] reports the successful use of the CEQ with extramural courses, also.

Pioneers in our efforts with the instructional system involving the UNIVEX Net were two instructors in Agronomy during the 1968 fall semester. This gave us a unique opportunity to observe graduate-level student attitudes about this course in four different locations, two of which would be on the UNIVEX Net and one conventional classroom on campus and one extramural classroom located 150 miles from the campus to which the instructor travelled each week to

WEEDS 326

RANK ACCORDING TO CEQ SUB SCORES

	IN PERSON		UNIVEX NET	
	MACOMB	CAMPUS	FREEPORT	MALTA
INSTRUCTOR A	1		3	2
INSTRUCTOR B		2	3	1
COMBINED	1	3	4	2

meet the class. Instructor A taught this extramural course in person. According to student attitudes as measured by the Course Evaluation Questionnaire, this was the best rated course, with the UNIVEX Net course at Malta in second position and the UNIVEX Net course at Freeport in third with the on-campus course in last position. Note that for Instructor B, his highest rating came from a UNIVEX Net location. In this assessment from the CEQ results we note a difference in instructors and location. A surprising evaluation of instructor attitude indicates that Instructor B gained a great deal more satisfaction from "face-to-face" teaching than from the impersonal teaching through UNIVEX, yet his best rating came from a UNIVEX location, which was even better than Instructor A. The rating at Freeport was significantly lower than the other three locations. In these ratings we observe the complexities of an instructional system as they are uncovered by the CEQ.

PORK PRODUCTION 303

DECILE PROFILE OF COURSE

	POOR							GOOD		
GENERAL COURSE ATTITUDE	0	1	2	3	4	5	6	7	8	9
METHOD OF INSTRUCTION	0	1	2	3	4	5	6	7	8	9
COURSE CONTENT	0	1	2	3	4	5	6	7	8	9
INTEREST--ATTENTION	0	1	2	3	4	5	6	7	8	9
INSTRUCTOR	0	1	2	3	4	5	6	7	8	9
OTHER	0	1	2	3	4	5	6	7	8	9

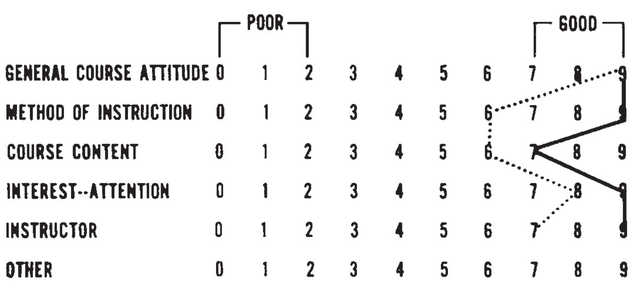
Another course, Pork Production 303, was taught during the 1969 spring semester providing the first opportunity to see how auto-tutorial and UNIVEX systems would work together for a graduate-level class.

In observing the sub-scores obtained from the Course Evaluation Questionnaire we find the course ranking in the 8th decile in general course attitude which was also the decile score for the instructor. However, the decile for method of instruction was at 3, which was two points below the all-University average. With all measurements considered, this particular course with this particular instructor and system rated better than the all-University average.

The students were taking the course at six educational centers throughout the state. At each center there was an auto-tutorial carrel tied into the instructional system with 10 auto-tutorial units assigned by the instructor. During the course we decided to document the use of these carrels as in a case study approach to see if the students were using the units and if so whether they were encountering any problems, and at the same time to get their evaluation. We noticed a great deal of difference in participation at the various centers. Eight of the units had been previously assigned by the instructor. One-sixth of the students had not on their own studied the units by that time. At Decatur the AT carrel was located in the Cooperative Extension adviser's office two miles away from the educational center. This definitely hindered the study of the AT units by the student. The students were not motivated to travel this distance. Again, the times that they could get access to the carrel were not appropriate times for them to study. Note that in the other locations half or more of the units had been studied where the auto-tutorial carrel was located at the educational center. This immediately leads us to conclude that the carrel must be located at the educational center for the convenience of the student.

Except for Decatur all locations were favorably inclined toward the need for auto-tutorial units in the course. For two locations, access to the auto-tutorial units was a limiting factor in studying them. Carrel equipment problems did not appear to hinder study except in one location. In regard to the question "I would not hesitate to enroll in another course using the same teaching methods," we found three locations favorably inclined with three locations not favorably inclined. At this time we could perceive the lower rating for the instructional method on the decile score mentioned above.

AGRICULTURAL LAW 303 DECILE PROFILE OF COURSE



Also, during the spring semester Agricultural Law was taught. The instructor used the conventional system for 57 students on campus and the UNIVEX system for 31 students. Data from all of the UNIVEX locations were averaged to represent the UNIVEX Net. These included the previously mentioned locations except Decatur. The Decatur location was so noisy and disturbing that the students travelled the extra distance to Urbana after the first week, to attend the course. In this case, the students were with the instructor in the UNIVEX terminal in Urbana. The instructor found this was very helpful to have the students right before him in conducting the class on the UNIVEX Net. Tests to check for significant differences were run between the UNIVEX Net group and the Urbana conventional classroom. The results indicated that the Urbana conventional classroom was rated significantly better than the UNIVEX Net as to (a) method of instruction, (b) student interest and attention and (c) the instructor. The UNIVEX Net was not perceived significantly different from the conventional classroom regarding (a) general course attitude (b) and course content. However, it should be noted that many instructors would be happy with the evaluation received by the UNIVEX system. The rating for the method of instruction and course content was still above the average for all-University courses.

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Mind Mapping to Explore Farming and Food Systems Interactions

The process of mind mapping to illustrate complex systems has been described in great detail in the book by Buzan (2000) and by others, and there are multiple software programs available to organize the process. This method can be used for taking notes, for summarizing a meeting or seminar, or for making connections and bringing together key interacting elements on a white board or chalk board while a class is in session. We have found this activity especially valuable for students in agroecology who are studying complex farming and food systems, where much of the action results from key relationships and interactions that lead to emergent properties of the system.

Learning Objectives are for students to 1) capture and record key elements of a system during discussion or class, 2) explore principle interactions and duplications of these elements, 3) determine the importance of interactions and begin to uncover important emergent properties of current farming and food systems, and 4) reinforce the holistic nature of systems and their complexities. Although we have used mind maps primarily in class for recording and summarizing discussion, this method can also be used for taking notes in classes or seminars, for keeping key ideas together while reading, or for organizing important elements while searching on the web. The objectives and outcomes can be as varied as the imagination of the user can make them.

Methods for constructing mind maps are as varied and rich as the thinking of those who create them. Generally they are started with a major topic or word in the middle of the board, and this immediately distinguishes the method from more conventional, linear and orderly top to bottom notes from a meeting or class. As topics or themes or elements come up in the conversation, these are added to the diagram in logical places. As much as possible, mind maps made on the board during class should be written in the same words used by the one making the contribution, or reduced to a single or pair of meaningful words to represent the component or idea. The discussion leader can clarify or confirm a word by asking, "Did I hear you say.…? Or "To be sure I have this right, did you mean ….? Or to buy time and to share responsibility, "How do you spell that word, and where do you think it should go on the diagram?" These are all ways to stimulate involvement, encourage ownership of the process, and broaden understanding of the topic. It is useful to plan ahead enough to be sure that most ideas will fit on the board, and that there is some provision for recording the results later on a flip chart or using a digital camera.

The moderator or the person making the mind map should seek the most logical place for each addition to the board. The advantage of a white board or chalk board is that words can easily be erased and moved to another position in the mind map. This is less easy when words are recorded permanently on flip chart paper, although the permanence is useful to have as a record. Some white boards now have electronic potential to record and even to send images to other locations, increasing the flexibility and application of the method. The process can also be shared in an interactive video conference if the camera is capable of focusing on the screen and the moderator is careful to use large enough letters, write clearly, and ask for continuous feedback from a remote audience.

Another dimension of the method is the potential to connect the elements during or after recording them. There can be lines, arrows, circles or other shapes to connect, lines to unite or divide portions of the mind map, and simple drawings to depict relationships or ideas. Different colors can be used to indicate families of words or ideas, or words can be written at different angles on the board. One should be careful to not make too many connections in one figure, although it may be useful to illustrate the total complexity of a situation. When there are too many related elements in a certain area, an additional map could be drawn to one side or on another nearby board or flip chart. The potential options with this method are near limitless, and personal creativity can be brought in to best illustrate the key points in a conversation and their connectedness.

Outcomes of the construction of a mind map from a class, discussion, or reading exercise include a semi-orderly compilation of the elements, major ideas, and preliminary connections among these system components. At the very least, the method causes students to think "outside the box" and beyond the traditional method of taking conventional notes in class or seminar. More importantly, it is possible to draw some relationships, to recognize and illustrate relative importance of different themes, and to begin to establish a foundation for the emergent properties of systems.

The method is related to another strategy for learning, a rich picture of the farm or community, that can be developed buy groups through discussion. This is described in another fact sheet in the series.

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Buzan, Tony. (2000). The Mind Map Book, Penguin Books, 1996.

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Tips for Teaching Adult Students

With the number of non-traditional students growing, many educators have discovered that adult learners are fundamentally different than their younger counterparts in many ways. Yet, most instructors have been left to their own devices to figure out how best to reach these students who come to class with an entirely different set of challenges, demands and expectations, and generally at a much different level of maturity.

How can instructors better accommodate and encourage adult student success in a classroom setting? Here are a number of ways to create a better environment for adult learners, no matter what the subject material.

Treat them like the adults they are. Adult learners are generally more sophisticated and experienced than their younger counterparts and they benefit from realistic examples of skills they can use in "real life." Adult learners will be empowered as they discover they have a great deal to teach their younger classmates, and the dynamic is mutually beneficial. Incorporate intergenerational discussions on issues that otherwise have a generational divide as appropriate for the subject matter to engage learners of all ages.

Be aware that their classroom skills may be "rusty." Some adult learners have not been in a classroom for 30 years, so you may need to remind them of basic rules and etiquette, such as raising a hand if you have a question. At the same time, reassure them that, as the instructor, you will not be judgmental of their life experiences or their perspectives, and that they will be evaluated only on their mastery of the content. Be generous when it comes to formatting issues such as APA writing guidelines. Instead, focus on content. Adult learners are often self-conscious, even apologetic, when it comes to being in the classroom. They might even exhibit some shame because they feel decades behind their classmates. The more you can break down these walls of insecurity, the better.

Consider and acknowledge the technology gap. Students in their 50s and 60s are generally not nearly as tech savvy—or tech dependent, as some would argue—as 18 or even 30 year olds. Assess each student's level of proficiency as it relates to class requirements and compensate. Provide help so adult learners can "catch up somewhat with the technology. Even if they are skilled with technology, adult learners tend to have dramatically different habits. While younger students may be tethered to technology, adults have longer attention spans and traditional classroom approaches appeal to them. This does not mean you can lecture to them for three hours, but you can expect the older learner to concentrate on complex material without feeling "withdrawal" of from a technology device.

Be efficient with lessons and activities. Move fast and don't waste anyone's time. Adult students have jobs, sometimes children and tons of responsibilities, so pack every class with information and useful activities. Consider balancing instructional time with "lab" time, giving students an opportunity to do modeling work or homework in class to give them a better chance of accomplishing all the requirements on time. Consider being "strictly flexible" — diligent in your expectations, yet understanding about busy lives, illness and working late. Like any job, it's not to be abused, but as grown-ups, they have priorities that sometimes take precedent over finishing assignments. Build in safety nets that allow a limited number of late assignments to maintain flexibility, accountability and expectations of excellent work.

Be creative. Use the unique vibe or personality of each class to teach the lesson and choose activities that engage, and even entertain to some degree. Pair highly motivated students with those less skilled on projects to create peer encouragement and mentoring. This strategy keeps students interested, attendance high and motivation strong.

Emphasize personal growth. While younger students are encouraged to do well on standardized tests and accustomed to being compared to their peers in this way, adult learners are challenging themselves. Consider making personal growth in ability and skills part of the actual grade; for example, compare first assignments with more recent ones to determine how they are personally improving. It helps build confidence and give tangible areas for improvement. School is hard enough. We should point out the positives.

Submitted by:
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Transect Walks across Farms and Landscapes

Learning to traverse and read the landscape is an essential capacity for agroecologists, and vital to the education of our MSc students. For students acquainted with farming and natural areas, it is important to learn to observe using all the senses and to put observations into the framework of prior experience. For those new to agroecosystems or the natural environment, it is essential to develop skills of observation to absorb details as well as view the macrocosm and context. For everyone in the field of agroecology – ecology of farming and food systems – it is an opportunity to acquire and practice observational skills that will help in later analysis and evaluation of current systems, as well as prepare them for envisioning improved and more sustainable systems for the future. The method has been especially valuable in Participatory Rural Appraisal as a tool for community leaders and citizens to assess their resources [FAO, n.d.], and there are many variations that are used in teaching and in research.

Learning Objectives are to 1) both open and hone the multiple senses to broaden observational skills to absorb as much as possible the complexity of farms and the rural landscape, 2) expose the details of these systems and learn how they are unique from other systems understood in other contexts, 3) provide a foundation for later discussion and analysis of farms and community food systems, 4) quickly orient the group to a new landscape and its features by sending people in different directions and later sharing observations, and 5) develop a capacity for social learning and interdependence as different people on a team observe unique details related to their prior study or experience that may be transparent to others, and share their experience with the group.

Methods that have proven useful in this activity early in a semester or short course have included two variations on "walking the landscape". We normally organize the class, course or workshop participants into pairs, with a goal of providing different perspectives on observations and to assure that each person will be a full and active participant in the exercise. Since people are often new to the immediate landscape and region where a course is held, we provide maps that include both topographic features and land use, as well as roads, trails, buildings, and other components of the built landscape. On these maps we designate a destination, with a distance from the classroom or other meeting venue depending on the time available; this is rarely less than one kilometer and may be up to three or four kilometers each way. We prepare for the exercise with key questions that are specific to the goals of the course. For example:

• What are the major observable consequences of geographic forces that have shaped the landscape?

• What are the most obvious human impacts on the natural resources and current land uses in the landscape?

• What features of the landscape appear especially valuable to provide ecosystem services?

• How is the landscape designed or managed to promote agricultural productivity? … to preserve biodiversity? … to provide resilience and stability to agriculture?

• Others unique to the goals of a course or workshop?

We normally discuss these learning goals and methods explicitly before people leave the class or meeting site, and ask in a general way what people are going to look for? The walks often provide an excellent venue for people to meet each other, discuss the landscape and its components, and compare the views and details with prior experiences. Another strategy we have employed on the walks is to urge people to walk quietly and not share observations on the outward bound trip, then to discuss their experiences on the return. We speculate that this will help each student enjoy a personal experience related to the landscape as well as a social learning situation on the return, but we have yet to decide which is best.

Outcomes that we have observed as well as gleaned from the subsequent discussions include an appreciation for the topography, principal land uses, and impacts of human development on the landscape. In Norway, one of our points in the orientation is that everyone in the country has access to the entire landscape, including tracts that are privately owned as well as those that are property of local or national government. This allemansreten policy guarantees everyone the right to follow trails or small roads, to pick berries or mushrooms (except in the vicinity of a dwelling), to cross forests or pastures, and to experience any area of the country as long as they are respectful of private property, close gates to keep livestock in or out, and refrain from walking through cereal fields that are near harvest. It is also legal to go on skis, by cycling or jogging, and to camp without permission, as long as the owner's livestock and equipment is respected. This rule that goes back to Viking times is a welcome surprise to many students who come from cultures where the signs "keep out" or "no trespassing" are commonplace.

The observations on multiple routes across the landscape quickly bring a fuller understanding of the total landscape to the student community. This could require several days or weeks if each person were to explore the entire territory on their own. The experiences of some people encourage others in the group to pursue further study of areas of special importance, including farming and livestock systems, especially interesting forests or land forms, and particularly unique paths for walking or trails/roads for cycling. Listening to others recount their experiences, we have heard classmates exclaim, "Oh, I saw that too, but I really did not understand what it was." Or, "That is really different, and it reminds me of …." One variation on the same activity is for student teams to take shorter transect walks across their project farms without the farmer, observing crop and livestock enterprises and their integration and interactions. They begin to observe and assess the production potentials of the farm, its soils and biodiversity, and form ideas about intensity of land use and possible improvements for the future. This adds to their foundation of information when they later meet the farmer and learn in depth about the production, economic, and social strategies and connections that characterize the current situation.

In summary, we have found the transect walks to be a valuable form of orientation at the landscape and at the farm levels. We have used this activity to build and practice observational skills, and have received strong positive evaluations from students.

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Book Reviews

Case Studies in Veterinary Technology: A Scenario-Based Critical Thinking Approach

By Jody Rockett & Chani Christensen, 2010, 452 pages, illustrated, Rockett House Publishing, 407 S 800 W, Heyburn, ID 83336, ISBN: 978061543-505-3. 2010, $44.00.

Case Studies in Veterinary Technology: A Scenario-Based Thinking Approach does an exceptional job of filling a void that, up until now, existed within textbooks used by veterinary technician students. This textbook provides guidance to veterinary technician students by helping them learn critical thinking skills via a case-based format. The textbook is organized into chapters that closely coincide with the AVMA Veterinary Technology Student Essential and Recommended Skills List, which veterinary technology programs use when developing a curriculum to ensure critical skills are included in instruction.

The book begins with an introductory chapter that explains what critical thinking is and how to apply critical thinking skills to veterinary patients as well as an introduction to and examples of subjective-objective-assessment-plan (ie, SOAP) notes and the concept map. The next 13 chapters each contain several examples of cases on the chapter topic. These chapters include communication-documentation, restraint, surgical nursing, anesthesia, diagnostic imaging techniques, medical nursing and behavior, clinical laboratory procedures, pharmacology, nutrition, emergency medicine, zoonotics, and laboratory animals-exotics. The subsequent chapter contains examples of cases that allow veterinary technology students to practice developing SOAP notes and concept maps. The final chapter includes photographs of case studies. Among other items, the appendix contains tables that reference the AVMA essential and recommended skills with the case studies, and vice versa.

In addition to the numerous case studies, this book contains many other excellent features. First, the authors have seamlessly incorporated the individual skills from the AVMA Veterinary Technology Student Essential and Recommended Skills Lists into case studies throughout this textbook, which makes this an extremely practical book for instructors to integrate into many courses within a veterinary technology program. Second, the list of references included at the end of each case provides guidance for veterinary technology students as they work through the cases. A third feature of this paperback book is its reasonable price.

Overall, the authors do an outstanding job of providing veterinary technology students with a variety of case studies pertinent to contemporary veterinary medicine that will encourage them to further develop their problem-solving skills. With its outstanding content and affordable price, I believe this would be an excellent textbook to incorporate into the curriculum of veterinary programs.

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Website: https://www.iupui.edu/~josotl/contact.php

Founded in 2001, the Journal of the Scholarship of Teaching and Learning (JoSoTL) is a forum for the dissemination of the Scholarship of Teaching and Learning in higher education for the community of teacher-scholars. This peer reviewed Journal promotes SoTL investigations that are theory-based and supported by evidence. JoSoTL's objective is to publish articles that promote effective practices in teaching and learning and add to the knowledge base. The themes of the Journal reflect the breadth of interest in the pedagogy forum. The themes of articles include:

1. Data-driven studies: formal research projects with appropriate statistical analysis, formal hypotheses and their testing, etc. These studies are either with a quantitative or qualitative emphasis and authors should indicate the appropriate domain. Acceptable articles establish a research rigor that leads to significant new understanding in pedagogy.
2. Reflective essays: integrative evaluations of other work, essays that challenge current practice and encourage experimentation, novel conclusions or perspectives derived from prior work.
3. Reviews: Literature reviews illuminating new relationships and understanding, meta-analysis, analytical and integrated reviews, etc.

4. Case studies: These studies illustrate SoTL and its applications, usually generalizable to a wide and multidisciplinary audience.

5. Comments and communications: Primarily, these are comments based on previously published JoSoTL articles, but can also include book reviews, critiques and evaluations of other published results in new contexts or dimensions.

Authors are encouraged to submit work in one of the following submission categories:

• Traditional Research Reports: data driven studies with either a quantitative or qualitative emphasis

• Reflective Essays on SoTL

• Reviews of current themes in SoTL research including meta-analysis

• Case studies illustrating SoTL and its applications

• Comments and Communications on previous JoSoTL articles, or book or software reviews

All submissions must be prepared following the JoSoTL Style Sheet. While there is no formal page limit, authors should adhere to recent article lengths, typically 20 pages or less. Authors are expected to include proper citation and referencing for their sources following APA style.

Enhancing Learning through the Scholarship of Teaching and Learning: The Challenges and Joys of Juggling

By Kathleen McKinney, 2007, 224 pages, Jossey-Bass, ISBN-13: 978-1933371290, $38.00

A growing demand exists for workshops and materials to help those in higher education conduct and use the scholarship of teaching and learning. This book offers advice on how to do, share, and apply SoTL work to improve student learning and development. Written for college-level faculty members as well as faculty developers, administrators, academic staff, and graduate students, this book will also help undergraduate students collaborating with faculty on SoTL projects. Though targeted at those new to the field of SoTL, more seasoned SoTL researchers and those attempting to support SoTL efforts will find the book valuable. It can be used as an individual reading, a shared reading in SoTL writing circles, a resource in workshops on SoTL, and a text in seminars on teaching. Contents include:

• Defining SoTL

• The functions, value, rewards, and standards for SoTL work

• Working with colleagues, involving students, writing grants, integrating SoTL into your professional life, and finding useful resources

• Practical and ethical issues associated with SoTL work

• Making your SoTL public and documenting your work

• The status of SoTL in disciplinary and institutional contexts

• Applying the goals of SoTL to enhance student learning and development.

This book is a concise yet comprehensive single resource for anyone interested in what we have come to call `the scholarship of teaching and learning.' It is packed with practical information on the essentials - how to frame research questions, gather evidence, and go public with the findings - but it also offers much, much more. It provides a brief history of SoTL, explains why faculty should consider doing it, discusses the practical and ethical issues involved in doing SoTL work, and suggests how faculty can fit their SoTL work into their institutions' reward structure. It also contains eight appendices that provide additional information on everything from SoTL-oriented Journals and Newsletters to examples of Tenure and Promotion language. Although it is the perfect entry point for faculty new to SoTL (in fact, there is a whole chapter titled "How Do I Get Started"), even faculty who have been involved in SoTL for years will gain new insights and find much useful information.

E. Barkley
Amazon.com

Blueprint for Learning: Creating College Courses to Facilitate, Assess and Document Learning

By Laurie Richlin, 2006, 160 pages, Stylus Publishing, ISBN-13: 978-1579221430, $25

An acclaimed educator presents hands-on advice on teaching that meets today's emphasis on learning outcomes and assessment. Informed by the up-to-date research on how people learn. This book is for all instructors in higher education--as well as high school teachers

Laurie Richlin has been running a workshop on course design for higher education for over fifteen years, modifying and improving it progressively from the feedback of participants, and from what they in turn have taught her.

Her goals are to enable participants to appropriately select teaching strategies, to design and create the conditions and experiences that will enable their students to learn; and in the process to develop the scholarly scaffold to document their ongoing course design and achievements.

This book familiarizes readers with course design elements; enables them to understand themselves as individuals and teachers; know their students; adapt to the learning environment; design courses that promote deep learning; and assess the impact of the teaching practices and design choices they have made. She provides tools to create a full syllabus, offers guidance on such issues as framing questions that encourage discussion, developing assignments with rubrics, and creating tests.

The book is packed with resources that will help readers structure their courses and constitute a rich reference of proven ideas.

What Laurie Richlin offers is a intellectual framework, set of tools and best practices to enable readers to design and continually reassess their courses to better meet their teaching goals and the learning needs of their students.

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