Student Academic Outcomes after Completing a First-Year Seminar[1]

J. Klatt[2] and R. Ray[3]
University of Wisconsin-Madison
Madison, WI

Abstract

We examine the effects of a first-year seminar course on student academic outcomes in a college of agriculture and life sciences. Seven cohorts of students who had completed the seminar were compared to their peers who had not completed the seminar on several academic variables. Results indicate that students who completed the seminar had higher first-term grade point averages ($F = 3.23$, $p = .037$), shorter time to degree ($F = 3.713$, $p = .027$), higher retention in the college ($X^2 = 5.856$, $p = .016$), and were put on academic probation less often than their peers who had not completed the seminar ($X^2 = 5.028$, $p = .025$). Implications for teaching are discussed.

Keywords: first-year seminar, retention, time to graduation

Introduction

First-year seminars are widely believed to have positive effects on student success and are becoming common offerings in college and university curricula (Keup and Barefoot, 2005; Porter and Swing, 2006; Schnell et al., 2003). Educators have developed many types of first-year seminar courses to address a variety of student needs (Swing, 2002). First-year seminar courses may be particularly valuable to colleges of agriculture where, in recent years, enrollments have grown substantially as instructional resources have declined (Biemiller, 2012).

For example, in the College of Agricultural and Life Sciences at the University of Wisconsin-Madison, undergraduate enrollment rose 30% from 2009 to 2012 (Registrar's Enrollment Report, Fall 2012-2013) while instructional resources declined by more than 5% (Data Digest 2012-2013). Biemiller (2012) notes enrollment in Penn State's college of agriculture grew 48% since 2006 and its budget was cut by more than 18%. Biemiller (2012) indicates many other institutions are experiencing similar circumstances. Colleges of agriculture need new strategies for addressing student academic and career success as they have fewer resources to help greater numbers of students make a successful transition to university life.

Agricultural colleges are also adjusting to a new student population. The large growth in enrollment includes many students who have little direct experience in agriculture (Biemiller, 2012). Students who do not have agricultural backgrounds are interested in issues such as sustainability, local foods, bioenergy and health; they are drawn to majors such as: environmental science, food science, human nutrition, biological systems engineering, agricultural business and communications (Biemiller, 2012; Krogstad, 2012; Mihaljevich, 2010). In addition large numbers of students are interested in genetics, microbiology and biochemistry with intentions to pursue careers in research or veterinary and human medicine (Biemiller, 2012). Because many of these students lack agricultural literacy, they could benefit from exposure to the big issues colleges of agriculture and life sciences address through teaching, research and outreach. Students also need exposure to the wide range of academic disciplines they can study, the complex nature of the issues on which they are being trained to work and the ethical dilemmas these issues present.

Although attending to student success and student agricultural literacy are not new issues for agricultural colleges (Colbath and Morrish, 2010; Lancaster and Robinson, 2011), larger enrollments and fewer resources make these issues more challenging. First-year seminars are one approach to addressing these pressures.

First-Year Seminars

Researchers have reported positive academic and social benefits of first-year seminar courses (e.g. Keup and Barefoot, 2005; Porter and Swing, 2006). Schnell et al. (2003) examined whether college graduation rates of students taking a first-year seminar differed significantly from a comparison group. They found a significantly greater graduation rate for those enrolled

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[2]Assistant Dean, Undergraduate Programs and Services, 116 Agriculture Hall, 1450 Linden Dr., Madison, WI 53706, 608-262-4618, jklatt@cals.wisc.edu
[3]Professor Emeritus, Forest and Wildlife Ecology, Room 103b, 445 Henry Mall, Madison, WI 53706, 608-698-7517, roray@wisc.edu

in the seminar. In a survey of almost 20,000 first-year students at 45 four-year institutions, Porter and Swing (2006) examined how first-year seminars affect students' intentions to persist and found these seminars have a positive effect on persistence. Keup and Barefoot (2005) used regression analyses to evaluate a wide range of effects of first-year seminars. Participation in a first-year seminar was positively associated with many variables including studying with other students, speaking-up in class and discussing course content with students outside of class. Compared to students who did not take a first-year seminar course, students who enrolled in a first-year seminar also reported skipping fewer classes, developing more close friendships with other students, participating in more volunteer / community service work, participating in more intramural sports, attending more campus-sponsored events, and interacting more often with faculty outside of class or office hours.

Faculty and instructional staff members in agricultural colleges can create first-year seminars to address student retention, persistence and engagement. First-year seminars represent a promising instructional intervention for colleges adjusting to larger numbers of students and fewer resources to support student success.

Authors have identified several types of first-year seminars. Swing (2002) discussed four types: (a) college transition seminars which covered topics such as orientation to college, life transitions, and academic skills; (b) special academic seminars which focused on a specific topic that was often interdisciplinary; (c) discipline-based seminars which served as an introduction to a major or academic department and were usually housed in individual academic departments; and (d) remedial/ study skills seminars which were closely focused on basic study skills. Smith et al. (2009) also discussed ways to differentiate first-year seminar courses. Some seminars served as an orientation to an institution and other seminars emphasized academic content which might be discipline-based. Other distinctions included whether or not the seminar was a requirement, or had credit associated with it. Seminars also differed in class size, length of the course and the components addressed in the course. Griffin et al. (2008) noted that despite differences, most of these courses shared common goals that included developing students' academic skills and orienting students to campus resources.

Teachers interested in developing first-year seminars can create courses based on the needs and educational goals of their departments or institutions. Faculty and instructional staff members can examine the needs rapid growth creates for their departments or the institution as a whole. Their assessment can then be used when considering the type of first-year seminar to create and implement. For example, a hybrid of an academic seminar and orientation seminar could help students with agricultural literacy and retention issues.

This Study

Our study examines the effects of a first-year seminar on a variety of academic variables. For more than a decade, the College of Agricultural and Life Sciences (CALS) at the University of Wisconsin-Madison has offered a first-year seminar. The seminar is a hybrid focusing on both academic content and transition issues. The course is designed to help students, particularly those in rapidly growing life science majors, not only learn about the big issues in agriculture, food, energy, and the environment, but also learn about resources and opportunities that support student success. The course has become an important part of the College as it has grown significantly in recent years.

CALS has 19 departments, 24 majors and about 3300 students. Students with interests relating to human, plant, or animal health; agriculture; energy; the environment; food; business; or community, find a home in CALS. Graduates work on challenging issues such as food safety and security for a global population, sustainable sources of energy, and health concerns such as diabetes and obesity.

The CALS curriculum has a strong focus on math and science. Most first-year students take math and general chemistry their first semester. The seminar provides a way for them to engage applied problems in agriculture and life sciences right away in their first term on campus. The seminar is a 1-credit course that has 14 sessions. The 14 sessions are divided in the following manner. The first two weeks are devoted to a class overview and presentation of ethical paradigms for assessing complex problems. The session on ethics serves as a base for the course because we want students to think about the topics in the course through various ethical paradigms. Ten sessions are devoted to significant topics CALS faculty address through teaching, research, and outreach such as bioenergy and genetically modified foods. Two sessions are devoted to transition issues, specifically advising and career planning. After the introductory session and ethics lecture, the seminar alternates between large lectures and small group discussions. There are five interdisciplinary topics addressed in the course. For example, water quality, bioenergy and food systems are common topics. One week, the students hear a lecture on one of these big complex issues. The next week they break into small groups of 8 – 10 students for a small group discussion of the topic. Faculty and staff from around the college convene and aid the small groups. Five faculty and staff also provide the lectures. During the class, all students have the opportunity to plan and lead a discussion, visit a faculty member, create an academic plan, and attend a public talk. They also choose four of eight additional activities such as exploring a research opportunity, or an international study opportunity.

With the rise of freshmen seminars and the widely held belief they benefit students; CALS started discussing the possibility of requiring all students to complete a first-year seminar. Therefore, it became important to know

if the College's course had a benefit. In this study, we investigated the academic outcomes associated with the College's first-year seminar.

Methods

We used a quasi-experimental design with two groups to evaluate the success of the first-year seminar. The experimental group consisted of the students who completed the seminar and the control group consisted of the students who did not. We examined differences between the two groups on a variety of academic outcomes.

The course was implemented in 2002 and we only included students in the data set who had sufficient time to graduate after completing the seminar. Therefore the sample consisted of the seven cohorts of freshmen admitted between Fall 2002 – Fall 2008. The sample included 2628 students, 607 (355 females and 252 males) completed the seminar and 2021 (1268 females and 751 males) did not. Table 1 contains additional details about the sample.

All data were obtained from the university Registrar's student record database. We asked the Registrar to provide the following data elements for the students in our sample: high school cumulative grade point average, high school percentile rank, composite ACT scores, composite SAT scores, university grade point averages (first term, second term, degree term, and cumulative), time to degree, degree completion in the college, probation and dropped status, gender indicator, international student indicator, targeted minority student indicator, and first-generation student indicator. The high school academic information and demographic information were used to test the equivalency of the two groups. To investigate the effectiveness of the seminar, we used directional Multivariate Analysis of Variance to test for group differences on university GPA (first term, second term, degree term, cumulative) and time to degree. We used directional Chi Squared tests to investigate group differences on degree completion in the college, probation status, and dropped status.

Results and Discussion

To assess pre-existing differences between the students who completed the first-year seminar and those who did not, we compared the two groups on academic and demographic variables. The two groups did not differ on high school cumulative grade point average, high school percentile rank, composite ACT scores, and composite SAT scores. In addition, the gender distribution of the two groups and the percentage of international students in the two groups did not differ across those who completed the seminar and those who did not. There were differences on other demographic variables. The group that took the seminar had lower proportions of targeted minority and first generation students than the group that did not take the seminar. The groups did not have pre-existing differences on academic preparation and were comparable on some, but not all, demographic variables.

In this study, directional multivariate analysis of variance (MANOVA) was used to test between group differences on a variety of academic indicators of success. We used a directional test because previous theoretical and empirical work indicates first-year seminar courses promote academic success. Means and standard deviations for each outcome variable are presented in Table 2. The omnibus MANOVA test was significant, $F = 3.680$, $p = .002$, $r^2 = .011$. Follow-up analyses revealed several significant tests: first term GPA, $F = 3.23$, $p = .037$, $r^2 = .002$; degree term GPA, $F = 3.713$, $p = .027$, $r^2 = .002$; and time to degree in elapsed calendar years, $F = 4.382$, $p = .018$, $r^2 = .003$. Second term and cumulative grade point averages were not significant. These results indicate the seminar is associated with positive academic outcomes. However, the positive effect on grade point average is not maintained over time.

We used Chi squared analyses to investigate group differences in the proportions of students placed on academic probation and dropped status. Placing students on academic probation is the first action taken when students are struggling in the classroom. Placing students on dropped status is a second, and more serious, action taken when students have sustained academic struggles. Fewer students who completed the first-year seminar were placed on academic probation than students who did not complete the seminar, $X^2 = 5.028$, $p = .025$, phi = .070, however, there were no group differences on dropped status. These findings suggest the seminar helps students who have less significant academic struggles succeed, but does not make a difference for those with more serious academic problems. The group difference observed for academic probation could be due to the personal connections students in the seminar develop. It is possible connections to the College faculty and staff members

Table 1. Demographic Description of Sample

	Completed Seminar (n = 607)	Did Not Complete Seminar (n = 2021)	Percent of Sample Completing Seminar
Female Students	355	1268	58.5
International Students	31	121	5.1
First Generation College Students	108	259	17.8
Targeted Minority Students	28	141	4.6

Table 2. Summary of Outcome Variables by Group – Means and Standard Deviations or Proportions

Group	First Term GPA	Second Term GPA	Degree Term GPA	Cumulative GPA	Time to Degree	Probation Status	Dropped Status	Earned Degree
Completed Seminar	3.21 (0.59)	3.10 (0.68)	3.47 (0.50)	3.28 (0.42)	3.91 (0.51)	191 / 607	28 / 607	319 / 607
Did not Complete Seminar	3.10 (0.71)	3.08 (0.74)	3.40 (0.60)	3.28 (0.43)	3.98 (0.58)	742 / 2021	120 / 2021	949 / 2021

provide students with people to turn to when they need help. The difference could also be that students in the seminar are exposed to campus resources such as the MathLab, Chemistry Learning Center, and other tutoring options that can help them before they experience academic difficulty.

Finally, we investigated retention in CALS. It is important to note that we did not test retention for a degree at the university, just retention for a degree within CALS. We found group differences in the proportion of students retained for a degree in the college. A higher proportion of students in the first-year seminar earned a degree from CALS than those who did not take the seminar, $X^2 = 5.856$, $p = .016$, phi = .047. Students who did not complete the seminar were more likely than those who did to leave CALS for disciplines outside the College or to leave the university entirely. There are at least three possible explanations for this finding. First, students taking the seminar are aware of academic resources to help them succeed in the CALS curriculum that includes challenging math and science courses. Second, from both the topic lectures and course assignments, students see how the College's curricular options lead to careers of interest to them. Third, assignments that require the students to learn about co-curricular and extracurricular opportunities in CALS might connect them to the College. For example, assignments such as exploring a student organization or a research opportunity could get students involved in CALS outside the classroom and allow them to find a home in the College.

Our study focused on academic outcomes. However, future studies of first-year seminar courses in colleges of agriculture could focus on other variables. For example, other authors have examined the need for agriculture literacy and the need for students to understand the complex food, energy, environmental, and health problems on which they could work (Colbath and Morrish, 2010). First-year seminars could be a way to address these issues. If teachers design seminars to cover these topics, then there is justification for having the seminars in the curriculum. The seminar tested in this study was designed to help students, particularly those who do not have an agricultural background, learn about important issues in agriculture and life sciences. A future study could compare the agricultural literacy among students who completed the seminar and those who did not complete the seminar.

Our first assessment focused on practical outcomes. A follow-up is needed that focuses on outcomes such as engagement. Kuh (2005) argues student engagement measures make valuable contributions to an institution's assessment program. When engagement data are combined with other information, the results can be used for: evaluating student performance associated with first-year seminars, assessing teaching and learning processes and meeting accreditation requirements. Future research could examine patterns in student engagement among those who take the first-year seminar course compared to those who do not. Given the nature of assignments in the seminar, students who complete this seminar could be more likely than those who do not to engage in high-impact practices (Kuh, 2008) such as undergraduate research and international experiences.

Future research could also examine outcomes of first-year seminar courses for specific groups of students. Do first-year seminars contribute to positive outcomes for targeted minority students, first-generation college students, and / or international students? It is possible that courses addressing transition to college (e.g. exploring campus resources, connecting to faculty and staff members, exploring co-curricular opportunities) are particularly beneficial for some groups of students.

Weissman and Magill (2008) noted there is limited research on the types of seminars that are most effective for specific types of students. They describe a study that used cluster analysis to develop a typology of student groups based on pre-college characteristics and examined the influence of two types of seminars on the academic performance of each student group. Their findings indicated the effects of the two types of seminars varied across the groups. The authors suggested that students' pre-college characteristics, such as grade point average, can be moderated by participation in the appropriate type of first-year seminar. Instructors should think carefully about their students' characteristics when developing first-year seminars. Additional research is needed to examine the effects of various types of first-year seminars for targeted minority, first-generation, and international students.

As we noted in the literature review, there are different types of first-year seminars. Educators who are considering implementing a first-year seminar can determine the best option for their department or college by asking themselves a few questions. For example, what academic disciplines are taught in their institutions? What qualities should students acquire before graduation? What are some of the goals of the curriculum? What does an ideal student look like at graduation? Should the seminar focus on academic content, transition issues, or both? Answers to these questions can help teachers identify the most important topics a seminar should address and the most appropriate assignments to include. Dooris and Blood (2001) provide a useful discussion of first-year seminar implementation and assessment which could help instructors who are developing a seminar.

There are two notable limitations of this study. First, we cannot generalize the results of this study to other seminars. We use a hybrid seminar that has academic and transition components. The seminar is designed to meet specific college needs. The uniqueness of the seminar limits the conclusions we can draw between our results and first-year seminars generally. Educators and institutions implementing first-year seminars should include assessment in their efforts. Assessment will allow them to investigate the effects their seminars have. Second, we cannot attribute a causal effect to the

seminar. We did not have a true experimental design. Students were not randomly assigned to the seminar or no seminar conditions. In addition, students who did not take the seminar might have completed other campus academic programs, such as learning communities or first-year interest groups, which have similar goals. Self-selection or other unidentified factors may have influenced the results of this study.

Summary

Recent growth in colleges of agriculture pressures institutions to develop new ways of supporting student success and helping students learn about the careers they can enter. First-year seminar courses represent one way to address these issues. Our study investigated the academic outcomes of a first-year seminar course. The course was designed to introduce students to curricular themes in agricultural and life science, connect them to activities that would help with professional development, and orient them to the college. Although this study indicates the course is associated with positive outcomes, coping with rapid growth requires a multifaceted approach, not just a first-year seminar.

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Preparing Students for a Diverse Future: Using Service-Learning for Career Training in Soil Science Community Outreach

Sarah Smith[1], Seb Prohn[2], Liz Driscoll[3], Dean Hesterberg[1] and Lucy Bradley[3]
North Carolina State University
Raleigh, NC

Julie Grossman[4]
University of Minnesota
St. Paul, MN

Abstract

We investigated the development of agriculture students' professional skills through a community-engagement project in which students taught seven weeks of sustainable soil management lessons to diverse populations in under-served communities. Our objectives were to (1) determine the skill sets desired by employers for community-based agricultural and food system work (2) evaluate the effectiveness of course activities to develop and improve these skill sets and prepare students for employment post-graduation and (3) compare results of an online survey evaluation of student skill development to narrative data provided by the student interviews and field observations of students teaching in the community. An analysis of student survey and interview data shows that when compared to a non-service-learning control group, service-learning students rate themselves as significantly more confident in career-relevant skills following the seven-week community engagement project. Field observation and student interview data indicated that by serving as community educators, students developed knowledge of agriculture, comfort working with diversity, leadership skills, and increased ability to teach agriculture-related content to the public. Preliminary findings suggest that service-learning projects incorporated into agriculture curricula provide students with experience that better-prepares students for the competitive job market.

Introduction

Colleges of agriculture with service-learning courses set in urban community gardens can provide students with opportunities to witness firsthand the complexities and challenges of agriculture, communicate the role of soil in sustaining a growing global population, and develop career-relevant skills by working with the public (Parr and Trexler, 2011; Malone et al., 2014).

Globally, urban gardens are instrumental in growing and distributing food to food insecure populations, while increasing food production capacity (Milligan et al., 2004; Zezza and Tasciotti, 2010). In 2010, 14.5% of U.S. households had limited or uncertain access to adequate food for all household members to sustain active, healthy living (Gunderson, 2008; Nord et al., 2004; Coleman-Jensen et al., 2011). Food insecurity disproportionately affects minority populations with 25.7% of African-American households and 26.9% of Hispanic households reporting a lack of consistent access to food, compared to 10.7% of white households (Wang and Chen, 2011; Nord et al., 2009). Urban community garden development is one strategy used by non-government organizations (NGOs) to combat food insecurity, promote active lifestyles and empower communities (Teig et al., 2009). These gardens are also ideal settings for exposing agriculture students to the real-world challenge of feeding those populations most in need.

The number of employers interested in hiring students with a global outlook and international multicultural competency has grown exponentially within the last two decades (Navarro and Edwards, 2008). Required content taught in traditional agriculture lecture courses leaves instructors little time for practical experience

[1]Department of Soil Science, 101 Derieux Street, 2232 Williams Hall, Box 7619, Raleigh, NC 27695
[2]Department of Psychology, 640 Poe Hall, Campus Box 7650, Raleigh, NC 27695
[3]Department of Horticultural Science, 2721 Founder Drive, Campus Box 7609, Raleigh, NC 27695
[4]Assistant Professor, Biological Principles of Sustainable and Organic Food Systems, 454 Alderman Hall, 1970 Folwell Ave. tel: 612-625-8597; Email: gross025@umn.edu

beyond the classroom, resulting in students that lack skills desired by prospective employers. In one study, 87% of surveyed employers desired to see internship experience beyond the classroom in addition to coursework, due to its usefulness for developing skills that complement technical abilities (Briggeman and Norwood, 2011). In fact, multicultural sensitivity, problem-solving, ability to work and manage a groups of people, organizational communication, analytical, problem-solving and field-related technical skills are seen by many employers as critical attributes for job applicants (Hansen and Hansen, 2007). Service-learning projects in curricula can give the students the practical "hands-on" experience desired by their future employers. Consequently, agroecology, organic farming and sustainable agriculture courses that address social justice and environmental issues related to food production systems are becoming more prevalent on university campuses (Grossman et al., 2010; Grabau, 2008; Sriskandarajah et al., 2005; Bhasvar, 2002). Whole curricula have even been designed that focus on immersing students in real life agronomic phenomena to help them direct their own learning and decide relevant theory to learn (Lieblein et al., 2004; Grossman et al., 2012).

This research assesses a service-learning component of a soil science course at North Carolina State University entitled *Service-Learning in Urban Agriculture Systems* to determine its usefulness in developing employment skills. North Carolina State University is a land grant institution of over 34,000 students located in the urban state capital of Raleigh, North Carolina. This course partnered with the Inter-Faith Food Shuttle (IFFS) a non-government organization (NGO), whose mission is to alleviate hunger by developing systems to recover, prepare and distribute wholesome, perishable food for North Carolina's poor, hungry, undernourished and homeless ("About IFFS", 2011). Community gardens started by IFFS in 2009 are one of IFFS' efforts to combat food insecurity by providing increased access to healthy local foods.

The assessed course represents a new form of education that seeks to expose students to aspects of sustainability and agriculture in the US via outreach projects designed to prepare them for future work in food systems (Nielwolny et al., 2012) . Through student evaluation of a service-learning experience, this project evaluated how pre-service training improved student perceived preparation to enter the urban agriculture and community food security workforce following graduation. The three primary objectives of this project were to (1) determine the skill sets desired by employers for community-based agricultural and food system work (2) evaluate the effectiveness of course activities to develop and improve these skill sets and prepare students for employment post-graduation and (3) compare results of an online survey evaluation of self-reported student skill development to narrative data provided by the students via pre and post service interviews and field observations of students teaching in the community.

Materials and Methods

Employer survey. We contacted sixty-four employers in the field of community agricultural outreach, food security and urban agriculture to determine desired skill sets for prospective employees. Of the sixty-four, twenty responded to our survey. Sample included ten NGOs, five universities and five private companies. Employers were contacted directly via email or phone and asked the following two open-ended questions:

1. Could you provide a list of qualifications that you would like to see in a person applying to work at (name of employer)?
2. Are there any specific skills that are required for working at your organization?

Staff members answered via email or directed us to a current job opening notice on their website to provide rich examples.

Service-Learning Course Design. Beginning in 2009, the Department of Soil Science at North Carolina State University offered *Service-Learning in Urban Agriculture Systems* (SSC 428), an advanced, two-credit course for undergraduate and graduate students designed to complement an upper level lecture-based ecological soil management course. Enrolled students used disciplinary knowledge to design teaching tools and accompanying lessons to educate youth on topics of sustainable soil management, agriculture and horticulture, with an emphasis on their relevance to human health and nutrition. Eleven students were then assigned a community in which they delivered their lessons to urban youth at IFFS' gardens. Student-community contact occurred once each week for 3 hours over a 7-week period, providing each NC State student with over 20 hours of direct community contact and teaching experience. Although SSC 428 has been in existence since 2009, evaluation of professional skills began in 2010 (Y1) and continued through 2011 (Y2).

Students in SSC 428 were assigned to work at one of three sites: a high school horticulture class, a community garden in a subsidized housing neighborhood, or a community garden in a manufactured-home community (Table 1). All three sites have been identified by IFFS as food insecure and are communities in which IFFS provides programming designed to improve community health and nutrition, and improve control over food choices.

Table 1. The demographics of assigned service-learning communities.

Year	Community	Program	Age	Ethnicity
Y1, Y2	High school for behaviorally challenged students	Horticulture class	Middle school - high school	Primarily African - American
Y1	Housing authority community	After-school mentoring program for low - income youth	Elementary - middle school	African - American
Y2	Manufactured home community	Community garden-based after school program	Middle school	Hispanic and African - America

Student Professional Skill Development. We used a mixed methods approach comprised of the following three specific methods: (1) quantitative survey data collection pre- and post-service-learning experience (SLE) (2) qualitative individual pre- and post-SLE student interviews, and (3) qualitative field observations recorded during students' community teaching. Field observations were conducted by a third-party individual not associated with course instruction. Quantitative data was used to validate themes that emerged from student interviews and field observations while qualitative data provided insights into survey scores.

The extensive online survey tool was delivered to students pre- and post- SLE. All surveys were conducted with SLE students (treatment group) as well as with non-service-learning students (control group) in an undergraduate soil science course (SSC 200), a course that included soil science content emphasizing the fundamentals of soil origin, composition, classification and chemical and biological properties (SSC 200). While the survey collected a broad range of data regarding achievement of learning objectives for students, for this study data from only 15 questions on student learning gains and demographics was used. The questions were followed by a five-point Likert scale ranging from *strongly disagree* (1) to *strongly agree* (5). In Y1 we were able to access demographic data on SLE students but not control students, therefore in Y2 additional questions regarding student demographics were added to yield a wider range of information about the student population such as grade level, GPA, major, gender and age. The North Carolina State University Institutional Review Board approved the study protocol and participants provided written informed consent prior to participation in survey. Only scores from students that completed both pre- and post- surveys were used in the final data analysis. In Y1 and Y2 a total of 11 students in the SLE class took both the pre- and post-SLE surveys. Response scores to each question from pre- and post-SLE surveys were statistically examined for differences using a matched-pairs *t*-test (JMP Pro 9.2). Using mean survey scores as an indicator of student confidence, we also conducted an independent samples t-test (JMP Pro 9.2) of Y1 service-learning experience (SLE) students (n=5) and Y2 SLE students (n=6) within each timepoint. The control student number in Y1 was n=7 and Y2 was n=11.

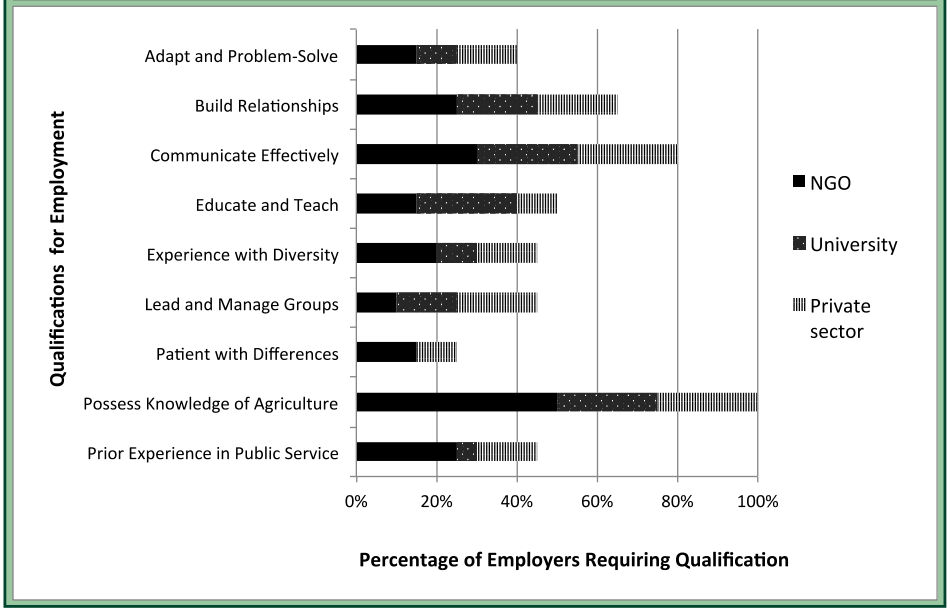
Field observation notes were taken during student teaching events in the community. Notations were made when students employed a professional skill or strategy in their service experience and were then compared to survey and student interview findings (Miles and Huberman, 1984).

Through interviews comprising of open-ended questions (Creswell and Plano Clark, 2007) SLE students assessed their experience and described both learning gains and project challenges. Students in the control group were not interviewed. Interviews consisting of 20 IRB-approved questions were conducted prior to and following the completion of their SLE. Student interview responses were audio-recorded, transcribed, and all data assigned anonymous numbers to ensure student privacy. Many questions were open-ended and therefore permitted students to communicate answers that include thoughts and reflections beyond the scope of the question. Pre-SLE interviews focused on the student's background, experience and confidence in skills relevant to the project. Post-SLE interview questions were similar to pre-SLE, but emphasized student perception of skill development and encouraged students to reflect on their service-learning experience by providing rich examples. A systematic coding framework was used to quantify changes student confidence in the following qualifications: Adaptability, Agriculture (content knowledge), Collaboration, Diversity, Leadership, and Teaching skill development (Strauss, 1987; La Rossa, 2005). Differences in mean values between pre-SLE and post-SLE responses were tested using a matched pairs *t*-test (JMP Pro 9.2). Research-relevant quotes were highlighted, categorized and used to explain survey and quantitative interview findings. Interviews were not conducted with control students.

Results and Discussion

Survey of Employers. Qualifications yielded from surveys with employers (n=20) were summarized in nine qualification categories (Figure 1). These categories

Fig. 1. Employer survey (n=20) of ten NGO's, five Universities, and five private sector agribusinesses yielded nine qualifications for required or desired for available positions. Each colored bar represents a different type of employer and the percentage of the whole sample that required each qualification.



included the ability to: Adapt and Problem-solve; Build Relationships; Communicate Effectively; Educate and Teach; Lead and Manage Groups; be Patient with Differences; Possess Knowledge of Agriculture (including horticulture, food production, soil management, gardening, and farming skills); have Prior Experience in Public Service; and Experience with Diversity.

The 20 responding employers offered positions in different areas of agriculture yet desired skill sets were shown to be surprisingly similar. The NGOs offered jobs as farm community garden managers, fruit or vegetable specialists, community organizers in food security, and directors of youth programs. The abilities to "adapt" and "be flexible" were requirements for work at many of the NGO's, as were skills and experience working with ethnically and culturally diverse populations. All university positions were associated with the Cooperative Extension Service interpreting, applying and disseminating relevant research findings in soil science, horticulture and agronomy to local producers. These employers primarily sought individuals with educator experience and strong communication skills for working with diverse populations. Positions in the private sector included consultants, sales experts, team managers, and scientists. Many private companies also emphasized diversity and leadership skills as well as community service experience (Figure 1). In addition to a strong understanding of all technical information, large agribusinesses like Syngenta and ConAgra, sought employees capable of collaboration and communication with culturally and professionally diverse groups. All twenty employers required applicants to possess skills necessary to not only work in agriculture, but also thrive in an ever-changing culturally, academically, and professionally diverse work environment.

Effective communication, leadership, teaching, and the ability to work with diverse populations were required qualifications at more than 50% of the organizations, universities and companies surveyed (Figure 1). It was evident that employers value prior experience working in an outreach or public educational capacity, suggesting that without basic teaching, leadership, and diversity skills a student may be at a disadvantage competing for a number of these positions. Much evidence exists to support that experiential learning projects taking place beyond the classroom improve student mastery of skills in social work, medicine, and public health (Kaf and Strong, 2011; Sadana and Petrakova, 2007; Nandan and Scott, 2011). As students of a similarly technical and applied discipline, agriculture majors planning to conduct community work may also benefit from such experiences to train them for leadership positions where they can confidently demonstrate agriculture concepts to diverse audiences of people.

Survey Data. Analysis of student survey results from the Y2 (n=6) SLE group revealed service-learning students rating themselves as having increases ($P \leq 0.05$) in their ability to design and teach hands-on science lessons for diverse audiences (Table 2). No student gains were reported in response to one survey question: "I am able to prepare a lesson" in either year of the study (Y1 $P = 0.375$; Y2 $P = 0.075$). However, responses to four other survey questions that specifically queried student ability to prepare lessons "for the public", "on soil science", that are "hands-on", and "for diverse audiences" did show confidence gains for Y2 SLE students (Table 2), suggesting that this group developed confidence in their abilities to perform their duties as instructors in a diverse community. Service-learning has been shown to increase students' perceived competence as instructors by improving teaching skills and instructional strategies (Kahan, 1998; Watson et al., 2002; Freeman and Swick, 2001; Verducci and Pope, 2001; Lake and Jones, 2008).

We did not see significant increases in Y1 (n=5) treatment student survey scores between pre- and post-SLE assessment, although Y1 pre-SLE survey scores trended towards being higher than or equivalent to post-(Table 2). An independent samples *t*-test of mean survey scores for Y1 and Y2 treatment students showed that Y1 students rated themselves higher in pre-SLE survey scores than their Y2 counterparts, but had significantly

Table 2. Comparison of pre-and post-course mean survey scores for service-learning experience (SLE) and control students in year 1 (Y1) and year 2 (Y2)

Survey Question	SLE Y1 n=4		Control Y1 n=7		SLE Y2 n=6		Control Y2 n=11	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
I am able to identify resources I need to be able to teach a hands-on science lesson to the public.	4.60	4.20	3.00	3.10	3.17	**4.67***	3.73	3.73
I am able to confidently develop a science lesson for diverse audiences from social, economic, or cultural groups different from myself.	4.60	3.80	2.87	2.30	3.33	**4.33***	3.27	3.55
I am able to confidently teach a science lesson for diverse audiences from social, economic, or cultural groups different from myself.	4.20	3.80	2.87	2.29	3.17	**4.33***	3.36	3.73
I am able to work effectively with diverse popluations (i.e. income, race, ethnicity, class, education or ability different from myself).	4.20	4.20	4.27	3.90	4.00	**4.50***	3.91	3.91
I am able to prepare a lesson.	4.20	3.60	3.20	2.70	4.00	**4.00**	3.45	4.00
I am able to teach a lesson to the public.	4.20	3.60	3.20	2.70	3.67	**4.50***	3.36	3.82
I am comfortable communicating soil science concepts to the public.	3.60	3.60	3.27	**2.70***	2.50	**4.00***	3.82	4.09
I am comfortable teaching diverse audiences.	4.20	4.20	3.27	2.30	3.50	**4.17***	3.64	3.82

[1] Significant at $P \leq 0.05$ using matched pairs *t*-test.

lower post-SLE survey scores (Figure 2). Community-projects immerse students in "real-life" situations that may be 'messy' and may place them in situations that are uncomfortable. The Y1 data suggests that this particular group of students' confidence in their own abilities and skills may have been inflated at the outset, and dropped once they were required to utilize these skills in their SLE. This finding is not uncommon, as student self-efficacy has been demonstrated to decline following community work if students initially believed themselves to be better prepared than they actually were (Guthman, 2008, Lichtenstein et al., 2011). Year 1 students from the introductory soil science (control) course, report being less confident in their ability to communicate soil science concepts to the public at the conclusion of their course than at the beginning (Table 2). Such a result may be attributed to students reevaluating their ability to teach soil science after learning more about the complexity of the topic, or to specific classroom experiences. Aside from this there was no significant change in the pre-and post-survey scores for Year 1 and Year 2 control group students (Table 2). Future qualitative data collection, such as student interviews, would help tease apart drivers for the decline in confidence within the control group. The introductory soil science course was fundamentally distinct from the SLE group course in that it was not designed to provide students with opportunities to exercise and or develop confidence in skills necessary for community outreach and extension-based agriculture work, thus such results were somewhat expected.

The most obvious difference between control and SLE student demographics was age, where our SLE group was slightly older (mean age 24 yrs) than the control group (mean age = 20) (Table 3). Further, the average reported GPA of the SLE group was 3.9 whereas the control group was 3.1 (Table 3), suggesting that students opting to participate in the service-learning class, at least in the years the study took place, were of above average academic achievement. There exists the possibility of bias created by survey respondents vs. non-respondents in the control group. A response bias can occur when the population being studied differs systematically from those invited to participate in the survey, but typically a study such as this, in which the response rate is very low, includes minimal or undetectable bias (Menachemi, 2011). However, due to this possible bias and the small sample sizes we are cautious about making generalizations beyond the scope of this data. Here we instead highlight trends worthy of future investigation looking for correlations between quantitative and qualitative findings.

Field Observation Data. Field observation data (Table 4) support survey and interview results demonstrating improved ability and confidence in adaptability (problem-solving), diversity, leadership, and teaching skills. Over the course of their seven weeks in the community, students learned to modify their lesson designs and teaching approaches to make inclusive exercises that engaged the diverse groups of people they were teaching. Their time in the community shifted from being primarily lecture to collaborative learning experiences where students demonstrated the importance of sustainable use of soil resources and horticultural concepts through hands-on demonstrations and activities, and tied these concepts to community members' quality of life. Consequently, at the end of the experience SLE students appeared to have increased their ability to lead their assigned community groups through discussions and activities that connect soil science and horticultural practices to issues of nutrition, food access and availability.

Student Interview Data. An increase ($P \leq 0.05$) in the mean number of times students in both years cited confidence in professional skills during interviews suggests that the SLE facilitated career-relevant gains for students (Figure 3). Gain in adaptability skills (ability to adapt, be flexible, resourceful and problem-solve) was one of the areas in which we saw the greatest increase in confidence from pre- to post-SLE ($P = 0.01$) (Figure 3). A community-based service-learning project sometimes involves working with community members with inconsistent interest levels in subject matter. The

Figure 2. Independent samples t-tests of year 1 service-learning experience (SLE) students' (n=5) average survey scores and year 2 SLE students' (n=6) scores within time points, P≤0.05.

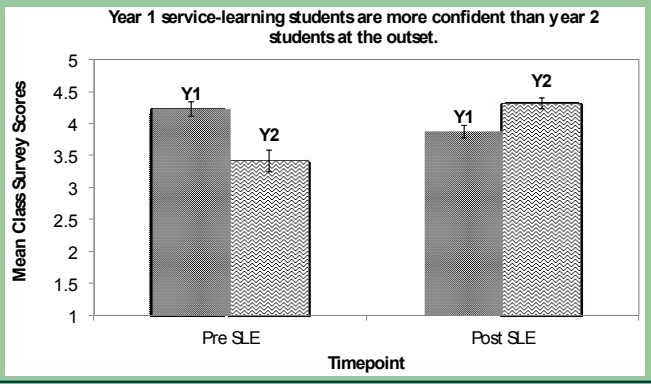


Table 3. The demographic parameters of year 1 and year 2 service-learning experience (SLE) students and year 2 control.

	SLE Y1	SLE Y2	Control Y2
Number of Student Respondents	5	6	11
Sex	1 female 4 male	4 female 2 male	8 female 3 male
Mean Age	21	24	20
Mean GPA	3.6	3.9	3.1
Grade Level	3 graduate students, 2 juniors	3 graduate students, 3 sophomores	3 sophomores, 6 juniors, 2 seniors
Ethnicity	5 white	3 white, 2 Hispanic, 1 Native American	9 white, 1 Asian, 1 mixed ethnicities
Disciplines Represented	Crop Science, Agricultural Education, Horticultural Science	Biology, Crop Science, Industrial Engineering, Food Systems	Agricultural Education, Natural Resources, Environmental Science, Horticulture Science, Biological Engineering, Plant and Soil Science

Table 4. Field observations made during student teaching days show improved teaching and leadership skills over the course of project.

	Y1		Y2	
	Group 1	Group 2	Group 1	Group 2
Preliminary	Students had difficulty managing and organizing group (leadership skills). Lesson did not engage community members (teaching skills)	Students teaching style was primarily "lecture" in style did not engage community members (teaching/diversity skills). Students used advanced science vocabulary but didn't explain the meaning of the words.	Students immediately organized group of community members and asked questions to get to know their audience (leadership/ diversity skills).	Students started with a structured lesson plan, but were forced to adapt their design dues to small attendance and challenging behaviors (community members yelling, leaving, cursing) (adaptablilty, teaching skills).
Intermediary	Students adapted lessons to be shorter and more relevant/ engaging (teaching/diversity skills), sometimes on the spot (adaptibility/problem solving skills)	Students began to simplify and explain concepts to help community members understand soil concepts and improved abilities to work with and lead the diverse group (diversity, leadership skills).	Students were challenged with climate (rain and wind) and disruptive people at soccer field (next door) and had adapt (adaptibility skills) their lessons to maintain community member engagement.	Students began to ask community members about their interests and values in order to build relationships(diversity). They used group management techniques to work through attention and behavioral challenges (leadership, teaching skills).
Final	Students still encountered group management and organization challenges, but displayed improved (leadership) skills and had lessons and activities that engaged for their diverse community.	Students delivered lessons relevant and engaging to community members and included students in the learning process (teaching skills).	Students displayed confidence in their ability to teach concepts adn work with their community (agricultural, diversity skills).	Students delivered lessons that related soil science and agriculture to their assigned community members' values and interests. Lessons were both informative and engaging (leadership, diversity, teaching skills).

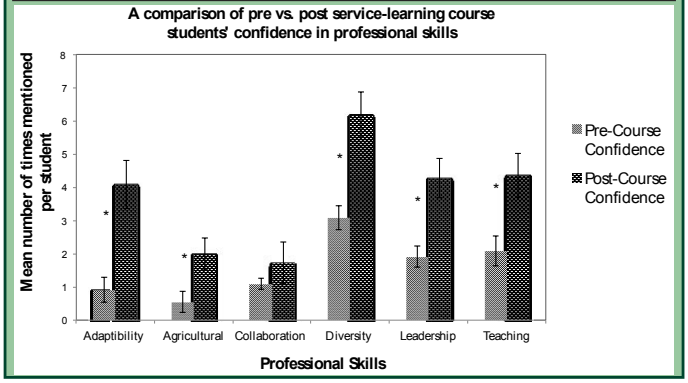
gardens where our students taught were located in three demanding locations (Table 1): a school for behaviorally challenged students, a subsidized housing community, and a manufactured home community. Student teaching was often limited by factors such as a distracting environment, climate (most sites did not have an indoor classroom option), lack of community member attendance, and other disruptions that required them to adapt their lesson plan for the day to ensure community member engagement and attention. In post SLE interviews students described the importance of adaptability and problem-solving skills, for example:

Student E: "*I think you really learn a lot about adapting and problem-solving and thinking on your feet when you teach.*"

Student G: "*We HAD to problem-solve..... I guess it [the SLE] helped me to work well under pressure, come up with solutions when you don't have a lot of time.*"

Student B: "*We had a lesson plan for every day and we had a presentation for every day and many times….every time... [laughs] that changed on the spot.*"

Figure 3. Pre- and post-course coded interview data for all service-learning students (n=11). *Significant at P≤0.05 using matched pairs t-test.



Multi-disciplinary approaches are often used to teach students to adapt and problem-solve in real life situations. Christy and Lima (2007) describe several service-learning projects where engineering students meet a local community need by designing much needed facilities (for example a wastewater plant) and simultaneously learn to troubleshoot and adapt their plans in the context of the real world. Manufacturing scenarios in which students must adapt for success, as they would at a job, are challenging to accomplish in a typical lecture. This SLE provided students with ample opportunity to develop this career-relevant skill (Figure1).

An important finding of this study is that after teaching agricultural science in these low-income and predominantly minority communities, SLE students rate themselves as more confident (Figure 3) in their ability to lead (Leadership Skills; $P = 0.01$) and to work with and teach (Teaching Skills; $P = 0.04$) diverse populations (Diversity Skills; $P = 0.01$). Cultural competence, the awareness and knowledge of how integrated patters of human behavior, including language, thoughts, communications, actions, beliefs, values, customs and institutions of racial, ethnic and social groups affect one's group identity (Cross et al., 1989), may be argued to be a critical skill for individuals working with any public audience, as well as one that is desired by the employers surveyed in this study (Figure 1). The incidence of food insecurity has been shown to be high in minority neighborhoods where education and resources are often lacking (Wilson et al., 2006; Keppert et al., 2007). Increased perceptions of competency to interact with diverse populations, as well as greater cultural competence and increased leadership skills, are well-documented outcomes of student participation in multi-cultural service-learning projects and community work (Carter and Spotanski, 1989; Mefford, et al.,

1999; Ladson-Billings, 1994; Flannery and Ward, 1999; Domangue and Carson, 2008; Meaney et al., 2008). Students participating in our study documented their increased comfort through quotes and examples, such as the following:

Student G: [in the future] "*…I'll try and avoid making stereotypes and just ask people about themselves…I definitely learned things about how to keep groups focused and excited*."

Student K: "*I think I'll just try and get to know [the community members], instead of assuming I know about their life,*"

Student L: "*I feel like a leader, being able to group-up the kids, like break up a classroom into smaller groups, take charge and being able to teach a group of people.*"

Teaching and collaboration were two areas in which increases in student confidence were expected. Service-learning students spent seven weeks teaching soil science to their assigned community in groups of two to four students. We found that SLE students mentioned confidence in their teaching skills in post SLE interviews twice as often when compared to pre-SLE interview data. Due to the high level of collaboration needed to carry out successful lessons, we expected increases in student confidence in their ability to collaborate with others, either in their group or in their community. Although students occasionally mentioned examples of collaboration skills in relation to their development as leaders within their groups, interview data did not support a significant increase in student ability to collaborate with others (Figure 3 and Table 2).

The weekly practice of developing and teaching a lesson plan appeared to be a driver in advancing student learning for a variety of reasons. Three students provided examples showing that while they previously had little teaching experience they now felt competent enough to design lesson plans and teach soil and agricultural science to a variety of audiences. One student in agriculture education was surprised by his reaction to community based-teaching, stating, *"Let's start with my major being ag education. This was kind of a big wake-up call…it was good to get that teaching experience."*

During interviews students explained that the pressure to teach the information to others required them to have a deeper understanding of the content and simultaneously improve their public-speaking skills. They describe their SLE as helpful for increasing (P = 0.01) their knowledge of horticulture, food production, soil management, gardening and farming (Agriculture Skills), and particularly their knowledge of soil science because the project required them to utilize and teach knowledge either gained through previous lecture material, or through self-education via books or other resources.

Student A: "*I feel like…um we had moved beyond these basic soils science concepts in [previous lecture course], but going back to those was healthy, very healthy, for my understanding.*"

Student L: "*Academically I learned that even though I feel like I have a pretty good mastery of certain concepts, I really don't. Because when you get in a classroom you start getting all these questions!*"

Student B: "*Example of something I learned? The refinement of my skills with soil science….there were a few things I was trying to get across and relate them to soil science and I realized that I was really not too comfortable with teaching that material, so I went back and looked at that…so in an academic sense, I got a lot more comfortable with teaching materials that I've spent so much time learning, but never teaching.*"

These findings are supported in the literature where service-learning participation has been shown to positively impact student academic goals (Serow et al., 1996; Barber and Barrisoni, 1993; Eyler and Giles, 1999; Zlotkowski, 1998) by enhancing student achievement of core educational outcomes (Markus et al., 1993; Osborne et al., 1998). Consequently, student teachers such as those in this study tend to internalize the knowledge when they use it to solve "real world" problems (Phelps and Kotrlik, 2008).

In their core courses, agriculture students are often provided with evidence suggesting the importance of concepts such as soil health, biodiversity, and the impact of current agronomic practices on the environment. This SLE required that they enter a community with a great degree of urbanization and various injustices, and many students expected to be well received when trying to demonstrate the benefit of sustainable urban production of food. But instead, as described in Guthman (2008), students were sometimes met with community member indifference, reluctant participation, as well as much larger problems than they had anticipated. Faced with these challenges, students sometimes questioned the purpose of their activities. We observed that through their various experiences, students discovered that working in the community modified their perceptions about how one successfully effects positive change with regards to food production and access. In particular, following their service-learning experiences students realized that, as paraphrased from quote by Student C any inroads to agricultural education for the general public may take more than basic knowledge of agricultural production in order to create lasting changes. To this end, students emphasized the importance of change occurring via the building of solid relationships with the community, with this being the key any educational progress. Mentioned 21 times during interviews, the act of "building relationships" is described as an effective way to develop food leaders within the community.

Student J: "*…you get to know the community, you understand how they communicate and build a relationship with them, you're understanding their reality and their comfort zone…listening is a really important skill, learning to actively listen to the community.*"

Students explained during interviews that benefits of the SLE extended beyond just skill development. The experience provided them an opportunity to work

outside of the university and offered perspective to concepts learned in university classrooms. One student described her experience as providing her with concrete examples of things she is learning in lectures across many courses.

Student J: "*In class we talk a lot about childhood obesity or food systems research, and how some elementary and middle school students consume up to 80% of their calories at school…like the kids [in the community] would talk about eating breakfast, lunch and snacks at school and you're like 'Holy crap! Kids really do this!*"

Through the SLE, Student J was able to personally witness a food security related phenomenon that the student had learned about in lecture. These types of experiences help students better understand various food security-related factors that ultimately contribute to obesity and other health problems. Another student mentioned that he was "shocked" when community members refused to eat carrots harvested from the garden because at one point in the carrots' lifecycle they "had dirt on them ." Witnessing this community member's disconnect from the origin of their food made him realize that his service-learning group was there to perhaps do more than teach soil science, and that their work may indeed change preconceptions about food production. The student explains, "*They had never seen dirt on their food before. You wash it off, you eat it, it's fine. You tell them, 'The food is really good and it's healthy and it's what you need to be eating and all of your food had dirt on it at one point anyway,' but they had never seen that, so it was a really difficult mentality to work with.*" Both Student J and C illustrate that community-based learning projects offer university student's exposure to real-life complexities and challenges of our modern food system. Our data shows that students leave the project not only more confident in professional skills and agriculture, but also having gained experience and perspective that increases their potential as future food system leaders.

Summary

Our survey of employers in the field of agricultural outreach and education found that organizations are interested in hiring graduates who are proficient in skills beyond knowledge of agriculture. Despite the small sample size, this study demonstrated how the integration of service-learning opportunities into agriculture curricula better-prepares students for the competitive job market. Student in this service-learning course credit the experience for providing helpful preparation for their careers, but more importantly for giving them insight into the issues surrounding food security and the role relationships play in education and social change. Such approaches to agricultural education can serve to both build strong relationships with the general public, and develop leaders who are able to communicate their scientific knowledge effectively.

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New Curricula for Undergraduate Food-Systems Education: A Sustainable Agriculture Education Perspective[1]

N. Jordan[2] and J. Grossman[3]
University of Minnesota
St. Paul, MN

P. Lawrence[4], A. Harmon[5], W. Dyer[6] and B. Maxwell[7]
Montana State University
Bozeman, MT

K.V. Cadieux[8]
University of Minnesota
Minneapolis, MN

R. Galt[9]
University of California
Davis, CA

A. Rojas[10]
University of British Columbia
Vancouver, BC

C. Byker[11], S. Ahmed[12], T. Bass[13]
Montana State University
Bozeman, MT

E. Kebreab[14]
University of California
Davis, CA

V. Singh[15], T. Michaels[16], C. Tzenis[17]
University of Minnesota
Minneapolis, MN

Abstract

New undergraduate degree programs that address food systems have appeared at a number of North American universities in the past decade. These programs seek to complement established food- and agriculture-related courses of instruction with additional curricular elements that build students' capacity to address complex food-systems issues (e.g., food sustainability, security, quality, equity and justice) in the course of their work in food-related professions. Here, we examine these emerging food-systems curricula, building on our collective experiences developing food-systems degree programs at University of British Columbia, Montana State University, University of California-Davis and the University of Minnesota. We present the conceptual framework that underlies our efforts, based on the premise that our degree programs should help students build "systemic" capacities that complement disciplinary training provided by various specialization "tracks." Thus, we intend for our graduates to have a dual preparation, in both a particular specialization, and in overarching systemic capacities that enhance their ability to address complex food-system issues. We assess our current curricula in light of our framework, and outline high-priority pathways for further development of these curricula.

Introduction

Our food comes from a complex nexus of biophysical and social factors and processes. These include physical life-support systems–land, biota, water, energy–and social dimensions that include economic, political, cultural, and even emotional and spiritual aspects. On the one hand, this nexus is producing more food than ever before. On the other hand, there are many

[1]Due to the number of authors, individual author information is provided in endnotes.

problems with food: troublesome patterns of consumption, scarcity and abundance, threats to the resource base supporting food production, and complex and controversial issues of equity, justice, and quality. Here we present our vision for how to apply best practices in teaching and learning theory and systems thinking to develop undergraduate curricula that address broad issues related to food production, health, and social justice. This vision is based on our collective experiences developing food-systems majors at University of British Columbia (UBC), Montana State University (MSU), University of California-Davis (UCD), and the University of Minnesota (UMN). Our majors are four-year degree programs explicitly focused on building capacities relevant to food systems *as "*wholes," and thus differ from related efforts that are more narrowly focused, e.g., on sustainable agriculture with emphasis on production. We believe our programs provide an informative sample of efforts to develop relative extensive curricula focusing on food systems *per se*, although we are well aware of relevant curriculum development at many other colleges and universities. We begin by outlining the rationale for our curricula.

To better address the food system and its strengths, weaknesses, opportunities, and threats, we propose that society must "up-scale" analysis and action to better address broader spatial-temporal scales, biophysically, socially, and conceptually (Foley et al., 2005; Jordan et al., 2007; Robertson et al., 2008). For example, expanding the scale of agricultural management to address landscapes is seen as a critically important strategy for sustaining food production. In the same vein, up-scaling of social organization by development of more extensive and effective social networks is recognized as crucial to develop a citizenry that can address global food challenges and controversial food-system issues such as equity, justice and quality. Metaphorically, up-scaling is often described as a shift in perspective–"looking up and out"–to gain understanding and new strategies for action. As well, we believe we must enable our students to "down-scale" analysis and action, by a second shift in perspective–"looking down and in"–to gain understanding of underlying processes and local mechanisms that manifest and help explain the workings of larger-scale phenomena

Consequently, we are working to create food-system curricula that will equip our students to upscale and downscale their thinking as integral parts of their quest for sustainability, equity, and resource efficiency. To do so, we have developed curricula that build relevant learning outcomes in skills, knowledge, habits of mind, and other capacities. The first and most overarching outcome is the ability to practice systemic or holistic thinking. We conceptualize systemic thinking and action as student competence in four capacities that have the potential to foster up-scaling–deep reflection, rich observation, visioning and design, and responsible participation. Each of these, we believe, is necessary to achieve effective systemic thinking and action in our students, and so we are implementing appropriate food-system curricula. Here, we present our collective vision and goals for undergraduate curricula that promote systemic thinking about food. We present the conceptual foundation for our vision, assess the current status of our curricula in relation to our goals, and identify promising pathways for further development.

Systemic and Systematic Thought and Action

Our conceptual foundation emphasizes the interplay of two forms of thought and action: the systemic and the systematic. We draw on notions of systemic thinking (ST) that emphasize interrelationships, patterns and connectedness; understanding system processes in addition to structure; and assessing how changes to one variable will impact other variables in a system (Ackoff et al., 2010; Boyatzis and Goleman, 2007; Mathews and Jones, 2008; Senge, 1994). Our key premise is that humans continually create and use simplifying mental models of the world around them (Argyris et al., 1985), often without explicit awareness of this cognitive process. Our curricula aim to help students develop their ability to consciously create such models, and to reflect critically upon them and their influence on attitudes and actions (Mezirow, 1996).

Moreover, we contend that work on complex food-system issues is strongly aided by an ability to shift between ST and so-called "systematic" thinking and inquiry (Ison, 2008). Most current curricula in food and agriculture focus on capacity to think and act systematically, in other words by using the particular rationalities and methods of a particular discipline or form of work. Systematic thought and action are carried out using a particular way of knowing–typically, one that is characteristic of a particular discipline or profession–to address relevant facets and dimensions of a situation. In our view, systemic thinking provides holistic perspectives that are essential complements to systematic thinking–e.g., a capacity to analyze "why" work and action are needed on moral and ethical grounds, resulting in enhanced abilities to work in coordination with others. We now describe our shared understanding of specific capacities that support effective ST and its integration with systematic thought and action.

Cardinal Capacities for ST (Systemic Thinking)

In order to construct the new food-system institutions that we call for above, society needs people who are prepared to inhabit and embody these institutions. To do so, our students must learn to play new or enhanced roles that integrate systemic and systematic thought and action. These include roles as innovators, storytellers, entrepreneurs, networkers and publically-engaged scholars. To play these roles, we believe that certain attributes, skills, visions and worldviews are needed, which differ markedly from those of systematic thinking. We summarize these outcomes in terms of four cardinal capacities or capabilities (Lieblein et al., 2007; Lieblein, pers. comm.); conceptually, the set of capaci-

ties is derived from the Kolb Learning Cycle (Francis et al., 2012).

Deep Reflection. A capacity for critical and constructive reflection on actions, underlying mental models, and worldviews of oneself and others, is crucially important for competent performance in new roles that involve ST and its integration with the systematic. This capacity is needed to address a fundamental and widely recognized challenge to sustainable development: the cognitive and practical capacities of individual persons, disciplines, and professions are too limited to manage complex sustainability problems (Pahl-Wostl, 2007; Pretty, 2003; Ravetz and Funtowicz, 1999). Rather, a process of intensive interaction among people in different disciplines with divergent "ways of knowing" is apparently necessary for progress (Warner, 2006; Berkes, 2007). To be most effective, such interactions appear to depend on the deep reflection we call for (Bawden, 2005; Toderi et al., 2007).

Rich Observation and Model-Making. Many important food-system issues reflect complex interactions within and between social and biophysical elements of agriculture and food production. Therefore, we call for development of a capacity for rich observation that enables students to create heuristic models of agricultural and food systems, via an inductive approach that enables collaboration with people from many disciplines in the model-building process. The creation of heuristic models involves a variety of methods for characterizing biophysical and socio-economic dimensions of eco-social systems in agriculture (Ison et al., 2007), such as mind-maps, influence diagrams, and similar techniques, soft-systems methodology, scenario planning, and simulation-based decision-support tools.

Future Visioning and Design. Design thinking is a powerful tool for integrating systemic and systematic thinking on complex and controversial issues (Nassauer and Opdam, 2008). New food systems and their relations with other societal and life-support systems must account for–and draw energy and inspiration from–the diverse priorities of myriad stakeholders. These priorities arise from divergent positions, interests, and worldviews among stakeholders. Emerging approaches to multi-stakeholder visioning and design aim to address these challenges head-on (Jordan et al., 2013); these use deliberation-based processes of planning and design (Ison et al., 2007; Pahl-Wostl and Hare, 2004) to enable multi-stakeholder groups to search for food-system designs that accommodate divergent interests, facilitate change, and achieve the goals of multiple stakeholders.

Responsible Participation. In our view, responsible participation is active and ongoing engagement in some form of collective action, regardless of the ideological motivation for such action. Engagement, in our view, includes helping to determine the practical and ethical concerns of the group, the actions that should be undertaken by the group, and how action should be taken. Responsible participation also suggests active involvement in a group's "metacognition," or learning about the group's own processes of learning, and questioning the adequacy of its knowledge and capacities.

We propose that our students will benefit greatly from the integrative practice of deep reflection, rich observation, visioning and design, and responsible participation in their future work, and that society will benefit as well. While this proposition is supported by an extensive body of evidence as noted above, the impact of our curricula on the broadest societal outcomes we seek is hypothetical, and accordingly we approach development of our curricula in the spirit of action research. Facilitating development of these cardinal capacities, systemic thinking, and the integration of systemic and systematic in our students' future working lives is, of course, a great challenge. Below we describe curricular approaches to this challenge that have been developed at our institutions.

Our Current Food-Systems Curricula

Our programs share the conceptual foundations outlined above, but vary in emphasis and implementation. Our degree programs are recently established: the Land, Food and Community curriculum at UBC has been in operation since 2000, while the others are more recent. The Sustainable Food and Bioenergy Systems major at MSU is in its 5th year of operation, the UCD Sustainable Agriculture and Food Systems major is in its 3rd year, and the UMN Food Systems major is in its first. Among our universities, 21 distinct majors or tracks within majors are offered; there are substantial commonalities and, as well, unique offerings at each location (Table 1). These courses of study illustrate the breadth

Table 1. Undergraduate majors, tracks, or options related to food systems and/or sustainable agriculture that share common systems core curricula at each of four universities in the U.S. and Canada. Note that programs at University of British Columbia are separate majors that share a common systems core curriculum; programs at other universities are concentrations or 'tracks' within a single major at each institution.

University of British Columbia	University of Minnesota	University of California, Davis	Montana State University-Bozeman
Applied Plant & Soil Sciences	Organic & Local Food Production	Agriculture & Ecology	Sustainable Crop Production
Food & the Environment	Consumers & Markets	Food & Society	Sustainable Food Systems
Food Market Analysis		Economics & Policy	
Applied Animal Biology			Sustainable Livestock Production
Global Resource Systems	Agroecoloy		Agroecoloy
Food Science			
Nutritional Sciences			
Dietetics			
Food, Nutrition & Health			
	Individualized Track		

of opportunities for systematic learning as conceptualized above; each of these courses prepares students to enter a particular field of work or to go onto advanced study, as necessary.

Our Systems Core Curricula

Each of our curricula has a "systems" core curriculum that aims to develop the capacities for systemic thought and action that we have outlined above, consisting of a sequence of four to six core courses for all majors (Table 2). The core-course sequence at each institution begins with an introductory course that provides an introduction to systemic thinking about food systems, by examining food systems as coupled human-environmental systems. This course is followed by various combinations of agroecology, holistic analysis of social, economic and ecological sustainability, epistemological awareness, awareness of alternative perspectives and problem-based learning. All programs also require either practica or capstone experiences.

Our curricula reflect a shared "theory of change" TOC). Our TOC expresses our working understanding of how and why our curricula can enable our students to integrate systemic and systematic thinking and to practice the cardinal capacities in their food-systems work. Our TOC is based on the following:

Most fundamentally, we believe that the underlying skills and understandings of systemic thought and action require development across the curriculum. It is not enough to, say, introduce the concepts in a course or two and then expect students to apply them successfully in a senior capstone project. Evaluation and critical reflection in our curricula strongly suggest the need for such an articulated curriculum (Galt et al., 2013; Rojas et al., 2012; Strachota, 2013); such curricula support cumulative systemic learning and competency development over the undergraduate years, and allow teaching and learning relationships to form between students and faculty and among students that support complex and challenging learning activities such as working in multidisciplinary groups.

Secondly, we recognize that young adult learners typically begin university at a cognitive and developmental stage that can significantly impede development of ST (Perry, 1970; Salner, 1986; West, 2004), and that certain subsequent stages of development are necessary to enable students to practice ST. In particular, development of a critical awareness of knowledge and worldviews appears fundamental to ST (Salner, 1986). Therefore, ST learning activities, if they are offered across the curriculum, must be sequenced to engage students at their current developmental stages and support development of cognitive capacities that enable ST. For example, first-year students in our curriculum at MSU have been shown to benefit from "simple" systems learning activities, including identifying their personal backgrounds and values, visiting complex situations, and beginning to envision themselves as systems thinkers in future work (Malone et al., 2013). Similarly, role-playing and service-learning activities in our curricula that promoted empathy for experiences of ethnic minorities around food, nutrition and gardening have also been shown to be helpful to lower-division undergraduates in our curricula (Galt et al., 2013; Grossman et al., 2012).

Finally, we hypothesize that bringing students who are studying different systematic disciplines together for shared ST learning activities can spur emotional engagement (e.g, via highly vivid experiential or narrative-based activities) that feeds back to enhance systematic learning. This "virtuous circle" effect could greatly enhance efficiency of learning across a curriculum (Huber and Hutchings, 2004) thus creating time and space for both systemic and systematic learning. Evaluation and reflection efforts in our curricula (Galt et al., 2012, Galt et al., 2013; Rojas et al., 2012,) strongly support this proposition, as we find that systemic learning activities increase our students' sense of agency and enthusiasm to apply their education to food-system challenges.

Across our institutions, we are further testing, evaluating and developing our TOC and core curricula. Courses in our curricula fall into five categories: introductory courses, social-systems courses, focused systemic

Table 2. Food systems core-curriculum courses at four universities in the U.S. and Canada.

University of British Columbia		University of Minnesota		University of California, Davis		Montana State University - Bozeman	
Core Course	Course Title	Core Course	Course Title	Core Course	Course Title	Core Course	Course Title
LFS 100	Introduction to Land, Food & Community	FDSY 1660	First-Year Colloquium/ Experience in Agroecocsystem Analysis	PLS 15	Inroduction to Sustainable Agriculture	SFBS 146	Introduction to Sustainable Food & Bioenergy Systems
LFS 250	Land, Food, & Community I	FDSY 2101	Plant Production Systems	CRD 20	Food Systems	SFBS 296/298	Towne's Harvest Practicum/Internship
LFS 350	Land, Food, & Community II	BBE/FDSY 3201	Sustainability of Food Systems: a Life Cycle Perspective	PLS 150	Sustainability & Agroecosystem Management	SFBS 300	Measuring Innovation in the Food System
LFS 450	Land, Food, & Community III	APEC/FDSY 3202	An Introduction to the Food System: Analysis, Management & Design	ARE 121	Economics of Agricultural Sustainability	SFBS/ANSC 498	Internship
		FDSY 4101	Holistic Approaches to Improving Food Systems Sustainability	ESP 191 A&B	Senior Capstone - Workshop on food System Sustainability	SFBS 491	Food System Resilience, Vulnerability & Transformation
						SFBS 499	SFBS Capstone

courses, practica and capstone courses. We review each of these, identifying where and how cardinal capacities are addressed, and instances where systemic and systematic thinking and action are integrated.

Introductory Courses. These courses strive to establish a conception of food as the outcome of coupled human-environment systems. All explore food production in its social context, typically through topical case studies, e.g., of urban agriculture or competition between agriculture and other sectors for water. The UBC introductory sequence (LFS 250 and 350) strongly emphasizes social factors, e.g, exploring biophysical aspects of food, from production to waste recovery in social context and in particular, via community-engaged learning in the Vancouver region, while emphasizing observation and model-building.

Social-Systems Courses. These courses also aim to establish a conception of food as the outcome of coupled human-environment systems, but center on social factors, including, e.g., economic, historic, geographic and cultural. These courses build skill in observation and model-making, but also strongly emphasize reflection. The UCD course (CRD 20) promotes development of new mental models of food systems, critical reflection on knowledge, premises, and values related to food and society, and heightened capacity for self-awareness (Galt et al., 2013). The UMN course (FDSY 3202) explicitly introduces systemic-thinking methods, and then applies these to build student observation and model-making abilities. The UBC course (LFS 250) presents a conceptual framework, termed "ecology of knowledge" that is used to promote reflection, observation and model-making around forms of knowledge, personal and collective experience, and participation in collective action and learning. All of these courses have strong community-engaged learning elements, using these experiences in observation and participation to complement in-class examination of reflective case studies and to provoke deep reflection. This could be combined/shortened.

Courses Developing Other Systemic Perspectives. These aim to build particular aspects of the cardinal capacities by a specific focus on some particular systemic perspectives on food. They include a UMN course (FDSY 3201) that examines food from global perspectives, including processes of production, distribution, preparation, consumption, and the effects of these for human health and environmental quality. This course thus builds students' abilities to 'look up and around' to perceive factors of the broader biophysical and social environments that affect food. Other examples include two courses in the MSU curriculum (SBFS 300 and 491), which, respectively, examine the nature of innovation related to food, and the resilience of food systems. In addition to supporting observation and model-making, these courses emphasize design and visioning and responsible participation.

Practice-based Learning Experiences. As with the capstone courses, practica on farms or internships in food-systems organizations are designed to provide experiential education opportunities for students and transferrable skills for future employment. These experiences challenge students to practice systematic skills related to their chosen profession and livelihood, while also engaging students in systemic thought and action, e.g., via civically-engaged learning situations that build capacity for responsible participation. More broadly, such experiences provoke synthesis of a wide range of knowledge, and heighten awareness of roles and values that may be operating in a situation, e.g., social justice issues (Niewolny et al., 2012). For instance, such insights are often observed in experiences where students must provide leadership to a public audience or organization, e.g., groups of under-served youth (Grossman et al., 2012). Practica that provide international food-systems experiences provide opportunities to apply and develop systematic skills while observing and reflecting on culture and context in food systems (Schroder et al., 2011).

Capstone Courses. To integrate and enhance systemic and systematic skills and understandings of final-year students, all curricula require a "capstone" course. The intent of these courses is to provide intense, integrative experiential learning that draws on previous systematic and systemic coursework, thus helping to prepare students to engage in creating or transforming food systems via up-scaling, down-scaling and the integration of systemic and systematic thought and action.

These courses jointly enroll students trained in a wide range of systematic tracks, challenging students to engage in methodological pluralism. All of the courses confront real-world problems and opportunities related to food, through engagement on- or off-campus. Each emphasizes rich observation, via characterizing problems/opportunities in systemic terms. For example, the UBC and UMN courses use critical reading of literature to support rich observation done in community; the MSU course features planning, site visits and data collection; the UCD course integrates the inquiry methods of a range of disciplines. In varying measures, these courses also feature other capacities. These include critical reflection: both UBC and UMN courses call on students to develop narratives of their personal experiences with food, while the UCD course asks students to assess the range of sustainability-related values that are perceived by different actors in a situation (Galt et al., 2012). All courses call for some level of design and visioning, in the form of creation of action plans, conceptual models, or a shared vision for improving the sustainability of food at UBC. As well, all courses involve responsible participation, via extensive interactions with a range of workers and participants in food systems, involving discussions, presentations, coalition building and other forms of civic engagement.

These capstone-course activities are relatively challenging and sophisticated tasks. Within the bounds of a single semester, it is unlikely that students can practice all of them deeply, nor consider their integration, and the broader issue of how these systemic capacities stand in

relationship to the systematic knowledge and capacities that are also engaged in these capstone experiences. Therefore, we are striving to increase relevant learning opportunities in earlier parts of the systems core curriculum, prior to the capstone experience.

Challenges for Our Curricula. Our current curricula face a range of challenges. Among the capacities that we seek for our students, our current core curricula most strongly emphasize development of observation/model-making. Development of other capacities and practice in the integration of systemic and systematic thought/action receive considerably less emphasis in most of our curricula. The UBC curriculum, which is the longest-established of our programs, incorporates the broadest range of systemic learning activities and these activities occur and recur across the core curriculum. Thus the UBC program is the most comprehensive in pursuit of our TOC. However, it has been implemented in a cultural and institutional setting that is significantly different from our other programs, which are all situated in US 1862-Land Grant universities.

At present, our curricula emphasize a narrow range of approaches to ST and, more broadly, holism. Currently, we focus on approaches developed by pioneers such as Churchman, Checkland, Bawden and Ison. Other methods, e.g., the "thinking with hands" emphasized in design disciplines, or visualization and visual thinking are much less prominent in our curricula. Accordingly, our curricula may be effective for only a narrow range of 'thinking and doing' types.

Community-engaged learning (CEL) has many difficult aspects, but is essential to our curricula. Essentially, CEL is a pedagogical strategy in which students engage in community service to address public needs while simultaneously developing disciplinary competency (Rhodes and Davis, 2001). We believe that CEL helps to build all of the cardinal capacities that we seek for our students. However, CEL is time-consuming for all parties, particularly when it involves "one-off" arrangements that require all parties to negotiate terms and arrangements anew with each new semester. CEL experiences have a large affective component; on the one hand, students may feel inadequate; on the other hand, community members may feel powerless as partners with university; these dimensions need to be recognized and addressed or learning may be undermined for many students. Accordingly, there is a need for staged and scaffolded CEL, especially when lines of difference between students and community must be navigated. Finally, CEL carries some risk of exploitation for all participants. Several of our programs are attempting to develop and maintain lasting partnerships with civil society as settings for articulated and sequenced CEL; these partnerships have potential to reduce transaction costs of service learning, and improve the value of these activities for all parties.

Many of our students are primarily oriented to natural sciences and/or are strongly "practically-minded." In our experience, such students can be highly challenged by open-ended, creativity-focused learning activities that are more common in design and artistic disciplines and which are important to ST learning (Strachota, 2013).

It is unclear how to balance "content" in the core curriculum with "capacity" building around the cardinal capacities, particularly in the introductory courses, in which the learning activities that students encounter are quite unfamiliar, e.g., design/visioning activities. The nature and significance of potential trade-offs between systematic and systemic learning are not well understood.

We are unsure how to evaluate development of the capacities we seek for our students. Evaluation methods are needed for, e.g., capacity to design and envision, or empathic appreciation of worldviews that differ from one's own; and the integration of affective and analytical aspects of learning. These methods need to be both effective and practical. For example, for both of those reasons, peer evaluation is likely to be important to building critical self-awareness of the cardinal capacities.

An important rationale for our programs is to provide skills and capacities that are now sought by many employers. In many surveys, employers say that they seek students who are excellent communicators, lifelong learners, skillful cross-disciplinary collaborators, unafraid to go into unfamiliar disciplinary and social environments, etc. Our curricula aim to develop such skills and capacities in forms and levels that are useful in professional practice, but do they succeed? What tradeoffs with other learning goals may exist?

Pathways for Program Enhancement

To address these challenges and work toward our shared goals, we are taking a stance of collective reflection and learning. We believe that priority should be given to the following practices, which we propose as key pathways for development. These pathways are: using narrative pedagogy across the curriculum; using simulation to develop ST; and employing design thinking as a fundamental vehicle for ST. Each pathway is presently implemented to some degree in our current curricula. However, we believe that significant potential exists for expansion and enhancement.

Using Narrative Pedagogy in Food Systems Education. Storytelling is one of the earliest known methods for communicating about new discoveries (Haigh and Hardy, 2011) and provides a powerful form of communication for learning in higher education (Lindesmith, 1994). Narratives can increase student motivation for learning and engagement with unfamiliar subject areas, encourage student responsibility as co-creators of knowledge, and contribute to effective leadership development as stories can help build trust and provide inspiration. When students make contextual links with academic material, it becomes more relevant and accessible. The classroom becomes a more cooperative learning environment, as there are opportunities for collective interpretation and

deep reflection, group participation, and teamwork. Relationships among learners and between students and teachers can improve (Haigh and Hardy 2011; Ironside 2003; Lindesmith, 1994; Miley, 2009). As well, stories can improve oral and written communication skills and enhance listening and critical thinking skills (Lindesmith, 1994; Miley, 2009).

Simulation as an Experiential Learning Activity. Food, agriculture and interrelated resources (water, land energy) are complex and simulation can help with understanding them. ST is not just the ability to conceptualize a system boundary, list components, or identify links between system components. ST thinking requires an appreciation that components interact to determine system level outcomes (Jacobson and Wilensky, 2006), and an interest in understanding these interactions and outcomes. Simulation models in a food-systems core curriculum aim to help students build understanding of key goals, components and their interactions, and of resulting system behavior over time and/or space. Various software have been developed to facilitate visualization of complex systems that can include social, economic and agroecological interactions, e.g., NetLogo (Gkiolmas et al., 2013, Jacobson and Wilensky, 2006).

Learning activities based on simulation must be guided with questions that prompt students to actively engage with simulations. These experiences reveal how system components interact, how human goals influence interactions and outcomes, and responses to perturbations and stress. Gkiolmas et al. (2013) conclude that active interaction with a simulation is helpful to students who have limited understanding of core systems concepts. For example, simulations can examine the resilience of alternate food systems that are designed with different goals (e.g., economic outcomes or energy conservation). Through experiments and trial and error, students can look for patterns in system behavior, ideally guided by expectations and intuitions articulated before simulation.

Learning through simulations is a form of experiential learning and requires critical reflection on experience, and we believe that simulation can strongly support development of several cardinal capacities. First, we expect that students' capacity for reflection on experience will be expanded by encountering archetypal system behaviors (e.g., reinforcing and stabilizing feedback, emergence); awareness of these phenomena is likely to transform how previous experience is understood and interpreted. Second, we believe that capacity for rich observation is likely to be heightened by simulation experiences. Specifically, if students are mindful of the conditions that create strong feedback, we propose that their attention is more likely to be drawn to interactions and the structure of relationships in a situation. Finally, we propose that capacity for design and vision is likely to be expanded by experience with simulation. For example, we expect that awareness of the dynamic behavior of systems will heighten appreciation of the need for designs that are robust to extreme situations.

Design Thinking. The use of "design thinking" (DT)–i.e., cognitive and creative activities typical of design professions by persons and groups that are not credentialed as "designers"–is becoming recognized as a powerful tool for addressing complex challenges. As discussed above, design and visioning is a cardinal capacity for ST, and we view design thinking (DT) as the most concrete and accessible vehicle for design and visioning. More broadly, we believe that a capacity to engage in DT can guide and inform the systematic practice of any food-related discipline or profession. DT is typically practiced via a sequence of activities termed empathizing, problem identification, idea formulation, prototyping and testing. Particularly when practiced by a group, the initial stages of DT are intrinsically systemic, as they probe for empathic understanding of the experiences of those affected in a situation, and consciously seek multiple framings of problematic aspects and possible responses to those aspects. DT is also intrinsically systemic because it widens cognition, encouraging the application of cognitive modes (e.g., "visual thinking," "thinking with your hands") that are seldom active in systematic approaches to food issues. We emphasize that our curriculum does not seek to develop designers in the traditional sense; rather DT is an accessible yet powerful "habit of mind" that we believe is foundational to systemic thinking. DT may be highly valuable for the development of applied systemic thinking in first-year students; it has been successfully used by first-year university students in engineering (Dym et al., 2005),. In addition, it can be brought to bear as a toolset to be applied when needed throughout the curriculum. Two directions may be taken for curricular integration. First, DT may be introduced in immersive skill-building workshops for first-year students. As well, DT can be inserted/integrated into specific courses throughout the curriculum whenever these are project-based and involve creating future designs/scenarios. In such applications, students are supported as they move among the various DT stages of empathizing, problem identification, idea formulation, prototyping and testing, as applied to particular challenges or opportunities in food systems, e.g., "food hubs" or community gardens that would be more accessible to low-income families (Grossman et al., 2012). Given the unfamiliarity of such cognitive and practical activities, students require coaching and feedback as they move through multiple iterations of the DT process (Razzouk and Shute, 2012).

Conclusion

Here we report on the benefits that can result from the application of ST in food and agricultural curricula, by drawing on experiences and co-learning activities of four universities with existing food systems programs. Our wish for our students is to provide them with solid preparation to address complex food-systems issues in a knowledgeable, just, and empathetic manner. Facing daunting global challenges to our current systems of production, distribution, access and consumption of

food, it is critical that society develops food-system professionals who can be both systemic as well as systematic thinkers within their chosen discipline or profession. Of course, such integrative professional practice–e.g, the notion of civic agriculture envisioned by Lyson and Barham (1998)–is the work of a lifetime. However, solid preparation for such work will only come via the intentional design of educational programs that allow them to practice new cognitive, affective, and practical abilities in a safe environment. We propose that integration of ST learning in an integrative core curriculum, anchored in experiential and community-based learning, can provide such preparation. Our collaborative intends to test this proposition through a shared program of curricular experimentation, rigorous assessment of results, and critical reflection. We believe that our collaborative approach is essential to develop new curricula in food-systems and agricultural education at a time when "venture capital" is in scarce supply in higher education.

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Endnotes

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[2]Agronomy & Plant Genetics Department 411 Borlaug Hall, Upper Buford Circle, St. Paul MN 55108, 612-625-3754, jorda0202@umn.edu

[3]Biological Principles of Sustainable and Organic Food Systems 454 Alderman Hall 1970 Folwell Ave. St. Paul, MN 55108, 612-625-8597, gross025@umn.edu

[4]Department of Land Resources and Environmental Sciences 334 Leon Johnson Hall, Bozeman, MT 59717, 406-994-5717, plawrencenw@gmail.com

[5]Food and Nutrition 201A Romney Gym, Bozeman, MT 59717-3360, 406-994-6338, harmon@montana.edu

[6]Department of Plant Sciences and Plant Pathology 725 Leon Johnson Hall, Bozeman, MT 59717, 406-994-5063, wyder@montana.edu

[7]Department of Land Resources and Environmental Sciences 334 Leon Johnson Hall, Bozeman, MT, 59717 406-994-5717 bmax@montana.edu

[8]Departments of Sociology and Geography, Society and Environment, 525 Social Sciences Building 267 19th Avenue South, Minneapolis, MN 55455, 612-625-8591, cadieux@umn.edu

[9]Department of Human Ecology, Davis, CA 95618, 530-754-8776, regalt@ucdavis.edu

[10]Faculty of Land and Food Studies, MCML 179 - 2357 Main Mall Vancouver, B.C., Canada V6T 1Z4, 604-822-0494, alejandro.rojas@ubc.ca

[11]Department of Health & Human Development,222 Romney Gym, P.O. Box 173360, Bozeman, MT 59717-3360, carmen.byker@montana.edu, 406-994-1952

[12]Sustainable Food and Bioenergy Systems Program, Bozeman, MT 59717, 406-994-6338, selena.ahmed@montana.edu

[13]Montana State University Extension 223 Animal Bioscience Building Bozeman, MT 59717-2900, 406-994-5733, tmbass@montana.edu

[14]Department of Animal Science, 2111 Meyer Hall, One Shields Ave. Davis, CA 95616, USA, 530-752-5907, ekebreab@ucdavis.edu

[15]College of Design, 1425 University Ave SE, Minneapolis, MN 55414, 612-625-3447, singh023@umn.edu

[16]Department of Horticultural Science 456 Alderman Hall, 1970 Folwell Ave St. Paul, MN 55108, 612-624-7711michaels@umn.edu

[17]Center for Teaching and Learning, Plaza Suite 400, Room 410 612-625-3330, tzeni001@umn.edu

Students Develop Compost Management Skills through Experiential Learning[1]

R.C. Bott[2] and E.L. Cortus[3]
South Dakota State University
Brookings, SD

Abstract

It is critical for college graduates to enter the workforce not only knowledgeable in a topic area, but also confident in their ability to apply their knowledge. Manure management is a major component of livestock production, including horses. Faculty from South Dakota State University's (SDSU) Animal Science and Agricultural and Biosystems Engineering departments partnered to develop an experiential learning opportunity for students to learn about manure management and composting. The objectives of this activity were for students to: 1) gain experience designing and constructing a compost pile, 2) critically evaluate compost progress and make appropriate management decisions, 3) maintain a logbook of management decisions and behaviors, and 4) develop an understanding of opportunities and challenges associated with manure management. This activity was integrated into an equine stable management course and an agricultural waste management course. The experience included reading assignments, discussions, a field day to construct compost piles, management, and recordkeeping. Pre-and post-tests included content questions, as well as a survey of students' views on manure management and the associated activity. Students from both classes who participated in compost management demonstrated improved performance on compost characteristic questions, and reported an increased confidence in knowledge and ability to compost.

Introduction

Roberts (2006) defined the Model of the Experiential Learning Process as a cyclic process whereby a learner is focused on an issue, emerged in experience, then reflects on the experience, and formulates generalizations before initiating the cycle again. This experiential learning process has been evaluated in various post-secondary agricultural program settings, including Environmental Farm Plan development (Stonehouse, 2000) and crop production and marketing (Rhykerd et al., 2006). Rhykerd et al. (2006) reported that the contest between four student organizations to physically produce and market corn and soybeans positively impacted the students' knowledge, self-confidence and leadership skills. Thus, experiential learning is recognized as a valuable teaching technique in post-secondary agriculture curricula, with a range of reported and potential subject matter.

With any course or learning model, numerous factors can impact the student performance and participation. Past research has examined factors such as gender, past experiences, program of study and grade scores for introductory animal science course performance (Lyvers Peffer, 2011), introductory forage management lecture or laboratory performance (Mousel et al, 2006) or goal-setting among animal science students (Splan, 2013). No specific studies on gender-related differences in context of experiential learning processes or outcomes were found, nor experiential projects related to composting or manure management.

Capstone and upper-year courses are generally designed as a platform for learners to assimilate and integrate fragmented knowledge from various components of a curriculum into a cohesive, working knowledge. This platform reinforces essential managerial skills of a specific field in addition to technical content. The managerial skills include planning, decision-making, and meeting the economic, physical and human needs of a system (Taylor and Field, 2001). Manure management on livestock operations is an example of a multi-faceted aspect that can have positive and negative economic (time, labor and equipment), environmental (water, air and soil quality), and public perception impacts. Composting is one of many forms of manure management, wherein the manure and a carbon-rich material (i.e. bedding) are broken down by microbes to form a soil-like material called compost (Rynk et al., 1992). Composting requires site-specific design, monitoring, assessment, and management (Rynk et al., 1992), and all four skill sets lend well to experiential learning.

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[2]Department of Animal Science; (605) 688-5412; Rebecca.Bott@sdstate.edu

[3]Department of Ag and Biosystems Engineering; (605) 688-5144; Erin.Cortus@sdstate.edu

To address these important issues, faculty members from Animal Science and Agricultural and Biosystems Engineering developed an experiential learning opportunity for South Dakota State University (SDSU) students to learn about manure management and composting. The activity involved classroom instruction (focus on an issue), field work (experience) and decision-making (reflection and generalization). The objective of this paper is to demonstrate the change in perceptions and knowledge of waste management for two groups of students with different backgrounds in two courses.

Materials and Methods

Course Background

Activities were conducted in two upper level management-focused courses on campus, Stable Management (SM) and Agricultural Waste Management (AWM) (Table 1). The majority of students were in the junior or senior level of their respective program.

The learning objectives for SM included developing an understanding of managing horses, designing and managing horse facilities, and also establishing a sound business plan for an equine operation. The compost activity was incorporated into the facility management objective of this course. The learning objectives for AWM were to understand the role of agricultural waste on the enhancement or degradation of natural resources and apply science-based principles to develop agricultural waste management plans for agricultural systems.

Compost Activity and Student Assessment

The activity was implemented in SM during the fall of 2012 and in AWM during the spring of 2013. For both courses, the learning objectives specific to the compost management activity were similar: 1) to gain experience designing and constructing compost piles, 2) to critically evaluate compost progress and make appropriate management decisions, 3) to maintain a logbook of management decisions and behaviors, and 4) to develop an understanding of opportunities and challenges associated with manure management.

The activity was conducted in a vacated, naturally-ventilated facility with concrete pens and basic office space for storage and record-keeping. The activity utilized procedures described by Rynk et al. (1992) for passive pile composting wherein the composting material was stacked and periodically turned. The periodic turning is prescribed to reintroduce air within the pile and maintain an aerobic environment. The raw materials were horse manure and straw bedding.

In the week prior to the start of the hands-on portion of the activity, informational materials were posted on the respective course websites, and students were asked to access and review the information. Students received one lecture on composting as a waste treatment method. For both classes, the pre-activity survey was distributed and completed during class time prior to the lecture.

During the first official week of the activity, SM students participated in a four-hour field day where they had interdisciplinary discussions with the Extension Equine and Extension Waste Management Specialists (who were also the respective course instructors). The first stop included a tour of the SDSU Equine Teaching Facility and observation of the raw materials available for use in compost piles, and evaluation of the current state of manure management. Students subsequently relocated to the compost activity site to plan how much manure, water, and other organic materials should be included in each compost plot. Four compost piles were constructed; pile one was a positive control managed by faculty, pile four was a negative control that students were asked to monitor, but not manage; and piles two and three were under student management. Finally, students were trained in measuring and recording ambient, core, and peripheral pile temperatures, moisture, volume, and odor. For AWM, a two-hour class was held at the compost activity site to design, construct and train in monitoring techniques. The pile management structure for AWM differed slightly from SM in that the AWM students constructed and were responsible for all four piles.

For the next 10 to 12 weeks of the activity, students were organized into groups of three, and assigned a week to observe and record information on compost progress. In both classes, students were responsible for documenting decision-making activities and subsequent actions. Periodic verbal updates on the observations and data collected were provided to the class by the students and faculty. During the last week of the activity, a group discussion on the data collected through the semester was conducted. The monitoring data were compiled by the instructors to demonstrate changes (or lack thereof) in the temperatures and sizes of compost piles.

The activity was 10% of the overall grade for each course. Student assessment was based on participation (in-class participation and evidenced by site records), a demonstration of knowledge of composting principles (evidenced by site records and calculations), and decision-making ability (evidenced by site records and decision justification). The AWM students also prepared a one-page “how-to” document. The weighting of participation, knowledge and decision-making in the activity grade were 33%, 33% and 33%, respectively for SM, and 20%, 50% and 30%, respectively for AWM.

Table 1. Course and participant information.

	Stable Management (SM)	Agricultural Waste Management (AWM)
Program	Animal Science	Agricultural Systems Technology (AST)
Optional/Mandatory	SM one of three course options required to complete a technical elective of the equine minor.	Required course for the AST major. Optional for graduate students.
Number of Students	26	25
Undergraduate/Graduate	26/0	23/2
Males/Females	2/24	24/1
Activity Period	October – December 2012	February – April 2013

Activity Assessment

To document the change in perceptions and knowledge of waste management for the two groups of participants, the activity was assessed using a pre-and post-activity survey that included participant background, perception, content and feedback style questions. Surveys were administered in class prior to commencement of compost activities (pre), and during the final week of class (post). The surveys were deemed exempt under federal regulation 45 CFR 46.101 (b) and approved by the South Dakota State University Institutional Review Board (IRB-1209015-EXM).

Open-ended participant background questions were designed to gauge the experience of the course participants in horse/livestock, land, and manure management, and were asked only in the pre-activity survey. Data were summarized for presentation purposes only, as shown in Table 2. Perception-based questions were asked using a five-point scaled response in both the pre- and post-activity surveys to gauge the importance, environmental beliefs, current knowledge and confidence in skill of the participants (Table 3). Content or knowledge-based questions were multiple-choice format, and administered in both the pre- and post-activity surveys (Table 4). The responses were anonymous and not considered in the student assessment for AWM. In SM content questions were graded and integrated into the knowledge portion of their activity grade. Finally, students were asked scaled-response (Table 5) and open-ended questions (Table 6) to obtain feedback on the activity as a component of their course.

Statistical Analysis

An exact Wilcoxon two-sample test was performed using SAS (Cary, NC) to determine differences in perception-based questions (scored on a scale of 1-5) pre- and post-activity for each cohort. A Chi-squared test was performed using the Frequency Procedure operation of SAS to determine changes in frequency of correct responses for knowledge-based questions. Differences within class for the Wilcoxon and Frequency tests were considered significant with a P-value of less than or equal to 0.05.

Results and Discussion

The survey response rate, being the number of surveys collected relative to the number of students in the course, was 100% pre and post for SM, and 72% and 88%, pre and post, respectively, for AWM.

Table 2. Livestock ownership and management experience, and agricultural land ownership/rental experience of student participants, shown as percentage of respondents within a class.

	SM		AWM	
Number of Horses/Livestock*	Owned	Managed	Owned	Managed
0	27	42	78	67
1	19	4	11	0
2 - 10	54	27	0	0
11 - 100	0	23	6	0
101 - 1000	0	4	0	22
>1000	0	0	6	11
Number of Acres**	**Owned**	**Rented**	**Owned**	**Rented**
0	46	77	44	39
< 80	38	19	17	11
80 - 160	12	4	11	22
360 - 640	0	0	22	17
> 640	4	0	6	11

* Responses to the open-ended question "How many horses do you own or help manage?" (SM) or "What type and how many livestock animals do you own or help manage?" (AWM)

** Responses to the open-ended question "How many acres do you own or rent?"

Table 4. Student performance (shown as % of students that selected the correct response) for content-based questions.

Topic	SM		AWM	
	Pre	Post	Pre	Post
Temperature and duration of exposure for pathogen destruction	8	89*	28	55**
Optimal moisture content of compost	73	100*	66	100**
Pounds of manure produced by horses daily	44	100*	NA	NA
Composting impacts	46	52	50	75
Health risks associated with manure	54	54	67	27**
Runoff prevention methods	73	88	72	64

*Represents a difference in scores in Pre- vs. Post- assessments for SM (P=0.01)

** Represents a difference in scores in Pre- vs. Post- assessments for AWM (P<0.05)

Table 3. Student response (shown as % of responses by category) to perception-based survey questions in two courses before and after compost activity.

Question	Time	SM						AWM					
		1	2	3	4	5	P-Value	1	2	3	4	5	P-Value
What level of importance do you place on manure management? (1 = Low, 5 = High)	pre	0.0	7.7	34.6	34.6	23.1	0.643	11.1	11.1	38.9	16.7	22.2	<0.001
How do you rate your current knowledge of composting? (1 = Minimal, 5 = Most Knowledgeable)	post	0.0	7.7	42.3	30.8	19.2	<0.001	0.0	0.0	4.5	27.3	68.2	<0.001
	pre	34.6	34.6	19.2	3.8	7.7		11.1	44.4	38.9	5.6	0.0	
How confident are you regarding your ability to manage a compost pile? (1 = Not, 5 = Very)	post	0.0	3.8	30.8	61.5	3.8	<0.001	0.0	0.0	22.7	63.6	13.6	<0.001
	pre	23.1	26.9	30.8	11.5	7.7		11.1	27.8	33.3	27.8	0.0	
What level of negative impact does manure from your horses have on the environment? (1 = None, 5 = High)	post	0.0	0.0	34.6	65.4	0.0	0.416	0.0	4.5	27.3	36.4	31.8	0.973
	pre	4.0	20.0	48.0	24.0	4.0		5.6	16.7	44.4	16.7	16.7	
Do you perceive manure management as a challenge or an opportunity? (1 = Challenge, 5 = Opportunity)	post	0.0	19.2	42.3	30.8	7.7	0.774	0.0	31.8	31.8	13.6	22.7	0.876
	pre	0.0	8.0	44.0	36.0	12.0		0.0	22.2	22.2	27.8	27.8	
What level of positive impact does manure management have on the environment? (1 = None, 5 = High)	post	0.0	11.5	46.2	26.9	15.4	0.109	0.0	9.1	31.8	36.4	22.7	0.430
	pre	0.0	4.0	24.0	52.0	20.0		0.0	0.0	11.1	44.4	44.4	
Do you consider yourself an active steward of the environment? (1 = Yes, 5 = No)	post	0.0	0.0	15.4	46.2	38.5	0.447	0.0	9.1	13.6	40.9	36.4	1.000
	pre	12.0	28.0	32.0	28.0	0.0		22.2	11.1	44.4	22.2	0.0	
	post	20.0	24.0	40.0	16.0	0.0		9.1	31.8	36.4	22.7	0.0	

Participant Background

Differences in classes were observed in terms of gender. Table 1 describes the gender distribution for the two cohort classes. The relatively high female and high male populations of SM and AWM, respectively, were reflective of the programs in general. In previous studies, gender was not found to be a significant indicator for introductory animal science course performance (Lyvers Peffer, 2011), introductory forage management lecture or laboratory performance (Mousel et al, 2006) or goal-setting among animal science students (Splan, 2013).

However, several additional differences between classes related to students' background experience in livestock, farm and manure management were elucidated from responses on the pre-activity survey. The majority of SM students had experience with horse ownership (100%) or management (73%), although the survey did not require students to discern between self-ownership, vs. family ownership. A minority of AWM students owned (22%) or managed (33%) livestock, but for those that did, the farms were typically of larger size and number of animals compared to SM. The majority of students in both SM and AWM did not own or rent land, however, of those who did, the AWM students had a background of managing a larger number of acres compared to SM students. Genders, prior experiences, in addition to overall course objectives, are all potential sources of variation between individuals and between classes.

Using the pre-activity survey instrument, participants were asked to describe their current manure management system in an open-ended question. More than one system or technique type was present in many responses. There was no verification of the actual practice(s) mentioned by each student; rather, this question was a preliminary gauge of participant experience in a manure treatment technique (i.e. composting) versus storage (i.e. stockpiling). The dominant practices indicated by SM participants were pasture (10 indications), and stockpile and haul (11 indications); one participant mentioned composting. For AWM, there were fewer instances of past experience noted, however experience included scrape and haul (3 indications) and liquid manure storage systems (4 indications). No other forms of manure treatment were indicated.

General Participation and Student Assessment

All students participated in the initial compost pile construction activities for both classes. Based on site records, all SM students participated in weekly monitoring, whereas three AWM students did not. During the activity period there were recommendations for management actions, yet only 16 SM and nine AWM participants made physical changes (i.e. mixing, adding water) to the compost piles. Student reasons for electing not to modify piles are described in Table 6. In SM, the students averaged 92% for the overall activity, considering their participation and demonstrations of knowledge and decision-making. In AWM, the average mark was 75% for this activity, in part related to an average assessment of 50% for documented management actions and accurate record-keeping.

Table 5. Student response (shown as % of responses by category) to activity feedback questions.

Question	SM					AWM				
	1	2	3	4	5	1	2	3	4	5
I enjoyed the manure management activity (1 = Disagree, 5 = Agree)	0.0	15.4	38.5	30.8	15.4	0.0	13.6	22.7	31.8	31.8
I learned useful information about manure management (1 = Disagree, 5 = Agree)	0.0	0.0	15.4	53.8	30.8	0.0	0.0	9.1	50.0	40.9
I learned more from this activity than if it had only been discussed in lecture (1 = Disagree, 5 = Agree)	0.0	7.7	15.4	34.6	42.3	0.0	4.5	22.7	18.2	54.5

Table 6. Summary and select examples of student responses to open-ended activity feedback questions.

Question	SM	AWM
Did you as a class, compost? Explain	Yes: 16; No: 1; Partially: 7 • Yes, we composted two piles of manure. We put water on them and rotated. • I would say no. The piles did reduce in size, but did not get to that pivotal 140°. The piles usually too dry also. • To an extent yes we did compost, though the full process takes a longer amount of time	Yes: 14; No: 1; Partially: 7 • Yes, we constructed the piles and kept track of them throughout the semester • No, our pile grew apparently • According to the graph = No; according to the pictures = Yes
Did you make management decisions with your group?	Yes: 25; No; 1 • Yes, we decided that one of the piles needed additional water and another needed to be turned • No, we thought the piles looked good after we inspected them	Yes: 15; No: 3; Partially: 4 • Yes, we decided to add water and completely turn the pile, hoping to get things going • No, we really didn't need to
Did you implement these decisions? Why/why not?	Yes: 15; No: 9; Partially: 2 • We watered the piles because they were dry. • No, weren't completely confident in our decision • We did not because we didn't know how far we could go with the managing and turning would have been okay but we did not want to disrupt the current composting	Yes: 12; No: 7; Partially: 3 • Yes to get our pile to compost • Time and temperature limited abilities
What did you learn overall from this project?	• I learned that it takes a lot of work. I thought that a person could just leave the pile and it would eventually turn to compost. • I learned theoretically how to manage a composting pile and I learned practically how to do it. I am really glad to know more about it and the risk linked with not managing manure.	• Management of the pile will yield better results than filling it up and leaving it • I learned how to compost by doing it hands on. I feel that you get a better learning experience by doing projects hands on • When properly managed, composting can be an effective tool for even the biggest of operations

While the site records, calculations and justifications were evidence of reflection during the course of the activity, the post-test survey was an opportunity for summative student reflection on composting, decision-making and implementation (Table 6). From the instructors' viewpoints, for both classes, further actions on the part of participants were warranted to effectively produce a quality compost material, recognizing time, weather, material and location restraints did exist. However, Table 6 reveals that the majority of students felt their actions (i.e. turning or mixing the piles) and decisions (i.e. determined the piles needed more water) were sufficient. Instructor-led discussion at the conclusion of the activity addressed the student perceptions and need for more actions.

Change in Perceptions

Table 3 summarizes the categorical responses pre- and post-activity by students on their perceptions of manure management. Within each class, student responses were comparable for all questions pre- and post-activity with one exception. While there was no difference in responses for SM, students in AWM placed more importance on manure management in their responses on the post-survey than in the pre-survey ($P<0.001$). This could be attributed to the different focus of the respective courses on manure management in general, as demonstrated by the course objectives. The relatively neutral responses for manure management as a challenge or opportunity and positive and negative manure management impacts may be reflective of the instructors' emphasis of positive and negative aspects of manure, as well as the students' prior background and experience in livestock and land management (Table 2).

Three pre-and post-activity survey questions addressed the students' perceptions of their own skills. There was a significant increase in both current knowledge and confidence in composting post activity ($P<0.001$; Table 3) for both classes. Yet, students did not report an increase in their self-perception as stewards of the environment. The interpretation of the neutral response for environmental stewardship over time is that initially students may not be fully aware of the environmental risks and benefits to manure management, but afterwards recognize more action is required to effect change. Thus, an improvement in factual knowledge during the activity may result in a more neutral response to environmental stewardship if they felt they had more room for improvement. Increased confidence in knowledge and abilities was supported by an increase in scores on the content knowledge portion of the survey.

Change in Knowledge

Student knowledge, determined by correct responses to multiple choice questions regarding the optimum temperature ($P<0.01$) and moisture content ($P<0.01$) of compost piles and the amount of manure produced by horses increased in students of SM ($P<0.001$; Table 4). The SM students, however, did not collectively improve in their ability to correctly identify composting impacts, or the ability to identify specific health risks associated with manure. These results differ slightly from that of content knowledge responses from the AWM class. The AWM students improved in their knowledge of the optimum temperature ($P<0.01$) and moisture ($P<0.01$) needed in a compost pile and being able to identify impacts of composting ($P<0.1$), but failed to retain information regarding health risks associated with manure, or how to limit runoff from a compost pile. It was considered a success that both classes demonstrated improvement in at least three areas of content knowledge. It is possible the improvement in response rate for the temperature and moisture content questions, in part, relates to the experience of monitoring and data collection activities undertaken by the students.

Activity Feedback

Table 5 demonstrates the distribution of agreements to the activity feedback questions. In both courses, over 70% of respondents replied with a 4 or 5 (indicating general agreement) when asked if they learned useful information, and whether or not they believed they learned more during this activity than if manure management only had been covered in lecture. The responses regarding their enjoyment of the activity were distributed between categories 2 through 5.

Ultimately, the intent of college instruction is to disseminate knowledge. The impact can be considerably more profound if it is achieved in a manner that also enables students to become confident in their knowledge and abilities. While we would have expected a stronger response on enjoyment, it does appear that students believe they learned useful information given this teaching strategy. Additional open-ended feedback is provided in Table 6. The student comments acknowledged that this form of manure management takes work, and that the perceptions of work involved changed over time. Feedback presented in Table 6 also acknowledges the students' perceptions of the importance of continual management, and the practical application of theory.

Composting provided a platform for experiential learning that related to both SM and AWM. The format and premise of this activity are suitable for other manure treatment technologies, or even different groups of learners. By monitoring the change over time of their actions or inactions, participants reflect on the impacts of their decisions. To enhance the opportunity for reflection, a critical element of experiential learning (Andreasen, 2004), a future potential change in activity delivery includes a shared document or other reporting process to facilitate sharing week-to-week results.

Summary

Two groups of agriculture students participated in an experiential learning-based activity involving manure composting. The groups differed in gender, and in the scope and scale of livestock and land management

experience. Also, the course material and learning objectives differed between (horse) Stable Management and Agricultural Waste Management. However, change over time in the participants' knowledge of compost processes and confidence in ability to manage compost was significant for both classes. In particular, participants' knowledge of the temperature and moisture factors that they, as managers, can monitor and evaluate increased. There was an increase in the perceived importance of manure management after completion of the activity for Agricultural Waste Management, but not for Stable Management, which was likely related to differences in overall course content. Instructors intend to place more emphasis on implementation of management decisions in the future. While access to water and climate provided challenges to the experience, they also provided an opportunity to understand real-life situations that can arise when managing a compost pile. Overall, students believed they learned more through this hands-on activity than solely through lectures.

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Gender Differences in Consumption and Perception of Local Produce among High School Students[1]

Kyle Colton Flynn[2]
University of Arkansas
Fort Smith, AR

Jennie Popp[3]
University of Arkansas
Fayetteville, AR

Sonja Hausmann[4]
Drexel University
Philadelphia, PA

Jeremy Whisenhunt[5]
Northwest Arkansas Community College
Bentonville, AR

Abstract

As farming practices have moved towards large-scale production methods, the average individual has become further removed from the practice of agriculture. As a result, many high school students gain the majority of their knowledge of farming in a classroom setting. This case study was conducted to better understand if gender plays a role in differing experiences, knowledge and perceptions of agricultural practices, local produce and produce consumption among high school students in Northwest Arkansas. Eleventh-grade students (n=50) from three school districts were asked to answer questions about their agricultural and local produce experiences, knowledge and perceptions. Young men were (p=.01) more likely to have taken an agriculture class in high school and were (p=.02) more likely to be able to identify the average farm-to-plate distance of produce. Furthermore, we found that female students were more likely to have positive perceptions of locally grown foods, whereas male students were (p=.04) more likely to believe that there are disadvantages to local foods. However, neither young men nor young women were meeting Center for Disease Control and Prevention (CDC) recommendations for fruit and vegetable consumption. Further study is warranted to explore the gender differences and the impact that education may have in the formation of knowledge, perceptions and healthy food choices among high school students.

Introduction

Studies have found that a relationship exists between gender and the intake of fruits and vegetables (Blanck et al., 2008; Emanuel et al., 2012; Serdula et al., 2004). The Center for Disease Control and Prevention (CDC) suggests that adolescents and children are failing to consume the recommended daily amounts of fruit and vegetables (Harris et al., 2012; Kim et al., 2011; Upton et al., 2012). Other studies have shown that consumption of produce increases with increased exposure to and availability of fruits and vegetables (Cullen et al., 2009; Evans et al., 2012). Related studies support that with opportunities for agricultural and local food education, students are more likely to make healthier eating decisions (Cullen et al., 2009; Desmond, 2004; Graham et al., 2005; Heneman et al., 2008).

The National Research Council (NRC, 1988) recommended that schools offer systematic instruction in agriculture to grades K-12 (Emanuel et al., 2012; NRC, 1988). Because most students participate in public school education, the classroom's educational environment is an effective means to transfer agriculture

[1]The University Institutional Review Board approved the study protocol. Study participants were under the age of 18 and in accordance with University regulations, guardians of participants provided written informed consent prior to participation in the study.

[2]Department of History, Geography, Political Science, Philosophy and Religious Studies, (479) 409-0725, kcflynn44@gmail.com

3Department of Agricultural Economics and Agribusiness, (479) 575-2279, jhpop@uark.edu

[4]Academy of Natural Sciences, (479) 684-7516, Sonja.Hausmann@drexel.edu

[5]Department of Life Sciences, (479) 466-5343, jwhisen@gmail.com

and nutrition knowledge to America's youth (Nolan, 2005). The establishment of food preferences and dietary habits are formed during childhood (Kirby et al., 1995) and by targeting the students at an early age, long-term healthier eating choices can be increased (Carter, 2002; Nolan, 2005). Similarly, studies suggest that integrating agricultural education in the classroom may influence students to make healthier food choices over time (Anupama et al., 2008; Graham et al., 2005).

When it comes to making food choices, studies have suggested that women when compared to men: 1) are more likely to consume fruits and vegetables (Emanuel et al., 2012; Blanck et al., 2008); 2) tend to have more positive attitudes towards local food purchasing (Gallons et al., 1997; Jekanowski et al., 2000; Kezis et al., 1998; Gracia et al., 2012); and 3) are more sensitive to the social dimensions of local products(Gracia et al., 2012). These results raise the question of gender differences among high school students with regard to the consumption, experiences, knowledge and perceptions of local produce and agriculture production.

The CDC (2010) daily consumption recommendations for active adolescent women (men) are 1.5 (2) servings of fruit and 2.5 (3) servings of vegetables. Produce intake by adolescents often falls short of these recommendations (Casagrande et al., 2007; CDC 2007; Emanuel et al., 2012; Guenther et al., 2006; Serdula et al., 2004). While no data were found for Arkansas adolescents' consumption of fruit and vegetables, the CDC (2010) reports that only 24.5% of Arkansas adults meet the fruit recommendation (compared to 32.5% nationally), but slightly exceed the national average in meeting vegetable consumption recommendations at 26.9% (compared to 26.3% nationally) (CDC, 2010). Furthermore, the gender gap between male and female fruit and vegetable consumption appears to be widening. In a study by Serdula et al. (2004), between 1994 and 2000 women increased their consumption of vegetables, while men exhibited no change in vegetable consumption.

Similar to the dietary practices of men and women, many studies have suggested gender differences with regard to social issues and the actions of selflessness (Andreaoni and Vesterlund, 2001); generosity (Cox and Deck, 2006); preferences (Croson and Gneezy, 2009); and the willingness to purchase local foods (Gracia et al., 2012). Furthermore, studies have suggested the willingness to pay for local food can have significant differences by gender (Gracia et al., 2012; Jekanowski et al., 2000; Kezis et al., 1998). Gracia et al., (2012) found that social influence factors play a role in the willingness to pay for locally produced lamb meat. In this study, women were found to be more willing to pay a premium for the locally grown product, but men did not show this same tendency. Jekanowski et al. (2000) surveyed 320 consumers and found that females had a greater tendency than males to purchase local products. This tendency was correlated with the amount of time females had lived within the state in which they were purchasing. Kezis et al. (1998) surveyed 239 shoppers at a small farmers' market in Maine and found that shoppers at farmers' markets are most likely (70%) to be women who are employed outside of the home.

Behaviors exhibited and attitudes held by men and women are shaped by their knowledge and experiences. Today, with the urbanization of the US and the loss of 95% of US farmers since 1900 (Ikerd, 2008), students have fewer opportunities to directly experience agricultural processes (Bagdonis, 2009; Berlin, 2002; Terry and Lawyer, 1995; Williams, 2000). One way to gain that knowledge is to include experiences such as gardening, farmers' visits, farm-to-school programs and agriculture courses in educational settings. Through a combination of agricultural and nutritional lessons, studies have shown that an increase in students' preferences of more vegetables becomes apparent (Morris et al., 2002; Nolan, 2005); positively affecting the amount of fruit and vegetable intake of students (Evans et al., 2012; CDC, 2011).

Research on gender differences is frequently conducted in a case study context (Gallons et al., 1997; Kezis et al., 1998). Case studies may be used to emphasize contextual analysis and to strengthen an area of knowledge that is already known (Soy, 1997). Therefore, in order to strengthen this area of knowledge, the research presented is offered in the form of a case study.

Purpose and Objectives

The purpose of this case study was to develop information regarding the relationship among Northwest Arkansas eleventh-grade students and their experiences, knowledge and perceptions of local produce and agriculture. The specific objectives of this case study were to determine for the study group whether:

- Fruit and vegetable intake differs significantly by gender.
- Experiences with agriculture production and local foods differ significantly by gender.
- Knowledge of agriculture production and local foods differ significantly by gender.
- Perceptions of agriculture production and local foods differ significantly by gender.

Materials and Methods

This study targeted eleventh-grade students from three school districts in two counties in Northwest Arkansas. Eleventh-grade students were chosen for three reasons. First, as only 18.9% of Arkansans receive a degree beyond a high school diploma (U.S. Census Bureau, 2012), high school may be the student participants' final chance to learn about local produce and agriculture in an educational setting. Second, eleventh-grade students are close to the age of moving out and making their own food choices, if they have not already. Third, at the time of the study, all students in Arkansas were required to enroll in 11th grade English, thus

improving the opportunity for the research to focus on a specific age group. Three school districts were chosen in order to capture the diversity in student populations in rural and urban communities.

A case study was conducted via a student survey. Following well established survey methodology (Dillman, 2000; Dillman et al., 2009; Rea and Parker, 1992; James and Bolstein, 1992), a questionnaire was constructed to examine students' consumption, experience, knowledge and perception of local food and agriculture production. The survey instrument consisted of 26 questions in five sections. The drafted instrument was pre-tested on a group of 80 college undergraduates and revised based on student comments. The revised version was approved by the University of Arkansas Institutional Review Board. Parents of participants under age 18 provided written informed consent prior to participation in the study.

Data from the participants' completed surveys were entered into an Excel database. The final data set was comprised of 74 different variables representing information collected from each question. The data were analyzed using the following methods. First, summary statistics were generated for each of the 74 variables. Next, additional statistical approaches were employed that included Chi-square tests (SAS Institute Inc., 2013) and Fisher exact tests (SAS Institute Inc., 2013). Significant differences were evaluated at the p=.05 level.

The following null hypotheses were developed regarding the relationships between gender and local foods:

- Ho1: There is no significant difference in the amount of vegetable and fruit intake between male and female 11th grade students.
- Ho2: There is no significant difference among male and female 11th grade students in experiences with local foods and agriculture production.
- Ho3: There is no significant difference among male and female 11th grade students in knowledge of local foods and agriculture production.
- Ho4: There is no significant difference among male and female 11th grade students in perceptions of local produce and agriculture production.

Results and Discussion

Respondent Characteristics

The fifty students who participated in the case study were enrolled in the 11th grade English classes of Bentonville (6 students), Farmington (16 students) and Lincoln (28 students) High Schools. Study participants were ages 16-17 with 20 young men and 30 young women.

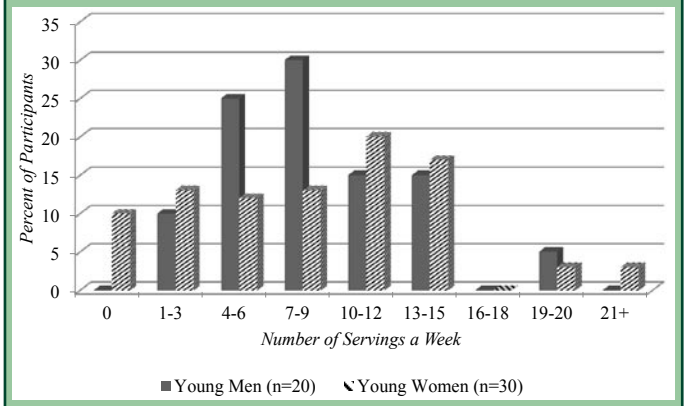
Fruit and Vegetable Intake

Most participants said they liked fruits (96%) and vegetables (94%) and 80% (64%) of them ate at least three servings of vegetables (fruits) each week. Among the students, corn [*Zea mays*] (17%) and strawberries [*Fragaria ananassa*] (26%) were the most preferred vegetable and fruit. Other vegetables and fruit that were preferred by students included carrots [*Daucus carota*] (15%), broccoli [*Brassica oleracea*] (11%), apples [*Malus domestica*] (15%) and grapes [*Vitis*] (9%). No significant differences in the consumption of fruit (p= .48) and vegetables (p= .14) between the young men and women. This result was unexpected given other studies (Blanck et al., 2008; and Serdula et al., 2004) found that approximately 9-10% more adult women were consuming five servings of vegetables and fruit on a daily basis, compared to adult men. The difference in results might be explained by changing perceptions and values as these case study students mature to adult age. However, public school classrooms are still an excellent forum to offer this education since the vast majority of American children attend public schools (Nolan, 2005).

Additional analyses showed that fruit and vegetable consumption rates of these young men and women fell well short of the CDC's recommended weekly intake. As mentioned earlier, the CDC (2010) daily consumption recommendations for active adolescent women (men) are 1.5 (2) servings of fruit and 2.5 (3) servings of vegetables or 10 (14) servings of fruit and 17.5 (21) servings of vegetables in a week. Participants were asked how many times per week they ate fruits at each meal and, separately, how often they ate vegetables at each meal. Each reported instance of fruit or vegetable consumption was counted as a serving and these numbers were compared to the recommended number of servings for fruits and vegetables according to CDC guidelines. Only 10% of men and 14% of women ate the recommended amount of servings of vegetables each week, while none of the men and only 7% of women ate the recommended amount of fruit servings each week (see Figures 1 and 2). Vegetable consumption per week peaks at 7-9 for young men and 10-12 for young women. This represents on average less than two servings a day. There was no significant difference (p=.98) between young men and women in weekly consumption of vegetables.

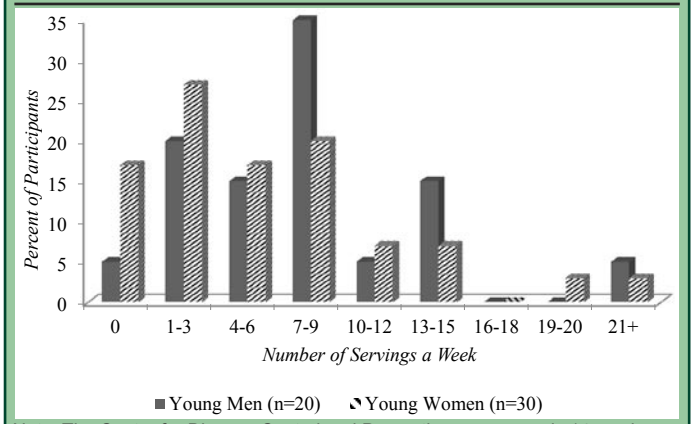
For fruit, young men's consumption again peaked in the 7-9 serving range. However, surprisingly among young women, consumption peaked only in the 1-3 range. This is surprising because young women met the CDC's fruit consumption requirements more often than male students and according to research (Serdula et al., 2004) women tend to consume more fruit then men. Statistical analyses again found no significant difference (p=.37) in the consumption of fruit. Research suggests that consumption rates could be improved by targeting students with agricultural education at an early age possibly leading to long-term healthier eating choices since these habits and preferences are developed early in life (Anupama et al., 2008; Carter, 2002; Graham et al., 2005; Kirby et al., 1995).

Figure 1. Weekly Vegetable Consumption Among Participants by Gender



Note: The Center for Disease Control and Prevention recommends 21 servings of vegetables per week for men and 17.5 for women. The results of the study were obtained in 2011 in the region of Northwest Arkansas.

Figure 2. Weekly Fruit Consumption Among Participants by Gender



Note: The Center for Disease Control and Prevention recommends 14 servings of fruit per week for men and 10 for women. The results of the study were obtained in 2011 in the region of Northwest Arkansas.

Local Foods and Agricultural Production Experiences

Survey participants were asked about a variety of experiences they may have had involving local produce and/or agricultural production. Questions gauged whether students had 1) lived on a farm, 2) grown a garden, 3) been to a farmers' market, 4) taken and agricultural course in junior high and 5) taken an agricultural course in high school (Table 1). While only a few students stated that they had lived on a farm (10% young men; 20% young women) a much larger portion of the survey participants had grown a garden (70% young men; 67% young women). The majority of young men (85%) and young women (80%) had been to a farmers' market. Only a small percentage of young adults (25% young men; 13% young women) had taken an agricultural class in junior high, but by high school, more of the students (75% young men; 40% young women) had done so.

Chi-square analysis was used to test for significant differences in the experiences among young men and women (Table 1). Significant gender differences (p=.01) existed for only one experience variable which was taking an agricultural class at the high school level.

Local Foods and Agricultural Production Knowledge

Survey participants were asked several questions that were intended to gauge their knowledge of agricultural production. Questions included whether they knew 1) the crop for which Arkansas has consistently ranked number one in production, 2) the average distance that produce travels from farm to table, 3) the name of the Arkansas state program (Arkansas Grown) that promotes the sale of meat and produce grown within the state and 4) the ability to identify produce readily grown in the state of Arkansas (Table 2). More than half of both young men (70%) and young women (53%) knew that Arkansas ranked first in the production of rice [*Oryza sativa*] in the nation. In 2012 Arkansas produced 48% of all the rice grown in the United States, harvesting 1,300,000 acres (530,000 hectares) of rice (NASS, 2013). Alternatively, less than a third of total students (young men 45%; young women 30%) knew how far produce travels, on average, from farm to plate (1500-2500 miles) (Pirog et al., 2001). No respondents knew the name of state program that promotes the sale of meats and produce grown in Arkansas (Arkansas Grown). Lastly, student participants were able to identify six different types of produce at least 60% of the time, as shown in Table 2. It is important to mention that corn and strawberries were correctly identified 100% of the time which was not surprising given student fruit and vegetable preferences. Furthermore, the produce that was incorrectly identified could be linked to the students' lack of awareness

Table 1. Affirmative Answer to Questions About Agriculturally Related Experiences by Gender

Experience	Young Men (%) (n=20)	Young Women (%) (n=30)	p[a]
Lived on a farm	10	20	.21
Grew a garden	70	67	.24
Been to a farmer's market	85	80	.27
Took an agricultural class in junior high	25	13	.17
Took an agricultural class in high school*	75	40	.01*

*p<.05, [a]Fisher's Exact Test

Note: The results of the study were obtained in 2011 in the region of Northwest Arkansas.

Table 2. Percentage of Correct Answers to Questions Relating to Agricultural Knowledge by Gender

Knowledge	Young Men (%) (n=20)	Young Women (%) (n=30)	p[b]
The crop that Arkansas grows more of than any other state	70	53	.15
How far produce travels from farm to plate*	45	30	.02*
State program that promotes the sale of meats and produce grown in Arkansas	0	0	N/A
Identification of fruits and vegetables:			
Blueberries [*Vaccinium corymbosum*]	90	100	.16
Cucumber [*Cucumis sativus*]	80	90	.20
Blackberries [*Rubus fruticosus*]	65	67	.24
Sweet Potatoes [*Ipomoea batatas*]	60	67	.21
Corn [*Zea mays*]	100	100	N/A
Strawberries [*Fragaria ananassa*]	100	100	N/A

*p<.05, [b]Fisher's Exact Test

Note: The results of the study were obtained in 2011 in the region of Northwest Arkansas.

of what these fruits and vegetables look like in raw form, when compared to their prepared form.

Chi-square tests revealed no significant differences between young men and young women for the knowledge questions with the exception of the average distance that produce travels from farm to plate (p=.02).

Perceptions of Local Agriculture

In order to capture the perceptions of local agriculture, questions were used to gauge students' belief of whether there are 1) benefits to buying local produce and 2) disadvantages to buying local produce. The percentage of young men (95%) and young women (93%) that believed that there are benefits to local foods was high. The local foods benefits that the young men most frequently suggested included 1) benefits the local economy and farmers (37%), 2) freshness (32%) and 3) knowing where the food was grown (26%). Among young women the most frequently suggested benefits included 1) less travel (18%), 2) knowing where the food was grown (14%) and 3) benefits the local economy and farmers (11%). The percentage of young men (55%) and young women (27%) that believed that there are disadvantages to local foods varied. Among those young men that suggested that there were disadvantages the most frequent reasons were 1) poor quality and lack of freshness (45%), 2) lack of knowledge of growing process (27%) and 3) lack of availability (18%). Young women suggested the following disadvantages most frequently: 1) poor quality and lack of freshness (38%), 2) more expensive (25%) and lack of availability (25%).

Chi-square tests were used to compare the perceptions of the young men and women. The results as well as the p-values can be found in Table 3. A significantly higher (p= .04) percentage of men surveyed (55%) were apt to believe that local foods had disadvantages, such as in areas of cost and year-round availability when compared to their young women counterparts (27%). Multiple studies have found concurring results, with women generally having a more positive attitude towards the purchasing of local foods (Gallons et al., 1997; Gracia et al., 2012; Jekanowski et al., 2000; Kezis et al., 1998). These studies show that women are also more likely to be willing to pay a premium for locally produced food. Other studies suggest that this may be due to a greater sensitivity to social issues, selflessness and generosity on the part of women, relative to men (Andreaoni and Vesterlund, 2001; Cox and Deck, 2006).

Table 3. Percentage of Male and Female Students Affirming the Benefits and Disadvantages of Local Produce

Perceptions	Young Men (%) (n=20)	Young Women (%) (n=30)	p[c]
Benefits of local foods	95	93	.44
Disadvantages of local foods*	55	27	.04*

*p<.05, [c]Fisher's Exact Test

Note: The results of the study were obtained in 2011 in the region of Northwest Arkansas

Summary

The purpose of this case study was to examine consumption, experiences, knowledge and perceptions of young adults with agricultural production, local foods and fruit and vegetable intake. Four hypotheses were tested to determine whether significant differences existed between these young men and women in 1) weekly intake of fruits and vegetables, 2) experience with local foods and agricultural production, 3) knowledge of local foods and agricultural production and 4) perceptions of local produce and agricultural production.

Study results showed that most students are not meeting the daily fruit and/or vegetable consumption recommended by the CDC. However, no significant difference was found in fruit and vegetable consumption between the men and women, thus we fail to reject the first null hypothesis. Our second hypotheses stated that no significant differences in experiences existed between these men and women with respect to having: 1) lived on a farm, 2) grown a garden, 3) been to a farmer's market, 4) taken an agricultural course in junior high and 5) taken an agricultural course in high school. We fail to reject that hypothesis for four of the five types of experience. Significant differences were only found for having taken an agricultural course at the high school level. No significant differences existed in knowledge between men and women related to 1) Arkansas' number one crop, 2) the Arkansas Grown program and 3) the ability to identify produce readily grown in the state of Arkansas. We reject only the null hypothesis that no difference existed between men and women's knowledge of food miles. Our final hypothesis focused on men and women's perceptions of advantages and disadvantages of local produce. While no significant differences existed in what they felt were advantages to local produce, a significantly higher percentage of young men listed disadvantages to local produce when compared to young women. So again, we could only reject part of the hypothesis.

Our case study provides some insights on the experiences, knowledge and perceptions of agriculture, local foods and produce consumption of eleventh grade students in Northwest Arkansas. Our results not only show that few differences existed between the young men and women studied but that many of these students lack experiences and knowledge of agriculture, in which the literature (e.g., Morris et al., 2002; Nolan, 2005) suggests can influence healthy food choices. While further study of larger groups of students is needed, our case study provides some justification for increased agricultural educational opportunities in the classroom if society's goal is to encourage healthy food choices for young men and women.

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Discovering Global Competencies of Agriculture Education Students through Reflective Journaling[1]

L. Sankey Rice[2], D. Foster[3] and M. Miller-Foster[4]
The Pennsylvania State University
University Park, PA

K. Barrick[5]
University of Florida
Gainesville, FL

Abstract

Researchers purport an efficient method to influence student thinking on globalization is to influence their teachers' thinking. Teachers with a global mindset can impact students to think beyond their own community, state and country. A course was offered to Agriculture and Extension Education majors to develop the knowledge, skills and dispositions of global competency. Nineteen students from two land-grant universities traveled to South Korea for 10 days and engaged with Korean school-based agricultural education, Korean professional teacher organizations and Korean student youth organizations as well as cultural experiences. Students were challenged to keep a reflective journal with provided prompts that were analyzed for emergent themes in global competency knowledge, skills and dispositions. Findings from the journal prompt show that context matters to help students grow personally, professionally and globally. Research implications suggest short-term study abroad embedded courses may not have enough impact to develop enduring globally competent skills of participating teacher candidates.

Introduction

According to a recent Longview Foundation report, most teachers in the U.S. begin their teaching careers with little more than superficial knowledge of the world (Longview Foundation, 2008). Although higher education in the United States has focused significant attention to internationalization of curricula, teacher training programs are often among the least internationalized programs on American college and university campuses (Longview Foundation, 2008). Despite the capacity of teacher training programs to provide unique educational opportunities and global experiences, Reimers (2009) asserts underperformance in preparing students to develop skills that address global challenges and opportunities exists.

A longstanding call from teacher education accreditation associations to infuse global perspectives into teacher education programs remains absent from major reviews of research on teacher education (Cochran-Smith et al., 2008; Cochran-Smith and Zeichner, 2005). Research has identified that good educators appreciate that the world is increasingly interconnected and students require global skills, including knowledge of world geography, complex cultural literacy and world language skills, to understand these interdependencies (Green and Olson, 2008; Johnston and Spalding, 1997; Mansilla and Jackson, 2011). Most educators understand that developing global competency is important and, at the same time, know that this development is not happening in many—probably most—schools (Hicks, 2007; Reimers, 2009). Educators recognize the importance of the growing emphasis on preparing global-minded teachers capable of working with diverse student groups; however, there remains little action towards equipping educators with the know-how to graduate globally competent teachers.

Valuable experiences exist for pre-service teachers who participate in study abroad programs. Che et al., (2009) purport study abroad programs for pre-service teachers help develop international/intercultural knowledge, skills and dispositions to work in diverse learning environments and to encourage critical reflection in teaching practice to enable creation of a more unified and unbiased society. In order for pre-service teachers to obtain the knowledge, skills and attitudes of global competency, active engagement is required in field-based

[1]The Pennsylvania State University Institutional Review Board approved the study protocol and all participants provided written informed consent prior to participation in the study.

[2]PhD Candidate in Department of Agricultural Economics, Sociology and Education; 12 Ferguson Building, University Park, PA 16802; sankey@psu.edu; 814-553-0324

[3]Assistant Professor, Agriculture Education in Department of Agricultural Economics, Sociology and Education; 211 Ferguson Building, University Park, PA 16802;foster@psu.edu; 814-863-0192

[4]Coordinator for Programs in Latin America; 106 Agricultural Administration Building, University Park, PA 16802; mjm727@psu.edu; 814-867-3831

[5]Professor, Department of Agriculture Education and Communication, 219 Rolfs Hall, PO Box 110540, Gainesville, FL 32611; kbarrick@ufl.edu; 352-273-2587

experiences which leads to deeper understandings than classroom learning alone (Villegas and Lucas, 2002); active engagement with others of different cultures leads to an expanded worldview and makes one a more flexible and compassionate teacher (Willard-Holt, 2001); self-reflection is an important part of professional development (Lee, 2005; Robertson and Webber, 2000). Villegas and Lucas (2002) explained field experiences *"offer prospective teachers their only opportunity to build a contextualized understanding of culturally responsive teaching by getting them out of the university classroom and into schools and communities"* (p. 137).

Theoretical Foundation

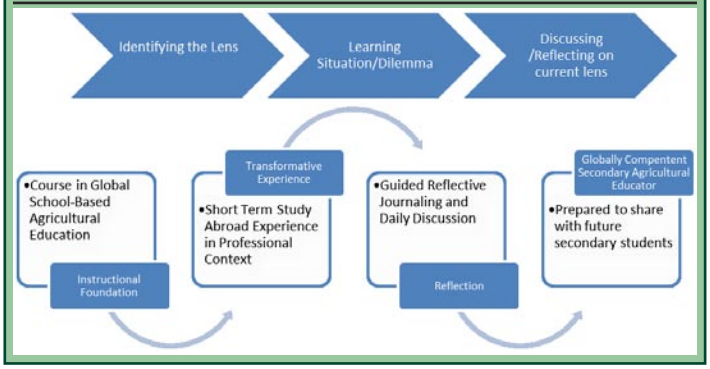
Mezirow's theory of transformative learning (2000) provided the theoretical framework for this research study. Transformative learning is the process of critically reflecting upon previous assumptions or understanding in order to determine whether one still holds them to be true or challenges their claims (Mezirow and Associates, 2000). King (2009) contends that Mezirow's transformative learning theory provides an explanation of the adult learners' experiences of fundamental change in their perspective or frame of reference as they engage in educational or academic work. Learning is seen as an experience of critical questioning of beliefs and assumptions as the adult learner examines the framework from which he/she has been viewing the world. Key to the process of transformative learning is to recognize narrow frames-of-reference through a disorientating experience thus problematizing current attitudes, values and beliefs (Mezirow, 1981).

Reflective journaling plays a major role in the transformative learning process (Grabov, 1997). Transformative learning allows students to change their orientation by critically reflecting on their beliefs and consciously making and implementing strategies that bring about improved ways of redefining their beliefs. Reflective journaling is a useful tool in facilitating the critical reflection underpinning transformative learning.

Conceptual Framework

As depicted in Figure 1, the transformative learning process in adult education involves a sequence of events. There should be an instructional foundation that assists the learner in identifying their lens or perspective on the situation. This is followed by the transformative learning life experience that includes guided reflection and discussion to challenge their current lens and gain understanding on the possible changes to that perspective (Mezirow, 2000).

Figure 1. Conceptual Framework of Study grounded in Mezirow's (2000) transformative learning theory.



Purpose and Objectives

A transformative learning experience was provided to nineteen agriculture education pre-service teacher candidates through a short embedded course with an international experience component that consisted of traveling to South Korea to explore school-based agriculture education. The purpose of the qualitative study was to identify if teacher candidates expressed global competencies developed within the context of agricultural education in a foreign nation that has school-based agricultural education and university agricultural teacher preparation programs. The qualitative case study would offer an in depth analysis of the knowledge, attitudes and skills towards global competency acquired by pre-service agriculture educators. In this study, the researchers examined the specific transformative effect of an embedded course and international experience on the knowledge, skills and attitudes of students through reflective journaling.

Materials and Methods

To investigate the research questions, this research study utilized a case study qualitative approach. Enrollment in the Global School-Based Agricultural Education: Explorations of Korea class was the single bounded case. Data was collected through reflective journal responses and analyzed through a content analysis.

Site and Participant Selection

Seoul, South Korea was selected as the focus of the course because the post-secondary preparation process of their secondary agricultural educators mirrors that of the American post-secondary education system in agriculture education pre-service preparation. It was also selected because of having already existing connections within South Korea to make entrance a more fluid process. Trust had already been established between the principle researchers and the faculty members of the agriculture education preparation program.

Students were required to complete and submit an application to enroll in the course. Upon submission of the application, each student was interviewed. The interview was to present course rigor, expectations, time commitment and financial responsibility. Students were then selected on the basis of the application and interview process as well as grade point average. All students had to hold a 3.0 GPA on a scale of 4.0. Using this process, the nineteen were selected.

Data Collection

The population for the study was nineteen college students from two land grant institutions. The students from both universities were enrolled in the Global

School-Based Agricultural Education: Explorations of Korea class. The class was co-taught by the two faculty members, one from each participating institution. The class convened one night a week for two hours. The two institutions interacted with one another during the class session via Skype© and Adobe Connect© technology. Upon completion of the class, students traveled to Seoul, South Korea for 10 days and engaged in interactions with Korean school-based agricultural education, Korean professional teacher organizations and Korean student youth organizations as well as experienced a variety of cultural experiences. The class met throughout the spring semester to introduce students to Korea and guide them in acquiring the characteristics of a global-minded agricultural education teacher. The students kept a journal throughout the on-campus instruction and abroad journey. The students journaled in response to prompts provided by the researchers. The journal entries were analyzed for emergent themes, to identify if students graduating from the two land grant institutions were developing the necessary skills to graduate globally competent. There was a total of 20 journal prompts provided to students to complete and all nineteen students responded to each journal prompt (Tables 1 and Table 2).

Data Analysis

The main form of data analysis was content analysis. Content analysis is a technique that enables researchers to study human behavior in an indirect way, through an analysis of their communications (Fraenkel and Wallen, 2009). Content analysis as a research method is a systematic and objective means of describing and quantifying phenomena and is known as a method of analyzing documents (Downe-Wamboldt 1992; Krippendorff 1980; Sandelowski 1995).

A conventional qualitative content analysis approach was used while moving backwards and forwards, a constant comparative strategy, between the journal responses. Researchers identified the presence of words and concepts that represent emergent themes within the reflective journal responses. Uncovering the regularities or patterns among categories is a process called thematic analysis (Shank, 2006). The uncovered patterns often create a network of themes. It is in this network showing the meaningful relations among constructs (presumed qualities, traits, abilities, etc.) that the theory emerges.

Table 1. Journal prompts provided during class sessions prior to travel.

Class Session	Journal Prompt
1	What made you choose to study abroad? What people influenced you in making the decision? How?
2	What do you hope to gain from this short term study abroad experience (including the class and the trip to South Korea? How are you expecting to grow personally from this experience?
3	What are some personal qualities or values you hope might change as a result of this experience? How do you see those qualities and values contributing to your development as an agricultural educator?
4	What would a "successful" study abroad experience to South Korea look like? What would an "unsuccessful" study abroad experience to South Korea look like? What will measure your success? How will you measure your success?
5	Traveling abroad to South Korea means that you will get to know new people, speak a new language, be far away from family and friends and so on. How do you think factors like these will affect you? How do you see yourself coping with these circumstances?
6	What are your expectations and what are your pre-conceived notions about South Korea's academic program? What do you hope to learn, and how do you envision the instructors and learning environments?
7	In what ways do you think you will be different than other pre-service teachers who did not have an overseas experience? What aspects of your international experience do you think other teacher education students could learn from?
8	How will you utilize the experience to strengthen your teaching and educational advancement?
9	What challenges do you anticipate while embarking on your international immersion experience in South Korea?
10	How do you see your time in South Korea impacting the lives of those you interact with while in South Korea?

Ethical Concerns and IRB Compliance

Students participating in the embedded course and study abroad trip were approached to obtain an

Table 2. Journal prompts provided during travels abroad.

Day of Travel	Journal Prompt
1	Describe the scene that greeted you upon arrival in the airport and recount the behavior you observed. What bewildered, delighted, interested, amused, or frightened you? Why?
2	Describe how your expectations and pre-conceived notions of South Korea are being met or not. How have your first impressions of the country and its people changed since your arrival?
3	What aspects of the country or culture of South Korea do you understand better? For example, did your experience increase your understanding of the South Korea's people, values, culture, economy, politics, society and/or environment? If yes, how? If no, why not?
4	Describe a situation(s) where you were required to develop tolerance, flexibility, and a positive attitude in order to adapt to the situation. What did you learn from the experience? Examples of situations may include changes in housing, diet, conversational style with others, customary practices, transportation, etc.
5	Describe a situation(s) where you believe your values were questioned. How did you handle the situation? Were you able to discuss differences while accepting the position of others? Examples may include criticisms about U.S. individualism and materialism, questions on U.S. political issues, complaints about U.S. habits and norms, stereotypes about U.S. behavior, etc.
6	Explain a scenario in which you were required to demonstrate resourcefulness, creativity or problem solving skills, or people skills. What life-long lessons, if any, did you learn? Examples may include getting lost, solving a particular problem, communicating in a foreign language, etc.
7	Systems of education and forms of teaching vary from country to country. What have you discovered about the system of education in South Korea compared to the system of education you experience in the U.S.? Are your pre-conceived notions hindering your progress or aiding you in navigating new academic rules?
8	Have your relationships with individuals or your understanding of the culture become more complicated as your stay lengthens? How long do you think it takes to begin to understand and be part of the complexities of your host culture?
9	It is not unusual for students to claim that studying abroad changed their lives. Do you believe your life is different because of studying abroad? How? Do you want to continue traveling internationally? Work in another country? Write any comments below that you want to share that have not been addressed in the questions above.
10	What was your favorite experience when you were abroad? Which experience had the most impact on you personally? What was the biggest difference in culture that you experienced while abroad? What surprised you the most about your time abroad? What did you appreciate the most from your abroad experience?

implied consent in an informational email. Students had the opportunity to read the study information and offer their consent. Forms were collected the first day of class. This study presented minimal risk to participants. Loss of confidentiality was the main risk associated with participation in this research. However, loss of confidentiality in this study was minimized by assigning participants a PIN so that their name or other identifying details were not associated with their data.

Verification and Validity Concerns

In content analysis the researcher should try to have some sort of validation study built into the design. In qualitative research, validation takes the form of triangulation. Triangulation lends credibility to the findings by incorporating multiple sources of data, methods, investigators, or theories (Erlandson et al., 1993). In this study, a pretest/posttest survey was administered to the students at the beginning of the class, at the end of the class sessions and then again upon arrival back into the United States at the end of the study abroad trip. This survey was used to determine the students' perceptions regarding global competency and citizenship. Direct observation was another form of data collection to triangulate the findings.

A foreseeable limitation in the methods of conducting the content analysis of the reflective journal entries was to enhance the utility of the analysis. Two fatal flaws that destroy the utility of a content analysis are faulty definitions of categories and non-mutually exclusive and exhaustive categories.

Results and Discussion

The research objective of this qualitative study was to identify the global competence growth found in the journal responses of students participating in a three-credit academic course of ten weekly sessions and an embedded ten day travel experience to Seoul, South Korea through content analysis. A significant finding from the qualitative study was the knowledge, skills and dispositions that evidenced global competence growth were found exclusively in the journal responses captured by the students during the actual trip to South Korea. The results were discovered through in-depth analysis for rich description expressing the students' transformed knowledge, skills and attitudes. The findings feature the voice of the students by using the words *they* chose in their writing and by citing sentences and paragraphs.

For development in knowledge, students' expressed increased awareness of South Korea agriculture, culture and the impact of historical events on a country. Students felt being in South Korea reinforced and brought more meaning to the factual information covered prior to the trip in the classroom. Students found being exposed to the South Korean culture and interacting with Korean students allowed them to develop language skills and identify social and cultural factors.

"Prior to this experience, I had a very provincial perception of Agricultural education. Travelling to Suwan and Yeoju agricultural schools, we have witnessed an entirely different scope of agricultural education. The magnitude of greenhouses, acres of land in production and student competencies is mind blowing."

Under the global competency construct of skills, students indicated that because of the opportunity to be immersed into the South Korean culture, they were able to gain very specific abilities. Students realized the immediate need to apply their skills to understand and interact with the Seoul students. Students expressed the need to be active listeners, cope with language barriers and develop effective presentation methods.

"The biggest skill I'm learning is how to communicate with individuals who have English as a second language or no English at all. I knew some key methods, but I got to see what worked and really didn't work."

The short term embedded course study abroad experience allowed students to develop global attitudes. Students expressed their newfound appreciation for different cultures, ongoing willingness to accept new perspectives and self-improvement. Going to a country that promotes school-based agriculture education and follows a similar post-secondary teacher preparation program regime, allowed students to become more aware and gain acceptance of cultural differences and cultural ambiguity.

"Being a global citizen, to me, means I have an open mind to all cultures and immerse myself to their customs. To use their ideas and skills in situation where they are needed."

"I am more prepared to inform and prioritize global issues with my future students."

Conclusions and Implications

The findings identified by the researchers suggest there was an increase in global competencies, however, it is unclear at this time if the students developed to a point of a paradigm shift and their thinking modified as a result of the new experiences. To label a student globally competent, the students must engage not only themselves, but others as well in the experience, reflect on what is happening to them and strive to integrate these new perspectives into their frame of reference. It is not until this occurs are they transforming into a globally competent graduate. Future research could follow the participating students as they become secondary agricultural science teachers to identify if and how they bring global issues into their classroom instruction.

Summary

Transforming curriculum to meet the demands of our global economy to produce globally competent teachers requires a commitment to internationalization at the department, college and/or institutional levels of higher education. The responsibility for expanding the international dimensions of agriculture teacher education preparation rests almost solely on faculty shoulders. Faculty must be internationally experienced

and teaching courses with international content. Studies show that teacher educators recognize that their own participation in study abroad programs translates into professional development opportunities for globalizing teacher education curricula and becoming more global minded (Garii, 2009).

Future research should be conducted to investigate how pre-service agriculture education students who have participated in international study programs have experienced a paradigm shift. Future research could identify how that shift fostered and formed their educational philosophy and classroom instruction.

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Agricultural Experiences and Factors of Undergraduates Who Enroll in a College of Agriculture

Benjamin G.Swan[1] and Ann M. De Lay[1]
California Polytechnic State University
San Luis Obispo, CA

Abstract

Industry partners and College of Agriculture, Food and Environmental Sciences (CAFES) faculty have observed students entering the college possessed fewer agriculture experiences and skills than their predecessors. They have also lamented the increasing pressure to develop industry-ready students, when the gaps are ever wider between their experience and skills entering college and what are required upon graduation. During the 2011 spring quarter, all CAFES students (*N* = 3,366) were sent an electronic survey that resulted in 911 responses (27% response rate). Three quarters of the students were female and one third were seniors. Prior to enrolling at the university, 34% had the opportunity to enroll in secondary agriculture courses but only 25% actually did enroll. Of those who enrolled in secondary agriculture courses, 15% enrolled all four years of high school. Only 28% were raised in a rural setting, with 12% on a farm and 12% on a ranch. When asked to identify what or who influenced their decisions to enroll in a CAFES major, the leading factor was parent(s), followed by a campus visit. Despite CAFES' large enrollment, former FFA and 4-H members are a minority, even with the work these organizations do to prime students for careers in agriculture. Recommendations to increase enrollment of students with agricultural experiences and skills include: encouraging students to attend campus events early in their secondary careers to capture interest and foster relationships, charging university faculty to attend local meetings and visit programs on their travels and crediting experiences and skills gained through organizations such as FFA and 4-H on admission metrics to ensure students entering CAFES have valuable experiences and skills to build upon.

Introduction

California agriculture is a billion-dollar industry relying heavily on colleges of agriculture to produce industry-ready graduates. Problem solvers and critical thinkers with agriculture-specific skills are required to solve tomorrow's problems (Goecker et al., 1999), while producing food and fiber as efficiently as possible. Academic leaders must look ahead to determine if colleges of agriculture are poised to help industry fill these positions.

There were 1,789,772 students enrolled in 1,304 California high schools during the 2011-2012 academic year (California Department of Education, 2012), with over 300 of these high schools offering agricultural education programs and serving over 70,000 students. Despite providing opportunities for secondary students to learn about and develop skills in agriculture, there are many high schools without agriculture programs, leaving nearly 1,000 high schools and 1.7 million students with no access to formal agriculture instruction during their high school experience. Many of the state's 59 counties have a 4-H program offered through their county extension offices, providing non-formal opportunities for students to develop their interest and skills in agriculture. Even with 4-H having a larger reach than high school agriculture programs, it should be noted not all 4-H programs offer agriculture topics and the curriculum and quality of agriculture programming can be uneven among clubs.

In 2011, California Polytechnic State University, San Luis Obispo's (Cal Poly) College of Agriculture, Food and Environmental Science's (CAFES) had an enrollment of 3,366. Both agriculture industry partners and CAFES faculty have observed the students entering CAFES possessed fewer agriculture experiences and skills than their predecessors. They have also lamented the increasing pressure to develop industry-ready students when the gaps are ever wider between their experiences and skills entering college and what are required upon graduation. This situation has faculty and industry wondering if experience and skill level prior to entering CAFES should have greater value on admissions applications.

The bulk of the current admittance system for Cal Poly specifically considers secondary school cumulative GPA, coupled with scores on SAT and/or ACT. The factors of work experience and leadership experience

[1]Agricultural Education and Communication Department, 1 Grand Avenue, San Luis Obispo, CA 93407-0252, Phone: 805-756-2803;
Emails: bswan@calpoly.edu or adelay@calpoly.edu

are simply yes/no boxes requiring no detail or statement about level of accomplishment. In addition, students applying to Cal Poly must apply to a specific major as there is no general studies option. Students are either accepted or denied into that specific major.

The Agricultural Education and Communication Department's Advisory Committee prompted the study. The purpose of this study was to determine the agricultural and leadership experiences current CAFES undergraduates possessed prior to enrolling in CAFES and determine what influenced students to enroll in a CAFES major. Specific objectives were to determine:

- Was agriculture coursework an option at the high school they attended?
- If so, who enrolled in high school agriculture programs and to what extent?
- Who and what influenced their decisions to enroll in a CAFES undergraduate program(s)?
- What experiences did these students have with the college prior to enrolling in CAFES' undergraduate program(s)?

Conceptual Framework

Researchers have investigated what students identify as factors in their decision to enroll in a college of agriculture. Wildman and Torres (2001) collected data related to five influential categories: agricultural exposure, family and friends, college of agriculture recruitment activities, professionals and job considerations. The agriculture industry experiences and FFA and 4-H experiences students had prior to post-secondary enrollment were the highest ranked factors influencing selection of major. These findings support the work conducted by Dyer, Lacey and Osborne (1996). Students with exposure to agriculture at the secondary level were more inclined to enroll in an agricultural major at the post-secondary level than students with no exposure. Furthermore, students with agricultural experiences were more likely to successfully complete a degree program in agriculture (Dyer et al., 1999; Smith et al., 2010). Rayfield et al. (2013) examined the decision to enroll in agricultural majors and identified parents as having the greatest influence. They also found scholarships and visits from university personnel to be effective recruitment measures.

Terenzini and Reason's (2005) model of influences on a first year college student, as operationalized by Smith et al. (2010), served as the frame for this study. The model identifies a series of influential factors, divided into three main categories: pre-college characteristics and experience, the college experience and outcomes. Although students in this study experienced factors related to each of the three categories, this study focuses on their pre-college experiences. The pre-college category addresses demographics, academic preparation and performance and personal and societal experiences. Students entering a university come from a variety of backgrounds and possess a variety of experiences. These factors significantly impact a student's growth and interactions at the post-secondary level (Terenzini and Reason, 2005). To adequately examine the student population entering CAFES, their formative experiences prior to enrollment must be addressed.

Methods

The researchers developed an instrument aligned with the purpose and objectives based on prior research completed at the University of Idaho (Lancaster et al., 1990). The departmental advisory committee served as the panel of experts to confirm face and content validity, doing so at the winter departmental advisory committee meeting in January of 2011. The instrument was amended accordingly and the researchers acquired human subjects' approval through the university's research and graduate program.

Upon approval, www.surveymonkey.com was utilized to develop the online survey instrument. The instrument was pilot tested with agricultural education graduate students (N = 14) during the beginning of the 2011 spring quarter. Several online instrument glitches were identified and addressed. The instrument was finalized to acquire the desired data from the frame. The online instrument was sent to all 3,366 CAFES students during the second half of the 2011 spring quarter. Dillman's (2007) online survey methods were followed, resulting in 911 CAFES student responses with a response rate of 27%, similar to other research using online survey methods (Fraze et al., 2003).

Results

Seventy-three percent of the participants were female (529 of 717) while 27% were male (198 of 717). Of those that responded, only 707 indicated their current academic standing: 32% were seniors (n = 225), 24% were juniors (n = 167), 17% were freshmen (n = 119), 15% were sophomores (n = 106) and 12% (n = 90) were super seniors (beyond their 4th year in bachelor's program).

Thirty-four percent (311 of 911) of respondents indicated they had the opportunity to enroll in secondary agriculture courses but only 25% (228 of 911) indicated they enrolled. Participants were asked to identify all of the pathways in which they took courses, thus the total number of enrollees is greater than those responding. Agri-Science and Animal Science were the most popular course pathways (over 14% each). Agricultural Mechanics and Agri-Business were followed most closely at over 8% each. It appears the least popular course pathways were Ornamental Horticulture (6.5%), Plant and Soil Science (5.0%) and Forestry and Natural Resources (2.6%). However, if combined as plant related topics, the popularity rises to 14.1% and reaches a rate similar to Agri-Science and Animal Science totals. Table 1 delineates the secondary agriculture course pathways in which students enrolled.

Table 1. Course pathways of those students enrolled in secondary agriculture (n = 228; N = 911)

Secondary Agriculture Course Pathway	f (%)
Agri-Science	130 (14.3)
Animal Science	129 (14.2)
Agricultural Mechanics	76 (8.3)
Agri-Business	74 (8.1)
Ornamental Horticulture	59 (6.5)
Plant and Soil Science	46 (5.0)
Forestry and Natural Resources	24 (2.6)

Table 2. Years students enrolled in high school agriculture classes (N=911)

# of Years of High School Agriculture Enrolled	f (%)
4 Years	139 (15.3)
3 Years	22 (2.4)
2 Years	31 (3.4)
1 Year	32 (3.5)
None	687 (75.4)

Table 3. Agriculture experiences prior to enrolling at Cal Poly (n=875; N=911)

Agriculture Experiences	f (%)
Raised in a rural setting	244 (27.9)
FFA member	189 (21.6)
4-H member	171 (19.5)
Grew up on a farm	110 (12.6)
Grew up on a ranch	102 (11.7)
Farm Bureau member	46 (5.3)
Grange member	5 (0.6)

Table 5. Family members who have attended Cal Poly (n = 734; N = 911)

Family Member	f (%)
None	403 (54.9)
Cousin	127 (17.3)
Father	97 (13.2)
Uncle	95 (12.9)
Aunt	75 (10.2)
Mother	75 (10.2)
Brother	74 (10.1)
Sister	71 (9.7)
Grandparent	26 (3.5)
Spouse	2 (0.3)

Note: Multiple responses allowed.

Table 6: On-campus experiences prior to enrolling at Cal Poly (n = 730; N = 911)

On Campus Experiences	f (%)
Took a campus tour	385 (52.7)
Attended Cal Poly's Open House	374 (51.2)
Visited friends and/or relatives on campus	264 (36.2)
Attended a Cal Poly Preview Day	207 (28.4)
Attend a Field Day on campus	93 (12.7)
Attended a Cal Poly athletic event	89 (12.2)
None of the Above	84 (11.5)
Attended a sports camp on campus	24 (3.3)
Met with an Agriculture Ambassador	19 (2.6)
Attended a Cal Poly Teach Ag Day	10 (1.4)

Note: Multiple responses allowed.

Table 4. Levels of influence on decision to enroll in agriculture major at Cal Poly (n = 734; N = 911)

Individual and/or Experience	Very Much	Substantial	Some	Little	None	M
Parent(s)	171	159	126	61	217	2.01
Visit S.L.O. campus for activity	125	107	106	48	348	1.47
Other relative(s)	82	114	108	72	358	1.30
Friend(s)	56	112	140	88	338	1.26
Past Cal Poly student	89	104	70	52	419	1.17
Current Cal Poly student	54	99	122	65	394	1.11
Agricultural education instructor	114	59	38	32	491	1.01
Cal Poly literature	30	89	138	66	411	0.99
Other high school instructor(s)	39	66	76	57	496	0.76
High school science instructor	29	57	77	66	505	0.69
High school counselor	30	50	75	75	504	0.67
Sibling	40	44	67	54	529	0.65
4-H leader	45	33	37	32	587	0.52
Visit from a CAFES professor	14	27	23	21	649	0.28
Personal letter from a CAFES professor	8	19	20	21	666	0.20
Visit from an Ag Ambassador	6	17	16	18	677	0.17

Note: Level of Influence Scale is 4 = Very Much Influence, 3 = Substantial Influence, 2 = Some Influence, 1 = Little Influence, and 0 = No Influence.

Of the respondents, 75% did not enroll in high school agriculture courses. Fifteen percent of the respondents indicated they were enrolled in four years of high school agriculture, while 3.5% of students were enrolled in only one year of coursework. Similarly, 3.4% of the students enrolled in two years and 2.4% of the students completed 3 years of courses. Table 2 displays the number of years agriculture courses were completed.

Nearly 28% of the respondents indicated they were raised in a rural setting. Related to location, 12.6% grew up on a farm and 11.7% grew up on a ranch. Twenty-one percent of the students indicated they were FFA members and 19% were 4-H members. Only 5% of the respondents reported being Farm Bureau members and less than 1% were members of Grange (a national agricultural organization focusing on community development). Table 3 clarifies the students' experiences prior to enrolling at Cal Poly.

Table 4 ranks the influence of factors on students' decision to enroll in a CAFES major. Students were asked to indicate the level of influence of each factor described as *very much*, *substantial*, *some*, *little* or *none*. The leading factor influencing a student's decision to enroll was their parent(s). The next highest ranking factor was visiting campus, followed closely by the influence of other relative(s) and friend(s). It is interesting to note 173 students indicated their Ag Ed instructor's influence to enroll in a CAFES major was *very strong*. Receiving visits from Ag Ambassadors and receiving a letter from a faculty member were at the bottom of the list.

The majority (55%) of respondents had no family members attend Cal Poly. Those who did were ranked as follows: cousin (17%), father (13%), uncle (13%), aunt (10%), mother (10%), brother (10%), sister (10%) and only 4% had a grandparent attend Cal Poly. Table 5 clarifies which family members have attended.

Prior to enrollment, over half of the respondents took a campus tour and/or attended the campus-wide Open House (see Table 6). One third of the students visited friends/relatives on campus. Almost 30% attended a prospective student Preview Day, while only 12% attended an FFA field day or attended a home athletic event any time during the year.

Discussion

Sixty-six percent of the respondents did not have access to secondary agriculture courses, yet still decided to enroll in a CAFES major. This finding is similar to previously conducted research in colleges of agriculture across the country (Rayfield et al., 2013; Smith et al., 2010; Wildman and Torres, 2001). Thirty-four percent indicated they had the opportunity to enroll in secondary agriculture courses, yet only 25% of the respondents enrolled. This leads one to question why nine percent of the respondents chose not to enroll in an available secondary agriculture course when they were heading to college to major in agriculture. Perhaps the instruction or content was not challenging or there was pressure to take other courses to better prepare them for testing or that would be more attractive to admissions officers. These questions are beyond the scope of this study but should be further pursued.

In regard to how many years students enrolled in secondary agriculture courses, there was little difference in enrollment frequencies among years one, two and three. However, there were five times more students completing all four years of an agriculture program which illustrates that, in most cases, students who can get into a CAFES major can fit four years of high school agriculture coursework into their schedules. Studying what these program completers took in terms of courses, coupled with test scores and GPA, would also be worthy of study.

When looking at who/what influenced these students to enroll in a CAFES major, parent(s) were named as the leading influence (Rayfield et al., 2013). A visit to campus was the second most influential, followed closely by other relative(s) and friend(s). It should be noted, 114 of the 189 participants who had been FFA members responded their agriculture teachers *very muc*h influenced their decision to pursue a CAFES major. When looking at low ranking factors it is important to note the respondents were not asked if they encountered these activities, merely if they were influential. Factors might have been ranked low because they seldom occur and cannot be considered influential. These included a CAFES professor visiting high schools and the professor writing a personal letter to a student. The Ag Ambassador's program budget has been reduced greatly over the past decade making visits nearly impossible. This situation might explain why this is the lowest ranking factor.

Despite the long-standing reputation as a large and prominent college of agriculture, 55% of the respondents had no family members attend Cal Poly. Respondents reported 13% had fathers and 10% had mothers attend Cal Poly. Only 3.5% of the students' grandparents attended. Perhaps there is little tradition between generations, which may not generate much loyalty or support.

In regard to students having on-campus experiences prior to enrolling at Cal Poly, half of the respondents indicated they took a campus tour and attended the annual Open House. One third of the students also visited friends or relatives on campus. Even in an increasingly digital age, direct contact with the campus environment is an important factor related to college decision. Pre-college experiences are foundational elements to students' decisions of college major choice (Terenzini and Reason, 2005). Considering the responses of the students and gleaning over the data, the following recommendations and implications have been developed.

Recommendations and Implications

In the secondary academic population, agriculture education comprises a small piece of the pie (California Department of Education, 2012), yet this subset serves a billion-dollar industry. The agriculture industry requires a workforce in possession of a thorough understanding of the many unique challenges facing agriculture (Goecker et al., 1999). The concerns university faculty has about the lack of agricultural experiences held by incoming university students (Dyer et al., 1999; Smith et al., 2010) and the charge given by the local advisory committee, indicate the need to know more about the factors forming a student's decision to enroll in college.

The CAFES students surveyed in this research project indicated elements as influential and successful in helping them find their way to a major within the college of agriculture (Terenzini and Reason, 2005). After analyzing the data, the researchers identified specific groups with whom the college maintains open communication. To seek the greatest recruitment impact, the researchers targeted those groups indicated by the survey population as influential and generated the following action plan. Those groups include: agriculture instructors, 4-H agents, volunteers, university agriculture faculty and staff and college of agriculture outreach staff.

To agriculture instructors and 4-H agents and volunteers:

- Recruit and encourage more students to take part in the program by focusing on career opportunities in agriculture.
- Offer wider opportunities beyond traditional livestock projects.
- Help students experience on-campus events like Open House, Preview Day, field days, etc.
- Introduce students to faculty and staff in their areas of interest during their freshman year to encourage good habits and focus on a goal early.

To university agriculture faculty and staff:

- Communicate with secondary agriculture teachers and 4-H agents about the knowledge and skill set(s) students need prior to leaving the secondary level to be functional and successful at the university.
- Intentionally visit local programs and attend meetings, followed up with personal letters to

encourage and support students with an interest in agriculture.

To college of agriculture outreach:

- Communicate with parents and counselors about the agricultural leadership and experiential opportunities in CAFES.
- Invite students and their families to campus for a visit. If a visit is not possible, produce short videos featuring the agricultural opportunities and what it takes to thrive in the CAFES environment. In videos, make suggestions about how prospective students can prepare to enter the CAFES environment (other formal coursework, leadership development and experiential learning opportunities).
- Make sure CAFES freshmen are happy to ensure their contact with prospective students from their home high schools is positive, serving as a natural recruitment tool.
- Consider the resources devoted to Agriculture Ambassadors and the return on investment. Many students reported having no real interaction with them. Who do ambassadors serve? What is their purpose? How can their role be maximized to better impact potential students?

While every high school student must have an equitable chance toward admission into CAFES, faculty members are frustrated with current students who come in with a lessened skill set and limited agricultural experiences. Is this surprising when 75% show up with no formal education in agriculture? There is frustration when students are actively involved in agricultural organizations to prepare for specific CAFES majors yet are not admitted. Rather, they are admitted to other universities, in-state and across the western United States, taking their experiences and skills with them. To better serve the agriculture industry, CAFES needs to insist specific agricultural work and leadership experience(s) be added to the current metrics of admissions selection criteria.

Further research should address the following:

- Ascertain from CAFES faculty and staff the perceived skill level of their students and identify skill gaps, cross-referenced with industry expectations.
- How leadership skills are demonstrated within CAFES and across campus.
- How leadership development experiences prior to enrolling in CAFES prepare students to excel in leadership on campus.
- How former 4-H and FFA members contribute in CAFES when compared to non-members.
- Determine what, if any, recruitment efforts students experience.

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Gender Differences in Economics

Siew Lim[1], Cheryl Wachenheim[2], David Roberts[3], Linda Burbidge[4] and Jeremy Jackson[5]
North Dakota State University
Fargo, ND

Abstract

Nationally, females account for less than one-third of the students in agricultural economics undergraduate programs. We identified a gender gap in test performance between genders with women in general economics and agricultural economics scoring nearly three percent lower than men. Compared to men, women also tended to be less interested in the subject. Contrary to expectations, interest in economics was not higher among women within business and economic majors when compared to women with other majors. Findings suggest the challenge of increasing women's interest in economics persists.

Keywords: agricultural economics, business, economics, gender gap, gender preferences

Introduction

Women play an important and growing role in U.S. agriculture. The percentage of farmers who are female nearly tripled, from 5% to 14%, between 1978 and 2007 (Hoppe and Korb, 2013). Women are also increasingly present in agribusiness, most recently comprising 44% of the workforce (Feedstuffs, 2013). However, the percentages of women receiving a degree in economics and agricultural economics differ considerably from general agriculture, other social science fields and certain business disciplines (Table 1). Women accounted for 28% of the bachelor's degrees in agricultural economics conferred in 2009-2010, while other social science fields saw a larger share comprised by women.

Although women's participation in economics has increased over the years, a gender gap continues. According to the National Center for Education Statistics (2012) among the almost half of the 12th graders in the U.S. completing a course in general economics, the average scale score was higher for male students than for female students. Additionally, 45% of males were at or above proficient level in economics, compared to 38% for female students. Whether this persisting gender gap is worrisome has been a subject of interest for decades; the findings remain inconclusive.

At North Dakota State University, women accounted for 11% of economics majors and 17% of agricultural economics majors during spring semester, 2012. These percentages of women's participation are small compared to the national statistics on women's share of bachelor's degrees in economics (29%) and agricultural economics (28%) reported in Table 1. Our department's lower percentage of women motivated a more detailed look at gender differences.

We tested for gender differences among students in a principles of microeconomics course at North Dakota State University. Principles of microeconomics is a core subject in agricultural economics, general economics, business and other undergraduate curricula. Gender differences in test performance and in student views on economics coursework, economics proficiency and likelihood of enrolling in advanced economics courses were considered.

Table 1: Percentage of Females by Discipline and Degree Conferred in the U.S. in 2011-2012

	Bachelor's	Master's	Doctor's
Agriculture, general	42.48	57.91	47.62
Agricultural business and management	32.81	45.00	NA
Agricultural economics	27.75	41.67	35.37
Business administration and management	48.54	44.11	37.34
Accounting	51.97	53.02	56.41
Finance	31.10	36.30	21.57
Management information systems	24.56	32.00	32.81
Marketing/marketing management	53.58	60.34	40.00
Computer science	13.05	24.50	17.69
Mathematics	44.21	38.74	24.32
Statistics	41.55	48.14	36.53
Psychology	76.57	74.17	69.77
Anthropology	71.22	66.58	63.94
Economics	29.24	36.46	32.80
Geography	34.76	42.09	38.91
Political science and government	43.83	44.79	39.92
Sociology	69.15	66.16	63.10
History	40.17	46.53	45.15

Source: National Center For Education Statistics (2013)

[1]Assistant Professor, Department of Agribusiness and Applied Economics, NDSU Dept 7610, PO Box 6050, Fargo, ND 58108-6050,701-231-8819, siew.lim@ndsu.edu
[2]Professor, Department of Agribusiness and Applied Economics, 701-231-7452, Cheryl.wachenheim@ndsu.edu
[3]Assistant Professor, Department of Agribusiness and Applied Economics, david.c.roberts@ndsu.edu
[4]Blue Cross Blue Shield of North Dakota, linda.burbidge@bcbsnd.com; 701-277-2898 (ext 72898)
[5]Assistant Professor, Department of Agribusiness and Applied Economics, 701-231-7832, Jeremy.jackson@ndsu.edu

Gender Gap in Economics

Gender bias in economics curricula has been noted in previous studies (Barlett and Feiner, 1992; Ferber, 1984; Ginther and Kahn, 2006). Barlett and Feiner argued that abstract reasoning and extensive reliance on mathematical formalism have displaced other methodological approaches to studying economics. Indeed, mathematics preparation is highly essential for students in economics (Ballard and Johnson, 2004; Schuhmann et al., 2005). Some programs require students to have a mathematic level above intermediate algebra to enroll in principles of microeconomics, while others have no prerequisite for the course. Dynan and Rouse (1997) observed that females were less likely to major in economics because they had relative advantage in other subjects; females also had weaker mathematic skills, but mathematic background was not a factor in first-year student's decisions on whether to major in economics.

Zafar (2009) found that much of the gender gap in academic major preferences was due to differences in preferences and beliefs about enjoying coursework. He found individuals' beliefs about their own abilities and future earnings to be insignificant in explaining the choice of academic major. On the contrary, Jensen and Owen (2000) found that students who are confident in their ability in economics are more likely to continue to study economics Confidence in turn was found to be dependent upon student's math ability, teacher's experience, whether students freeze up during examinations, GPA and other factors. They also found that, in general, females are less likely to take an introductory economics class or to continue in economics after taking the first introductory course in economics – a finding generally consistent with the conclusion reached by Horvath et al. (1992).

Besides concerns about math skills, general perceptions about economics as a business-oriented field also contribute to the negative predispositions women have towards studying economics (Bansak and Starr, 2010). The course content in introductory economics courses may instigate a more negative attitude and disinclination towards the subject, even in the absence of a performance gap (Bollinger et. al., 2006). But undergraduate business majors are broadly composed by a number of sub-disciplines. While females have low participation and less interest in finance (Ford and Kent, 2010), some business majors are dominated by women (Ball, 2012). Women accounted for most of the accounting and marketing degrees at the bachelor's and master's levels in 2009-2010 and they also accounted for nearly half of the bachelor's degrees in business administration conferred during the same period (National Center for Education Statistics, 2012).

In the U.K., Ashworth and Evans (1999) observed no gender differences in opinions on economics among those who studied A-level [General Certificate of Education Advanced Level.] economics. However, 63% of the women who opted not to enroll in A-level economics felt that the subject was uninteresting (32%) or that they knew nothing about it (31%). Do students' past experience and knowledge in economics have influence over their current performance in and perception about economics? If so, how?

Based on a sample of college students in California and Washington, Gill and Gratton-Lavoie (2011) observed that college students who had taken economics in high school performed slightly but significantly better than students who had not. These results, however, contradict earlier findings by Reid (1983), Becker et al. (1990) and Ballard and Johnson (2005) who found a negative correlation between high school economics experience and performance in college-level introductory economics. Ballard and Johnson (2005) noted that this lapse is more pronounced among women and women tend to have a lower expectation on the grades they will receive in economics. These lower expectations, they noted, are self-fulfilling.

Methods

This research is part of a project entitled "Assessing Student Learning in Economics," approved by the Institutional Review Board at North Dakota State University on January 10, 2011. All participants provided written informed consent prior to participation in the study. We developed a set of survey questions regarding student's personal background and academic preparation for Principles of Microeconomics. Personal information collected in the survey included student's age and personal background. Academic information included student's high school graduation year, year in college, ACT score, cumulative college GPA, academic major, economics course experience and math background. The survey was administered online via Blackboard. Students in the course during years 2011 and 2012 were invited to participate in the survey during the last three weeks of class. Students' answers to 44 core questions were used to measure their learning and cumulative knowledge in principles of microeconomics.

Principles of Microeconomics is required of all agricultural economics, business, economics and pharmacy majors at the university and is also is a course listed under a list of general education courses for all undergraduate students. In this paper, business majors include all accounting, business administration, finance, marketing, management information systems majors. Economics majors include both economics and agricultural economics. A total of 921 students participated in the survey, but due to missing values and incomplete or ambiguous responses, the resulting sample size is 771. Due to a relatively small number of economics students (7 students), students in both economics and agricultural economics are combined as one group, abbreviated as AGEC.

Differences in Preferences

Females accounted for 42% of the students in our sample. Table 2 displays the levels of enjoyment with coursework by gender. The Fisher's exact tests in Table

Table 2: Contingency Table by Major

A. All Students

	Do Not Enjoy	Enjoy	N
Male	32.8%	67.2%	445
Female	50.3%	49.7%	326
Total	40.2%	59.8%	771

Fisher's exact test = 0.000

B. Non-Business and Non-AGEC Majors

	Do Not Enjoy	Enjoy	N
Male	37.9%	62.1%	256
Female	50.7%	49.3%	213
Total	43.7%	56.3%	469

Fisher's exact test = 0.002

C. Business and AGEC Majors

	Do Not Enjoy	Enjoy	N
Male	25.9%	74.1%	189
Female	49.6%	50.4%	113
Total	34.8%	65.2%	302

Fisher's exact test = 0.000

Table 3: Business and AGEC Majors

A. AGEC Majors

	Do Not Enjoy	Enjoy	N
Male	5.3%	94.7%	19
Female	50.0%	50.0%	8
Total	18.5%	81.5%	27

Fisher's exact test = 0.017

B. Finance Majors

	Do Not Enjoy	Enjoy	N
Male	14.3%	85.7%	21
Female	42.9%	57.1%	7
Total	21.4%	78.6%	28

Fisher's exact test = 0.144

C. Accounting Majors

	Do Not Enjoy	Enjoy	N
Male	25.6%	74.4%	43
Female	53.3%	46.7%	30
Total	37.0%	63.0%	73

Fisher's exact test = 0.026

D. Marketing Majors

	Do Not Enjoy	Enjoy	N
Male	37.5%	62.5%	16
Female	71.4%	28.6%	14
Total	53.3%	46.7%	30

Fisher's exact test = 0.081

E. Business Admin/Management Majors

	Do Not Enjoy	Enjoy	N
Male	28.0%	72.0%	75
Female	43.4%	56.6%	23
Total	34.4%	65.6%	128

Fisher's exact test = 0.081

2 suggest dependence between gender and preference. Panel A shows that 67% of all males enjoyed the coursework. Although considerably less than the proportion of males who viewed the course favorably, females' preferences split almost evenly on how much they enjoyed the course. Women's split opinion persists even among the AGEC and business majors; about 50% of female AGEC and business majors enjoyed the course, compared to 74% of males (Panel C).

For comparison purposes, we broke down business and AGEC majors into different sub-disciplines and report their preferences in Table 3. The table shows that males overwhelmingly had a favorable view on economics, especially among finance and accounting majors. Among the economics majors (Panel A), 95% of male students viewed the coursework positively, compared to just 50% of female students. Only 7 of 28 (or 25%) of finance majors were females. Fifty-three percent of female accounting majors and 71% of female marketing majors did not enjoy the course in microeconomics. We observed only 18% of business administration and management majors in our sample were female – a proportion substantially less than the share of women receiving a bachelor's degree in this field nationally and the percentage of female business administration and management majors at our institution. In Spring 2012, 24% of finance majors, 43% of marketing majors, 40% of management majors and 34% of business administration students at our institution were women.

Differences in Academic Performance

The average test score for non-economics and non-business majors in our sample (both male and female) (60.5%) was 2.6 percentage points higher than for economics and business majors (57.9%). The difference is statistically significant (t statistic = 2.238) at the 5% level. The same group of students also had a higher average GPA (3.2 out of 4.0) than economics and business majors (3.0). The difference was significant at the 1% level (t statistic = 4.071). A sizable portion (30%) of the non-AGEC and non-business majors in our sample are pre-pharmacy students. Among the pre-pharmacy students in our sample, 60% are women. The admission criteria for the pharmacy program at our university are fairly stringent. Hence, the average GPA and test score for pre-pharmacy students are higher than for others. Table 4 presents the average economics test scores and GPAs by gender and major. The last column of Table 4 reports the t statistics for the two-sided t tests on the difference in average test scores and on the difference in average GPAs.

In general, the average test scores are not different for males and females (59.7 vs. 59.3). We broke down our sample by student's major. While the average test scores for male economics and agricultural economics majors are higher than those of women by nearly 6 percentage points, the difference is not statistically significant. The gender difference in economic test performance is only significant for finance majors – the average test score for men was about 13 percentage points higher than that for women in finance. While more females in accounting and most females in

Table 4: Average Test Score and GPA by Gender and Major

	Mean		H_0: Difference = 0
Economic Test Scores	Male	Female	t-stat
All Students (N = 771)	59.7	59.3	0.318
Non-Business & Non-AGEC Majors (N = 469)	60.8	60.3	0.299
Pre-Pharmacy (N = 145)	68.4	64.8	1.273
Business & AGEC Majors (N = 302)[#]	58.2	57.5	0.345
AGEC (N = 27)	61.0	55.1	1.024
Finance/Pre-Finance (N = 28)	62.8	50.0	2.190**
Accounting/Pre-Accounting (N = 73)	58.8	59.5	-0.185
Marketing/Pre-Marketing (N = 30)	58.8	59.3	-0.075
Pre-Business Admin/Pre-Management (N = 128)	54.8	57.5	-0.999

	Mean		H_0: Difference = 0
GPA	Male	Female	t-stat
All Students (N = 771)	3.041	3.282	-5.725***
Non-Business & Non-AGEC Majors (N = 469)	3.114	3.328	-4.062***
Pre-Pharmacy (N = 145)	3.489	3.490	-0.016
Business & AGEC Majors (N = 302)[z]	2.941	3.195	-3.602***
Econ & Ag Econ (N = 27)	3.018	2.974	0.158
Finance/Pre-Finance (N = 28)	3.014	3.339	-1.855*,†
Accounting/Pre-Accounting (N = 73)	3.050	3.278	-1.831*,†
Marketing/Pre-Marketing (N = 30)	2.858	3.248	-1.276
Pre-Business Admin/Pre-Management (N = 128)	2.841	3.144	-3.091***

[z] We found only 1 female student among 16 MIS majors in our sample. Hence, MIS majors' mean test scores and GPA's are not reported in this table.

*** significance at the 1% level for a 2-sided t test

** significance at the 5% level for a 2-sided t test

* significance at the 10% level for a 2-sided t test

†significance at the 5% level for a 1-sided t test

marketing said that they did not enjoy the coursework (see Table 3), they fared no worse than male students in the same programs (Table 4). Additionally, with the exceptions of economics and marketing majors in the sample, on average, female students have higher GPA than male students.

Regression Analysis

We modelled the percentage of student's correct answers on the set of core questions (student's test score) as a function of the student's characteristics, academic background and course features. The binary variable Calculus = 1 for students who had had or were concurrently taking applied calculus or higher level calculus, otherwise Calculus = 0. Work is also a binary variable and Work = 1 for students who reportedly had a job and zero otherwise. We also controlled for student's gender (1 for female student, 0 otherwise), instructor's gender (1 for female instructor, 0 otherwise) and teacher's experience. The final ordinary least squares regression results are presented in Table 5. We also controlled for student's algebra preparation, status of financial aid, family background, parents' education, marital status, participation in intra/extramural activities, course load, previous experience with economics (prior high school and college economics), transfer status and other class characteristics. None of these factors were significant. Further, we broke down students by major, but only pre-pharmacy major consistently remained significant in the model. Hence, only the final results are presented here.

In Model 1, GPA and calculus had a positive effect on student's test score. A one point higher GPA is estimated to raise student's test score by 8.3%, almost a full letter grade. Students with some calculus background were estimated to have an approximately 5% higher score (or half a letter grade) than those who did not have calculus. Although some colleges require students to have taken intermediate algebra or college algebra before taking principles of microeconomics, to the authors' knowledge, calculus is not a prerequisite for principles of microeconomics. Calculus concepts, however, are very much useful and applicable in economics and they are routinely applied in higher level economics at the intermediate and advanced levels. Having some calculus preparation may give students an edge over their peers even in introductory economics.

While we saw in Table 4 that generally, without controlling for student's characteristics, average student test scores were not significantly different for the two genders, Table 5 shows that female students are estimated to score about 2.8% lower on the economic test than their male counterparts, after controlling for student's GPA and other factors. This means that, even though women tend to have a higher GPA in the class, given the same GPA and holding all other factors constant, a male student would score 2.8% higher than a female student on the test.

Lumsden and Scott (1987) suggested the multiple-choice exam format may serve as a clear disadvantage to female students taking introductory economics. In our study, even for the female pre-pharmacy students who tended to have a higher GPA and a higher economics test score than other students, their average test score was no better than that of male pre-pharmacy students. Unfortunately, due to limited teaching resources, we were not able to assess student performance using essay questions and to also address the problem of inconsistency in essay grading highlighted by Ferber et al. (1983). The coefficient on female instructor also suggests that having a female professor had no significant effect on student performance. A Wald test shows that the slope coefficients in Model 1 are the same for males and females. [Wald test for slope differences between males and females: $\chi 2 = 0.81$, p-value=0.606.]

In Model 2, we broke down the Female Student dummy variable by students' majors in three undergraduate programs (pre-pharmacy, business and economics and others) and male students in the sample constitute the base group for comparison. Recall that women in the pre-pharmacy program have a higher average GPA than all other female students (see Table 4). To some extent, their GPA reflects their academic performance. Because the admission criteria into the pharmacy

Table 5: OLS Regression Analysis[z,y]

Dependent Variable: Economic Test Score	Model 1		Model 2		Model 3	
	Coef.	t stat	Coef.	t stat	Coef.	t stat
GPA	8.353	10.40***	8.583	10.94***	8.349	10.36***
	(0.803)		(0.785)		(0.806)	
Calculus	4.759	5.07***	4.933	5.36***	4.764	5.06***
	(0.939)		(0.920)		(0.941)	
Work	-2.726	-3.14***	-2.745	-3.16***	-2.730	-3.15***
	(0.867)		(0.868)		(0.867)	
Female Student	-2.769	-3.25***				
	(0.852)					
Female Pre-Pharmacy Student			-0.730	-0.52	0.014	0.01
			(1.404)		(1.565)	
Female Business/AGEC Student			-2.896	-2.50**	-2.336	-1.77*
			(1.157)		(1.317)	
Female Student in Other Programs			-3.347	-2.75***	-2.784	-2.03**
			(1.219)		(1.374)	
Male Pre-Pharmacy Student					2.695	1.58
					(1.710)	
Male Student in Other Programs					0.421	0.35
					(1.214)	
Female Instructor	1.612	0.359	1.590	0.90	1.647	0.94
	(1.756)		(1.759)		(1.757)	
Teacher's Experience	-3.375	-1.50	-3.230	-1.47	-3.329	-1.48
	(2.250)		(2.450)		(2.246)	
Constant	28.406	8.70***	27.96	8.60***	28.115	8.47***
	(3.266)		(3.250)		(3.319)	
N	771		771		771	
R^2	0.5065		0.5052		0.5066	

[z] Robust standard errors reported in parentheses.

[y] Semester control variables not reported in the table.

***, **, * denote significance at the 1%, 5% and 10% levels, respectively.

program at this university are stringent and the acceptance rate is low, students in the pre-pharmacy program are highly motivated in addition to having a strong academic record indicative of their high ability. Controlling for other factors, we observed a statistically insignificant and negligible (< 0.75 percent) gap between female pre-pharmacy students and male students. However, women in the business and economics programs and women in all other programs, respectively, are expected to score 2.9 and 3.3 percentage points lower compared to their male counterparts.

In Model 3, we partitioned male students in our sample into three sub-groups in accordance to their majors (pre-pharmacy, business and economics and others) and we held male students in the business and economics programs as the base group for comparison. Notice that in Table 5 (Model 3); the coefficient on Female Pre-Pharmacy Student is positive, relatively small in magnitude and insignificant. Controlling for all other factors, there is not a knowledge gap between women in this program and the base group (male business/economics students). But such gap persists for women in all other programs including those in the business and economics programs.

Lastly, to probe students' persistence in economics, we use a 5-point Likert scale (0 for very unlikely, 1 for unlikely and 4 for very likely) to explore the likelihood of students taking another course in economics after the introductory course. The summary of their responses is reported in Table 6. The Fisher's exact statistics on Panel A of the table confirmed that the responses are not gender-independent. About 29% of men are unlikely or very unlikely to take another course in economics, compared to 47% of women. In Panel B, 43% of men and 66% of women in non-economics and non-business programs are unlikely or very unlikely to enroll in another course in economics. This is largely consistent with the composition of students in upper division economics classes and in undergraduate and graduate economics programs, in which women constitute a considerably smaller percentage of the student body.

Table 6: Likelihood of Taking Another Course in Economics

Panel A. All Majors

	All	Male	Female	N
Very Unlikely	15.5%	11.2%	21.5%	120
Unlikely	20.7%	17.5%	25.2%	160
Neutral	7.3%	9.9%	3.7%	56
Likely	23.9%	24.0%	23.6%	184
Very Likely	32.6%	37.3%	26.1%	251
	100%	445	326	771
Fisher's Exact = 0.000				

Panel B. Non-AGEC and Non-Business Majors

	All	Male	Female	N
Very Unlikely	24.1%	17.2%	32.4%	113
Unlikely	29.9%	26.2%	34.3%	140
Neutral	9.0%	12.5%	4.7%	42
Likely	21.7%	24.6%	18.3%	102
Very Likely	15.4%	19.5%	10.3%	72
	100%	256	213	469
Fisher's Exact = 0.000				

Summary and Discussion

Economics offers an essential and practical means to tackle social, market and policy issues. Indeed, individual and policy decisions benefit from sound economic knowledge and understanding. Agricultural and general economics majors continue to be disproportionately male. In this study, we observed a gender gap in test performance in introductory microeconomics after controlling for student's GPA and academic major and in-spite of the fact that women tend to have a higher GPA compared to their male counterparts. Women in business, economics and agricultural economics degree programs did slightly better than women in other programs, except pharmacy. However, they fared worse than men in all degree programs including those in their own programs.

However, test scores alone may not be the sole factor that deters women's participation in economics. Fifty percent of women in our study, compared to 33% of men, did not enjoy the course in microeconomics. The gender difference in interest was especially notable among agricultural and general economics students. To some extent, this result suggests a need to look at means to increase women's interest in agricultural economics. If the goal is to increase the share of women in the field, the literature and the current study suggest that potential venues include efforts to increase women's knowledge of the range of careers available to economics graduates and to help build their confidence in the field; We need to show women the careers they could have and build their confidence that they can succeed in the program and in these careers. Female role-models more publically now include Dr. Yellen, Chair of the Board of Governors of the Federal Reserve System, but there are many others that can serve, through example, to demonstrate economics is a viable option for women.

Limitations

One limitation of our study is the use of multiple-choice exam questions. Lumsden and Scott (1987) noted that male students performed better on multiple-choice questions, while female students performed better on essay questions because of their verbal skills. However, Ferber et al. (1983) argued that, even if the same key is used, the grading of essay questions is subjective, depending upon the grader. Additionally, the multiple-choice exam format itself may not be the driver of low economic test scores among women since multiple-choice exams are rather common in introductory courses in sociology, anthropology and psychology which historically have had a relatively larger share of women's participation.

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A Descriptive Account of Factors Affecting Student Satisfaction in an Online Master's Degree in Agriculture and Life Sciences

B. Burbuagh[1], T. Drape[2] and D. Westfall-Rudd[3]
Virginia Tech
Blacksburg, VA

Abstract

The purpose of this qualitative study was to explore factors affecting student satisfaction with an online master's degree in agriculture and life sciences. Purposively selected program graduates (n=8) provided in-depth interviews utilized by the researchers to understand student motivation, perception of their educational experience, factors affecting satisfaction and provide recommendations for improvement. Primary themes that emerged were related to technology, instructional design, coursework, teaching and learning, student support and recommendations for improvement. These themes were utilized to frame the results and offer recommendations to improve the teaching and learning process. Based on the results, recommendations include: (1) develop a marketing plan that includes an online presence and targeted information to industry groups and professional associations; (2) provide orientation sessions for online graduate students; (3) utilize multiple delivery methods to accommodate learning styles; (4) provide technical assistance in course development; (5) review course materials periodically; and (6) design experiences that promote faculty-to-student and student-to-student engagement. This study provided an opportunity to assess the teaching and learning process using student perceptions and experiences. The information is being utilized to improve an online master's degree program and should be considered when designing future online degree programs in Colleges of Agriculture and Life Sciences.

Introduction

Enrollment in online courses and degree programs in Colleges of Agriculture continues to experience robust growth in the United States (Allen and Seaman, 2011). This growth has led to the accelerated development of online courses and degree programs as a result of the increased number of people with internet access and modern information technology platforms which have facilitated a change in the way educational content is delivered (Sher, 2008). With 31% of all college and university students now taking at least one online course (Allen and Seaman, 2011), the institutional capacity needed to address this emerging educational environment continues to evolve as well as offer tremendous opportunities for Colleges of Agriculture. In 2011, 65% of chief academic officers reported that online learning was critical to their strategic plan (Allen and Seaman, 2011). It is evident that online learning has become a mainstay in educational institutions around the world (Harasim, 2000) and the trend towards online delivery of educational content is likely to continue (Weller, 2013).

Online education has been defined as a "group communication phenomena" (Harasim, 2000, p.43). These online courses and degree programs are characterized by the activities such as the presentation of information, discussion and group work are undertaken online (Waltonen-Moore et al., 2006). The availability of online education and the increasing number of students enrolled speak to the importance of this educational delivery method (Zapalska and Brozik, 2006). The flexibility of online education has increased people's expectations for quality instruction and provides the impetus to investigate student satisfaction in online courses and degree programs (Kaminski et al., 2009). Student satisfaction in online courses has been implicated in program persistence (Rivera and Rice, 2002), motivation (Bolliger and Wasilik, 2009) and higher levels of learning (Shea et al., 2001). The experiences and personal perspectives of online learners can provide valuable data that speaks to what matters most to online students and help institutions gain a better

[1]Department of Agricultural and Extension Education, (540) 231-6836, burbaugh@vt.edu
[2]Office of Ed Research and Outreach, (540) 231-1802, tdrape@vt.edu
[3]Department of Agricultural and Extension Education, (540) 231-5717, mooredm@vt.edu

understanding of current strengths and challenges in delivering online programs (Noel-Levitz, 2011) as well as provide a framework for program and course enhancement (Olmstead et al., 2011). Additionally, satisfaction data from the learners' perspective can assist faculty members and administrators can identify areas where improvement is needed (Reinhart and Schneider, 2001).

The purpose of this study was to provide an evaluation of the online Masters of Agriculture and Life Sciences (OMALS) degree offered at a land grant institution in the mid-Atlantic region of the United States. The objectives were to:

1. Determine the factors affecting student satisfaction in an online degree program.
2. Offer recommendations to improve student satisfaction in online degree programs.

Prior to this study, no evaluative data had been collected on this program to inform the faculty, the college or to offer guidance for future students and their needs as learners.

Literature Review

As the number of online degree programs continues to increase and competition for students among universities is amplified, it is important to evaluate and assess the effectiveness of these online programs and the factors that influence student satisfaction. Student satisfaction is defined as the student's perceived value of his or her educational experiences at an educational institution (Astin, 1993). Allen et al. (2002) and Wang (2003) argued that in any educational institution, the satisfaction of a student can be determined from his level of pleasure as well as the effectiveness of the education that the student experiences. Students with higher levels of satisfaction towards various aspects of e-learning courses are reported to show considerably higher levels of learning than students with a low level of satisfaction (Shea et al., 2001). In this regard, instructors of online courses can increase their students' satisfaction by considering the primary factors of student satisfaction (Leong et al., 2002). Bollinger and Martindale (2004) identified three primary factors central to online student satisfaction: instructor, technology and interaction.

In online courses, the ability of an instructor to reduce the social distance between themselves and their students is a positive predictor of student learning and course satisfaction (Arbaugh, 2001). A lack of feeling connected to faculty has been shown in previous research to be a significant variable in the student's sense of potential for completion of the online course (O'Brien, 2002). Additionally, the time and place flexibility that technology provides has been found to positively influence student satisfaction (Berger, 1999).

Interaction has been deemed one the most important components in online education (Moore and Kearsly, 1996). Previously, the quality of interactions with faculty and other students has been found to influence student satisfaction (Thurmond and Wambach, 2004; Levy, 2007). And the perceived emphasis an instructor places on course interaction has been positively associated with student satisfaction (Arbaugh, 2000). Because high levels of satisfaction lead to lower attrition rates, higher persistence in learning and higher motivation in pursuing additional online courses (Allan and Seaman, 2011), assessing student satisfaction in online degree programs can help institutions evolve and address the needs of this unique group of learners.

Background

The Online Masters of Agriculture and Life Sciences (OMALS) was developed by the College of Agriculture and Life Sciences as a completely online degree, which primarily utilizes asynchronous with some synchronous instruction and blended learning tools and technology into the program. The program provides broad, scientific-based courses in agricultural and life sciences and related fields. The online format offers participants access to a graduate degree program relevant to their professional career areas in the agricultural industry, agricultural education or extension. The OMALS program required 30 credits of coursework that must include 12 credits in one of five areas of concentration: Biosecurity, Bioregulations and Public Health; Education; Environmental Science; Food Safety; or Plant Science and Pest Management. Additional coursework includes nine credits in core courses, three elective credits, as well as 12 credits for the culminating project and report required for completion of the program. At the time of the study there were 31 graduates of the new program. By identifying and understanding factors affecting student satisfaction faculty can add value to online degree programs.

Materials and Methods

Case study methodology was employed in an effort to understand the in-depth, real-life phenomenon over a period of time with a set audience, to try and gather meaningful data (Yin, 2009). A strength of case studies, when compared to other research methods, is that a variety of evidence is provided through an array of techniques, like interviews, observations or document analysis (Yin, 2009). This qualitative case study did not propose to represent all students in the program, but instead focus on the program as it is conducted within the Department of Agricultural and Extension Education at Virginia Tech. Corbin and Strauss (2008) explain, *"Qualitative research allows the researcher to get at the inner experience of participants, to determine how meanings are formed through and in culture and to discover rather than test variables"* (p. 12). Additionally, interviews provide rich descriptions of the ways students engage in cognitive processes, which could not be accomplished through pure quantitative analysis (Rossman and Rallis, 2003).

The population of the study was OMALS program graduates (n=31). The sample of nine graduates was purposively selected based on their willingness

to participate in the study. The (name of institution) Institutional Review Board approved the study protocol and all participants provided written informed consent prior to participation in the study. Open-ended questions served as the primary evaluation tool. An interview guide was used by the researchers to help students recall and reflect on the curriculum, the structure of its delivery and the technology used to deliver the lessons. The data collected included conversations and comments from a semi-structured interview format that allowed for follow-up questions (Ary et al., 2009). The data from the interviews was audio recorded to achieve accuracy and transcribed by the researchers to provide evaluative data. Constant comparison analysis was used to examine the results. According to Strauss and Corbin (1998) in vivo, focused and axial coding methods characterize constant comparison analysis. Express Scribe© transcription software and Atlas.ti© coding software was used during the transcription and coding of the interviews with participants. After interviews were transcribed, the researcher used in vivo coding in Atlas ti© to first break the data into large codes based on patterns that were emerging using the participants own words. In vivo coding was done to determine what meaningful patterns were emerging to make up sub-categories of data (Charmaz, 2006). After open coding was complete, focused coding occurred. The resulting codes were more direct and began to explain larger segments of the data. Focused coding helped determine the adequacy of the in vivo codes (Charmaz, 2006). By comparing data to data, focused codes were created to help the researcher begin grouping like codes and refining them into larger groups of categories. The final step in the coding process was axial coding. Axial coding helped the researcher bring all of the data together and determine themes based on the research questions (Corbin and Strauss, 2008). All participants were assigned pseudonyms in accordance with IRB policy and approval.

Results and Discussion

Online education has emerged in response to the need to provide access to people who would otherwise not be able to participate in face-to-face courses (Allen and Seaman, 2011). It allows the learner and instructor to be together but physically apart from one another in an educational environment (Beldarrain, 2006). The aforementioned research is supported by the fact that the majority of participants in this study were working full-time in agricultural or life science industries. The careers of participants varied from food safety specialists to managers in the Virginia Department of Agriculture; however, the majority of participants were agricultural and extension educators. Three of nine participants were required to obtain a master's degree as a condition of their employment; these individuals also received employee tuition reimbursement to offset the cost and serve as a motivator for them personally and professionally. Participants who self-funded their degree and those who were provided employer assistance agreed that the program was valuable. As one student explained, "*I will happily pay the money that I owe and be thrilled with information I got, [and] by no means did I waste my time or money, it was well worth it*" (David, p. 8).

The motivation for returning to school varied among students. Personal aspirations were mentioned briefly, but the reoccurring themes were an interest "in learning new things and thinking outside the box" (Debbie, p.3). Another student explained that a master's degree provided "*an opportunity to increase my earning power and advance in the organization*" (Scott, p. 1). A majority of the participants learned about the online degree program from their supervisor, professional association or by searching the Internet.

Six themes related to student experiences in the online program emerged during data analysis. These themes included student perceptions of technology, perceptions of instructional approaches, application of coursework, effective teaching and learning, influence of student and faculty interaction and recommendations for improvement. These themes are consistent with Shelton's (2010) quality scorecard for online education programs. The quality scorecard was developed using the Delphi method with 43 college administrators from public and private institutions serving as experts. These experts agreed upon quality indicators that should be used to evaluate the quality of online degree programs.

Student Perceptions of Technology

Technology plays an important role in the delivery of online degree programs (Shelton, 2010). Data analysis revealed two reoccurring sub-themes related to technology. First, technology provided the flexibility that working professionals desired. Students did not have to be place bound in order to complete the degree program and this was perceived as an advantage. As one student explained, "*For my work I probably travel about 5 weeks of the year so during that time I was able to continue my studies and I could do that from home as well as in the evenings after work"* (Scott, p. 3). This advantage was the sole reason why some individuals enrolled in the program, "*I looked at different college classes a lot of times and having to drive somewhere or be somewhere and this was the only thing that worked*" (Scott, p. 7). One student explained further that it was the only option "*to get continuing education and not have to give up your life and live in Blacksburg*" (Brooke, p. 1). The perception that the online program was "*virtual and it wouldn't impact my work*" (Larry, p. 1) was supported by many participants who posited, "*with my full-time job scheduling normal sit in the seat classes was pretty much out of the question*" (David, p. 1). Another student commented that the program allowed me to "*be a full-time professional while also being a student*" (Larry, p. 1).

The self-paced environment that technology provided was perceived as a benefit. Maggie commented that "being able to work at odd hours and review the lectures and work on the assignments at my own pace" was an advantage of the program (p. 2). This finding is

congruent with several studies that found the flexibility of online courses is attractive for students trying to balance work and family demands (Stanford-Bowers, 2008; Holder, 2007; Nash, 2005).

Two participants were weary of the technology utilized to deliver instruction. Debbie successfully conveyed the feelings of these participants when she described herself as "not that technologically advanced" and that she "felt intimidated" by the technology utilized in the program (p. 2). These two individuals eventually overcame the learning curve as Debbie explained best, "it took a little time to get used to the technology, but it is not that bad once you learn it" (p. 3).

The online degree program also provided individuals who were not technologically proficient the opportunity to learn new skills. As posited by Park and Choi (2009) this sense of personal growth can positively influence student satisfaction, motivation and persistence in online programs. As one student explained:

"*I was not proficient with web use and going to find things; that class really helped me earn how to use the web and be able to search for things and as a result I have encouraged a lot of people in my age bracket to go ahead and try it [online programs] because it is not that bad once you learn how to use the computer programs."*(Brooke, p. 6)

This type of emotional support and encouragement from friends, family and coworkers has been shown to improve persistence of students enrolled in online programs (Holder, 2009).

Perceptions of Instructional Approaches

Instructional design is the practice of creating "*instructional experiences which make the acquisition of knowledge and skill more efficient, effective and appealing*" (Merrill et al., 1996, p. 2). A variety of instructional approaches were utilized by the faculty members in the OMALS program. The primary educational delivery method was Adobe® Connect and Adobe® Presenter augmented by Blackboard© or Scholar© forums and blog postings to facilitate discussion of the course material. Courses that included a mix of synchronous and asynchronous instruction were perceived as the highest quality. One program graduate commented that:

"*Professors that taught in a way that basically gave you a lecture like they would if you were standing in the same room with them or they were in a room with 100 other people, those were, for me were the most beneficial classes because I can read a book, but the nuisances that you get when it is explained helped me learn it faster."* (Brooke, p. 3)

Student experiences with this type of synchronous instruction heavily influenced the student's satisfaction with the course:

"*These classes were probably more like a real class rather than just going online and having a whole bunch of reading assignments, I mean we had that too, which was a good thing, but the whole experience was like being in the classroom rather than trying to teach yourself, which was great."* (David, p. 3)

Asynchronous methodology was cited as beneficial by participants whose preference was to move at their own pace, "I like to move at my own pace so I like the information already up there [on Scholar©] so in case I finish something I can keep going" (Larry, p. 5). Another student commented that the asynchronous nature of forum and blog posts facilitated student interaction:

"*The use of Blackboard© where we could post or ask questions of each other works pretty well because even though we didn't know the others in the class you could kind of get a sense of how they were by what they wrote."* (Neil, p. 3)

Lastly, faculty members that provided lecture materials that could be printed by a student and utilized to follow along during the lecture was cited as beneficial to their experience. Larry commented that "some of the instructors actually had their lectures in a text so you could save them and print them and follow along and highlight" (p. 5). These findings are congruent with Ojokheta (2010) who found that students who are satisfied with the program delivery method are more likely to persist in online programs.

Application of Coursework

Graduates of the program were asked to provide feedback related to the coursework as well as the amount of work required to complete the degree program. The most beneficial courses were those that were perceived as "relating to directly my current job" (Neil, p. 3). One graduate of the program summarized the sentiments of others by positing that she had positive experiences when she:

"*Could apply the coursework immediately to what I was doing in my work as a 4-H agent, which was nice. For example, I took a volunteer management class and there was information about volunteer recognition that I used immediately because it just fell at the time of year that we did our achievement night."* (Maggie, p. 2)

Another student reflected that the coursework was relevant to develop a consulting business:

"*The business plan that we worked on was something that I could use in the future. Just the knowledge about how to approach a business plan and how to understand other people's business plans by doing that one was beneficial. I took that business plan and I am doing very well in business now."* (Brooke, p. 5)

Overall, the courses that were seen as beneficial were perceived as meaningful and were considered to have practical application, "I got to apply my knowledge in a practical way and that was kind of cool" (Brooke, p. 6). Participants perceived some classes as, *"least beneficial only because of what my profession is; it was a great class, but I just do not do anything with the idea of marketing or building a business with what I do professionally"* (David, p. 6). These findings are consistent with research that found students who voice satisfaction with the relevance of coursework to their

individual needs persisted in online degree programs (Park and Choi, 2009).

Quality of communication in online courses has been found to be associated with student satisfaction. Hart (2012) posited, "Ambiguity in content or communication can be difficult for the online student to process, thus increasing the importance of quality interactions with faculty" (p. 32). This is evidenced by the sentiments of students who took a course taught by multiple professors:

"*Each [professor] has different teaching styles and expectations. That made the course almost certainly my most difficult educational challenge I have ever had and I desperately fought my way through that class and I am just amazed that I was able to get through."* (David, p. 3)

Effective Teaching and Learning

Several themes emerged from the data related to effective teaching and learning. The majority of participants preferred engaging instructional approaches. Participants felt satisfied when they were engaged with the curriculum and faculty members. Debbie explained, "*A couple of the classes were really good because it was hands-on types things, you were actually doing things and turning in work the same time you were listening and doing the lectures"* (p. 6). On the other hand, learners with varying styles were satisfied when they were provided with opportunities to learn using their preferred style:

"*I really like the way we went to class. I am a visual and auditory learner. I am more auditory then I am visual and the fact that you could go to class and you could get a PowerPoint® presentation with voice that would talk through the material."* (Brooke, p. 2)

By providing several approaches to teaching and learning, instructors were able to provide experiences that benefit multiple learning styles. Additionally, practices that provided feedback were seen as positive and were perceived by students to improve performance:

"*Some professors had weekly quizzes or quizzes over a section. I think that is a big help because you know when midterm comes or the final at least you are prepared, you know how that instructor thinks and what kind of information they are looking for."* (Debbie, p. 6)

The quality of instructor interaction and feedback improved the students' satisfaction with the online program. Feedback has been found to play a role in student satisfaction (Ivankova and Stick, 2007) and influence student perception of the course content (Ojokheta, 2011). Overall, multiple instructional methodologies and feedback loops enhanced the student experience and improved student satisfaction with the program.

The Influence of Student and Faculty Interaction

The data indicated that student interaction with faculty members is the most influential experience that informs the students' satisfaction and regard for the program and their degree. The theme that emerged related to faculty support was communication. This major theme was broken down into sub-themes: communication before the course and communication during the course. Due to the online nature of this program most students need sufficient time to acquire textbooks:

"*It would be nice to have faster notification in regards to textbooks. Some of the classes that I took, I barely got the textbook in time and it is tough because we are not on campus, we just can't walk over to the bookstore and get it."* (Larry, p. 4)

The majority of students indicated that they would like to be provided an opportunity to meet with faculty before class starts or during the first week of class. The preferences espoused by participants were either one-on-one or group so long as the process facilitated an open line of communication: "I would love to Skype© or have a phone conversation if they are available" (Neil, p. 4).

Communication during the course was perceived by some students as a major source of frustration:

"*A really frustrating thing for me was that pretty much in all of the classes that I took the professors never participated in the online forum so I kind of felt like they were just posting the material that they did the past year and just kind of signing out for the rest of the year. I just didn't feel a professor present at all."* (Maggie, p. 5)

On other hand, students who had positive experiences when communicating with faculty were satisfied:

"*What strikes me is that these people that spent their time teaching all of us they are very accessible if I reach out to them. If I email them they email me back immediately and it is not my feeling that other professionals in that level of education that they are that approachable. That I can reach out and actually get a hold of them and actually get a person to person conversation and then they talk to me level across board. They don't try to hold that higher education that they have above the person they are talking to over the phone."* (David, p. 7)

A key measure of satisfaction, as reported by students, is an open line of communication with faculty members.

Recommendations for Improvement

The majorities of participants in the study had positive experiences and were satisfied with the degree program. Common recommendations that emerged during the interviews were the development of supplemental materials to orient new students, *"from a student perspective and someone who hasn't been a student for a while just trying to find out how to register how to get online. I mean some kind of tutorial would be helpful"* (Scott, p. 8). The majority of participant's indicated that tutorials on the proper use of Blackboard© and Scholar© platforms would be helpful too.

Several participants reported difficulty finding a time-line for when courses would be offered, *"it was difficult to*

stack up some of the courses; it was very tricky trying to lay it out so that I could finish and complete the program when I wanted to" (Maggie, p. 4). A common recommendation was to ensure, *"more variety and more consistent offerings of the classes that are in the course catalog cause a lot of classes I wanted to take, but they were never offered at the time I needed them"* (Neil, p. 4).

Another common recommendation for program improvement was the development of guidelines for final projects. The fact that there was not a written guideline was a source of frustration for some students:

"*I never got any guidelines as to how I could change my idea into a project or report and so finally after doing that for two years and I was coming towards the end of my course work and I just started working on it without the approval of my advisor."* (Maggie, pp. 2-3).

Summary

This study is an initial step toward understanding student satisfaction with an online degree program from the learner's perspective. These findings lead to several recommendations for agricultural faculty members who seek to improve or develop effective online degree programs. The relatively small sample size may not be representative of all program graduates, but based on the results of this case study the following practices could be implemented to improve the marketing of the program and student satisfaction.

First, the completely online nature provides working professionals with the flexibility needed to earn a master's degree with a career-relevant area of specialization. Berger (1999) found that time and place flexibility positively influences student satisfaction. The ability of our participants to complete coursework at their convenience allowed for the successful balance of work and family obligations. It is recommended that the completely online nature of the program should be highlighted when marketing the program to prospective students. For example, Ohio University developed an "MBA without boundaries" in an effort to attract place and time bound individuals into their online degree program (Ohio University, 2013).

Secondly, a majority of the individuals learned about the degree program from their supervisor or professional association and completed follow-up investigation of the program via the Internet; therefore, online agricultural programs should develop a marketing plan that includes a robust online presence and targeted information to agricultural industry groups and professional associations. An online presence could serve as a venue to share positive experiences of program graduates via testimonial videos and print materials. Many individuals placed an emphasis on the ability to advance in the organization as a reason for pursuing their degree. A follow-up study is recommended to determine the career advancement of graduates as well as the realized salary increase as a result of completing the degree program.

Lastly, a majority of participants felt they had limited experience with computers and online educational delivery systems. The perception of these learners is that technology can be intimidating. It is recommended that the coordinator of the program develop tutorials for the technology that will be utilized in the online degree program. The development of tutorials will facilitate the use of technology as a tool to achieve learning outcomes. This recommendation is supported by Arbaugh (2000) who found that perceived usefulness of course software is positively associated with student satisfaction.

It is recommended to provide an orientation session for new online graduate students. This practice is often seen as a valuable experience for students who are on campus. An orientation that provides an overview of the program, technology, expectations and faculty can also serve online students as well. In order to ease student apprehension, technical assistance and support should be provided throughout the degree program. This orientation can also serve as a means to develop relationships between students and teachers. This recommendation is congruent with O'Brien and Renner (2002) who found that a lack of feeling connected to faculty has been shown to be a significant variable that influences student satisfaction. If an orientation session is not feasible, having a point of contact to address technology related questions in order to streamline the process and alleviate technology related requests to the student's adviser or other faculty members who may not be of assistance. Assistance from one source will be more efficient and can be done via email to start and move to other modes of communication to address technology related issues. This will also ensure that the message is consistent for similar problems and the students know that one person or a group will support them.

These findings indicate that students preferred to be taught as if they were in a traditional classroom. Courses that incorporated multiple instructional modalities were often considered the most valuable to graduates. The practical implications are that faculty members should focus on instructional activities that are varied and seek ways to provide interaction with the course materials and students. One way to accommodate various learning styles is to utilize synchronous and asynchronous delivery methods. Options to call into the equivalent course that is offered face-to-face can be done at the students' discretion and the faculty member should make streaming available. By offering the asynchronous students the option to participate in the live class, they may feel as though they are receiving a more traditional setting, have access to more information during the class and interact with the students in the course, offering the feeling that they are participating. It is recommended that faculty or advisors encourage online students to engage with each other to provide camaraderie, support and build professional relationships. Data from cohorts suggests that students who feel supported by their peers persist through their degree program. By encouraging interaction among students, it can foster positive relationships that will aide in the completion of coursework and degree program.

Coursework that was relevant to the individual's career or aspirations was seen as most beneficial and motivated students to continue in the program because they saw the value it would have later on in their career fields. Instructors who augmented course reading with additional insight through personal stories, current events or additional materials and media improved the educational experience of students. It is recommended that course materials be reviewed periodically in order to remain relevant and responsive to the needs of learners.

The ability of the faculty member to design experiences that promote faculty-to-student and student-to-student engagement heavily influenced the satisfaction of program graduates. Those individuals who felt that they did not have an open line of communication were frustrated with the course and online degree program. On the other hand, those individuals who had an open line of communication had positive experiences, developed ongoing relationships with faculty and are advocates for the OMALS program. Improving the lines of communication between faculty and students can have a tremendous impact on the student's college experience. It is recommended that faculty members remain responsive to the needs of online students; feedback on student assignments should be provided in a timely manner. Additionally, faculty members should communicate their preferred method of communication with students enrolled in online courses. Students should also be provided a forum to interact with other students in the online environment. Additionally, it is recommended that the coordinator of the online degree program make an effort to engage students with the institution.

This study provided an opportunity for the College of Agriculture to assess the teaching and learning process using student perceptions and experiences. The following information will be utilized by [college] to improve the online master's degree in agricultural and life sciences. This data should also be taken into account when designing future courses and degree programs in Colleges of Agriculture. By building on the positive results and addressing areas for improvement this degree program can continue to meet the educational needs of working professionals.

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Skills, Knowledge and Abilities Employers Seek in New Professionals Entering Careers in the Fed Beef Industry

K. Williams[1], T. Robertson[1] and L. Kieth[1]
West Texas A&M University
Canyon, TX

Amanda Deal[2]
Northwest High School
Justin, TX

Abstract

Plains Nutrition Council members that make hiring decisions (N=129 surveyed; 47 responded) were surveyed to determine skills, knowledge and abilities employers seek in new professionals entering the fed beef industry and to identify how well prepared new professionals were in these areas. For this study, a "new professional" was defined as a person who had completed or was working toward a masters or doctorate degree and was entering an initial career in the cattle feeding business. Of 41 individual skills employers assessed for new employee preparation, the ability to speak a second language was the only item new professionals were believed to be not prepared. Industry employers who participated in this study valued the importance of integrity, honesty and dependability over all other skills. Other skills employers valued included new employees understanding and following directions, listening, initiative and problem solving. General work experience and career-related employment were found as the most valuable experiential learning opportunities new professionals could acquire. Recommendations were made for all stakeholders to promote character education along with leadership and communication skills through both formal and non-formal means. These opportunities could come in the form of course offerings, conference activities, added responsibilities or extracurricular type activities.

Introduction

Pool and Sewell (2007) defined employability as *"a set of skills, knowledge, understanding and personal attributes that make a person more likely to choose and secure occupations in which they can be satisfied and successful"* (p. 280). Gurcharan et al., (2008) found employability skills are not job specific, but are applicable across all domains as well as all levels of employment. Even though many college graduates possess excellent academic qualification, a major concern from employers is many graduates do not have the right combination of skills and personal attributes (Daud et al., 2011).

In the rapidly changing business world of the 21st century, partnerships between industry and the educational institutions that produce their future employees are vitally important. Nowhere is this more critical than agriculture. To keep the competitive edge American agriculture has in the world requires a skilled labor force. According to Graham (2001), schools are calling for reform to better prepare their students in higher order thinking skills and reasoning skills. Because of immense increase in technology and the rapidly changing agricultural industry, a need has developed to determine what skills the new, entry-level employee needs in order to succeed. Andelt et al. (1997) posited the more is known about the competencies required for an industry the more employable graduates there will be in the marketplace.

The Plains Nutrition Council (PNC) is comprised of professionals from private consulting, cattle feeding companies, allied industries (feed, nutrition and animal health) and research and extension institutions. Its members account for 85 to 90% of the United States feed yard capacity. This group is vital to the proper nutrition, growth and overall well-being of beef cattle fed in our nation's cattle feeding yards. However, PNC members also play a role in helping educational institutions prepare masters and doctoral students to become successful employees within this fed beef industry. For all stakeholders to best serve and prepare

[1]Department of Agricultural Science, P.O. Box 60998, Canyon, Texas 79016; (806)651-2505; Emails:kwilliams@wtamu.edu, trobertson@wtamu.edu, lkieth@wtamu.edu
[2]2301 Texan Drive, Justin, TX 76247, (817) 215-0239; Email: ADeal@nisdtx.org

these students for career success several questions need to be addressed. How prepared for a professional career are students entering the fed beef industry? What employability skills are deemed most important to industry employers? What does the future hold in within the profession?

Theoretical Framework

Human Capital Theory served as the theoretical framework for this study. According to Oded and Moav (2002), investing in knowledge, skills and health of workers not only benefits them as a person, it benefits the employer and potential productivity of the organization. Becker (1975) believed declaring an investment in human capital through education and training is as important as investment in other tangible forms of capital. Higher education is a key to this process by improving the overall skills of its graduates, human capital is grown (Knight and Yorke, 2003).

Harvey (2000) listed two sets of attributes employers desire in their employees: interactive and personal. Communication, teamwork and interpersonal skills were described as interactive attributes required by employers. Intellect, knowledge, willingness and ability to learn and continue learning are all personal attributes needed to be successful in the ever-changing work place. Harvey added the willingness to continue learning has become far more important than knowledge to employers. Simmons-McDonald (2009) stated lifelong learning is a critical factor in the employability of an individual.

In a study of employers, Graham (2001) determined university graduates are prepared to enter into entry-level agricultural positions. Yet, Graham also determined a need for graduates to better demonstrate the ability to work in groups, show leadership, dedication and initiative. This need was theorized as "on-the-job awkwardness" which is potentially explainable by needed growth in business skills or even maturity. Graham (2001) recommended from this finding university curriculum needed to be assessed and continued employer feedback was essential.

Purpose and Objectives

The purpose of this study was to determine skills, knowledge and abilities employers seek in new professionals entering careers in the fed beef industry and to identify how well prepared employers perceived new professionals to be in these areas. For this research a new professional was defined as a person who had completed or was working towards a masters or doctorate degree and was entering an initial career in cattle feeding business. The specific research objectives were as follows:

1. Describe the preparation level of new professionals toward skills, knowledge and abilities as perceived by industry employers.
2. Describe the industry employer's perceived importance of skills, knowledge and abilities needed by new professionals.
3. Determine if difference exists, in the preparation level and importance of skills, knowledge and abilities associated with new professionals to the entry-level positions in the fed beef industry.
4. Determine the value of experiential education in the preparation of new professionals for the fed beef industry.
5. Identify career growth areas in the industry that may affect the preparation of new professionals.

Methodology

The target population of this study consisted of Plains Nutrition Council (PNC) members who make hiring decisions within the fed beef industry (N=129). This group consisted of both private industry employers and post-secondary education faculty. Faculty members were included for their role in hiring masters and doctoral candidates who work on graduate assistantships along with their role in selecting new university faculty.

The survey instrument was a self-administered questionnaire adapted from Graham (2001). Section One of the instrument consisted of items to determine skills, knowledge and abilities needed by new professionals entering careers in the fed beef industry. Employers rated these new employees on their preparedness along with the perceived importance in six areas on a five-point, Likert-type scale. Part Two of the survey was the importance of life experiences for entry-level positions within the industry. Section Three was associated with perceived growth areas for future employment. Employers rated growth areas from one being little growth to seven being significant growth. A panel of three university faculty and four Plains Nutrition Council Members reviewed the instrument to establish content and face validity. Chronbach's alpha was used to calculate reliability of the instrument at .93 (Gliem and Gliem, 2003). Review of the survey instrument by the Institutional Review Board (IRB) at the university was required. The chairperson of the university's IRB approved the research.

Prior to the survey being administered, an introductory letter was sent to prospective survey participants explaining the purpose and importance of the survey. According to Dillman (2000) repeated contact with respondents will increase response rates by 20 – 40 %. Approximately two weeks after the introduction letter was sent, an email was sent with an online link to the survey hosted by Qualtrics.com. Three follow up emails were sent out by researchers. These emails thanked participants who had responded to the survey instrument and encouraged non-respondents their participation in the study was appreciated.

Forty-seven PNC members responded to the survey producing a 36.4% response rate. To control for nonresponse error, comparisons were made between early and late respondents as recommended by Miller and Smith (1983). Survey participants who responded within 21 days of the initial email were classified as early respondents while those completing the survey

after 21 days were classified as late respondents. No statistically significant differences were found between the two groups. Data were analyzed using the SPSS® statistical package for Windows™. For the objectives of this study, means and standard deviations were used for description of the data. With objective three a mean weighted discrepancy score (MWDS) was calculated by taking the importance rating minus the preparation rating and multiplying it by the importance rating.

Results/Findings

Objective One

Objective one sought to describe the preparation level of new professionals toward skills, knowledge and abilities as perceived by industry employers. New professional preparation was divided into five sections titled: interpersonal skills, communication skills, computer skills, character and technical competency. Table 1 lists all items included within the five sections.

Table 1. Employer Mean Values of Preparation Level of New Professionals

Interpersonal Skills	Rank	Mean	SD
Professional Appearance	1	3.41	0.98
Open-minded to new experiences/ideas	2	3.22	0.89
Teamwork skills	3	3.20	0.82
Employee Curiosity	4	3.13	0.89
Initiative	5	3.11	0.99
Willingness to Travel	6	3.00	1.00
Dedication to job	6	3.00	1.03
Etiquette	8	2.91	1.03
Organization skills	9	2.87	0.95
Problem-solving skills	10	2.81	0.97
Creativity skills	11	2.80	0.87
Willingness to Relocate/Move	12	2.65	0.99
Decision-making skills	13	2.64	0.90
Leadership skills	14	2.47	0.89
Global Awareness	15	2.36	084
Management/Business skills	16	1.89	0.87
Communication Skills			
Understand and follow instructions	1	3.53	0.87
Presentation Skills	2	3.24	1.15
Telephone Skills	3	3.16	1.00
Verbal expression in speaking	4	3.11	1.11
Technical writing	4	3.11	1.13
Listening	6	2.93	0.89
Creative writing	7	2.40	0.85
Ability to speak a second language	8	1.43	0.66
Computer Skills			
Ability to use the Internet	1	4.52	0.63
Word Processing	2	4.09	0.87
Spreadsheets	3	3.91	1.02
Databases	4	3.17	1.40
Computer graphics	5	2.52	1.21
Computer Control Systems	6	2.33	1.02
Computer aided design	7	2.27	1.12
Computerized accounting systems	8	1.80	0.73
Character			
Integrity	1	3.56	0.99
Honesty	2	3.53	0.92
Dependability	3	3.44	0.97
Technical Competency			
Biological Sciences	1	3.59	0.97
Physical Sciences	2	3.11	0.84
Mathematics	3	2.93	1.15
Environment Sciences	4	2.77	0.96
Social Sciences	5	2.50	0.63
Humanities/ Fine Arts	6	2.32	0.71

Scale: 5=Thoroughly prepared; 4=Good preparation; 3=Prepared; 2=Somewhat prepared; 1=Unprepared

The first section found in objective one was interpersonal skills and consisted of 16 items. Fed beef industry employers rated new professionals entering the field as best prepared in the area of professional appearance. This was followed by open mindedness to new experiences or ideas, teamwork skills and employee curiosity. Thirteen items produced means over 2.50 indicating the new employees were perceived to be prepared in these areas. The interpersonal items with mean scores less than 2.50 were management/ business skills, global awareness and leadership skills.

Communication skills were listed in section two and contained eight items. Survey participants deemed new professionals as having good preparation in the ability to understand and follow directions. The next highest rated item was presentation skills. Generated mean scores reflected new professionals to be prepared in six of eight communication items. Ability to speak a second language was rated as the least prepared communication skill.

Eight specific items were measured under computer skills. Ability to use the internet produced the highest mean. Word processing and spreadsheets ranked second and third for preparation. Least preparation was determined to be computerized accounting systems and computer aided design.

Entry-level preparation looked to describe how well new fed beef employees exhibit a variety of character skills. The three items listed under character were honesty, dependability and integrity. All three items produced similar means. Integrity yielded the highest mean and was closely followed by honesty and dependability.

Employers participating in this study were also asked to determine the level of preparation of new professionals in the technical areas of curriculum. From this employers determined this group to be most prepared in biological sciences, physical sciences and mathematics.

Objective Two

Objective two aimed to describe the industry employer's perceived importance of skills, knowledge and abilities needed by new professionals. With this item researchers hoped to capture the skills employers attached the most importance to with new employees. The items discussed in section one, along with an additional section associated with specific coursework for graduate students, were assessed by survey participants. Table 2 displays findings for all items.

For interpersonal skills thirteen items rated as very important by employers yielding a mean greater than 3.50. The interpersonal skills survey participants rated as most important were initiative, problem-solving skills, dedication to job and decision making skills. Although all items generated means over 3.00, the least important items were determined to be global awareness, creativity skills and willingness to relocate.

Employers regarded listening as the most valuable communication skill. The next highest means were produced by verbal expression in speaking, understand and

Table 2. Employer Mean Values for Importance of Skills Needed

Interpersonal Skills	Rank	Mean	SD
Initiative	1	4.41	0.65
Problem-solving skills	2	4.40	0.61
Dedication to job	3	4.22	0.79
Decision-making skills	4	4.21	0.66
Teamwork skills	5	3.98	0.75
Leadership skills	6	3.77	0.90
Open-minded to new experiences/ ideas	7	3.73	0.69
Management/Business skills	8	3.66	0.82
Willingness to Travel	8	3.66	0.86
Organization skills	10	3.62	0.68
Professional Appearance	11	3.56	0.76
Etiquette	12	3.52	0.81
Employee Curiosity	13	3.51	0.86
Willingness to Relocate/Move	14	3.40	0.96
Creativity skills	15	3.39	0.95
Global Awareness	16	3.14	0.77
Communication Skills			
Listening	1	4.38	0.61
Verbal expression in speaking	2	4.11	0.83
Understand and follow instructions	3	4.02	0.75
Presentation Skills	4	4.00	0.77
Telephone Skills	5	3.61	1.02
Technical writing	6	3.55	0.93
Creative writing	7	3.02	1.13
Ability to speak a second language	8	2.50	1.04
Computer Skills			
Spreadsheets	1	4.10	0.82
Word Processing	2	3.83	0.82
Ability to use the Internet	3	3.80	0.90
Databases	4	3.48	1.09
Computer Control Systems	5	2.56	0.98
Computerized accounting systems	6	2.43	1.04
Computer graphics	7	2.23	1.01
Computer aided design	8	2.07	1.00
Character			
Integrity	1	4.96	0.30
Honesty	2	4.84	0.42
Dependability	3	4.82	0.44
Technical Competency			
Biological Sciences	1	4.30	0.77
Mathematics	2	4.21	0.80
Environmental Sciences	3	3.36	0.97
Physical Sciences	4	3.32	0.80
Social Sciences	5	2.65	0.92
Humanities/ Fine Arts	6	2.11	0.87

Scale: 5=Extremely Important; 4=Very Important; 3=Important; 2=Somewhat important; 1=Unimportant

follow directions and presentation skills. Ability to speak a second language was expressed as the least important communication skill by employers in this study.

Spreadsheets, word-processing and ability to use the internet were ranked as the three most important computer skills valued by survey participants. The next closest items were databases with a mean of 3.48 and computer control systems with a mean of 2.56.

The three items survey participants evaluated with character and importance all produced mean scores close to 5.00 (Extremely important). The mean scores produced for the three items were 4.96 for integrity, 4.84 for honesty and 4.82 for dependability.

In the technical areas of curriculum the employers who completed the survey instrument placed the greatest importance upon biological sciences. Mathematics produced the second highest mean and was followed by environmental sciences and physical sciences.

Finally within objective two employers rated the importance of eleven academic courses for graduate students. The courses employers rated as most important to new professionals entering the fed beef industry were nutrition courses, leadership courses and research methods courses. The courses with the lowest means were social science, human resources and foreign language.

Objective Three

The third objective aimed to determine if difference exists, in the preparation level and importance of skills, knowledge and abilities associated with new professionals to the entry-level positions in the fed beef industry. An overall mean for interpersonal skills, communication skills, computer skills, character and technical competency was calculated for preparation and importance. The difference between these two sets of numbers (multiplied by importance rating) was also figured as a mean weighted discrepancy score (MWDS). Table 3 shows complete findings for this objective.

The section of character produced the highest overall mean score for both importance and preparation. However, this section also had the greatest MWDS at 6.64, indicating the largest need for better preparation of graduates. The next greatest MWDS was found between importance and preparation in the area of interpersonal skills. A similar MWDS was found for the area of communication. The smallest MWDS between perceived importance and student preparation was for computer skills.

Objective Four

The fourth objective of this study looked to determine the value of experiential education in the preparation of new professionals for the fed beef industry. Eight items comprised this objective and were led by general work experience closely followed by career related employment, career related internship and thesis/ dissertation. The four experiences employers put the least value toward were international experience, officer

Table 3. Overall Mean Weighted Discrepancy Scores(MWDS) for Employability Skills

	Preparation		Importance		
	Mean	SD	Mean	SD	MWDS[z]
Interpersonal Skills	2.84	0.38	3.76	0.38	3.46
Communication Skills	2.86	0.66	3.72	0.71	3.20
Computer Skills	3.08	1.00	3.06	0.82	0.04
Character	3.51	0.05	4.87	0.06	6.64
Technical Competency	2.87	0.45	3.33	0.86	1.51

[z]MWDS=(importance-preperation) x importance

Table 4. Perceived Value of Experiential Education by Employers

	Rank	Mean	SD
General Work Experience	1	3.86	0.88
Career Related Employment	2	3.70	0.88
Career Related Internship	3	3.52	0.98
Thesis or Dissertation	3	3.52	1.27
Bilingual	5	2.65	1.09
Active Student Club Member	6	2.26	0.93
Officer of a Student Club	7	2.16	0.94
International Experience	7	2.16	0.97

Scale: 1=not important; 2=somewhat important; 3=important; 4=very important; 5=extremely important

of a student club, active student club member and bilingual. Complete results are listed in Table 4.

Objective Five

The fifth and final objective of this study identified changing trends in the industry that will affect the preparation of graduate students for the fed beef industry. Specifically top growth areas for employment in the fed beef industry for the next five to ten years were evaluated. Technology knowledge was projected to have the most future growth potential. This future growth area was followed by data management, logistics and international relations. The area determined to show the least future growth was cooperative extension. Table 5 highlights scores for the fifth objective.

Conclusions

Of the 41 individual skills assessed in this study, the ability to speak a second language was the only item where employers perceived new professionals to be unprepared but this was also the lowest ranked item in importance by employers. On the other end of the scale new professionals were felt to be most prepared in regards to the three computer skills which included use of the internet, word processing and spreadsheets. Other items employers felt entry-level employees had received good preparation included technical competence in biological sciences, the ability to understand and follow directions in communications and all three skills listed under character. Professional appearance and open minded to new experiences were the highest rated items measured under interpersonal skills.

Employers who completed this study rated 36 items higher in importance than preparation. Integrity, honesty and dependability were the three skills survey participants valued as having the greatest importance. Other skills employers ranked highly were ability to understand and follow directions, initiative and problem-solving skills. Items determined to be least important in this study included four of the eight computer skills along with the ability to speak a foreign language.

In evaluation of differences between preparation levels and importance of skills, the area of character produced the greatest separation of means. This was due primarily to the high value placed on the importance of character; new professionals were evaluated to be best prepared in these skills. The other two skill areas that highlighted a potential need for improved education or training were interpersonal skills and communication. Less need for enhanced preparation of new professionals was found for technical competence in curriculum and computer skills.

Employers valued general work experience and career related employment as the most valuable experiential learning opportunities new professionals could acquire. Not surprisingly, course work was shown to be most valued for nutrition. This was followed by courses in leadership and then research methods. The projection of top growth area for employment in the fed beef industry within five to ten years showed technology knowledge, data management and logistics as having the most potential for future growth.

Table 5. Predicted Change in Trends Relative to Employment in the Next 5-10 Years

Career Areas	Rank	Mean	SD
Technology Knowledge	1	5.35	0.97
Data Management	2	4.95	1.27
Logistics	3	4.88	0.97
International Relations	4	4.67	1.29
Consumer Relations	5	4.57	1.13
Cattle Health Assessment	6	4.56	1.35
Cattle End Point Selection	6	4.56	1.37
Communications	8	4.53	1.30
Education & Training	9	4.33	1.18
Middle Management	10	4.12	1.13
Ingredient Procurement	11	4.07	1.42
Equipment Knowledge	12	3.90	1.30
Marketing Consultant on Staff	13	3.88	1.22
Nutrition Consultants on Staff	14	3.76	1.30
Upper Management	15	3.74	1.18
Cattle Procurement	16	3.63	1.40
Veterinarian Consultant on Staff	17	3.60	1.22
Human Resource Management	18	3.37	0.95
Grazing Management	19	3.37	1.13
Cooperative Extension Agents	20	1.88	0.96

Scale: 1= Little Growth in this Area; 7=Significant Growth in this Area

Recommendations and Implications

The target population of this study consisted of Plains Nutrition Council (PNC) members who make hiring decisions within the fed beef industry (N=129). This group consisted of both private industry employers and post-secondary education faculty. Forty-seven surveys were completed for a response rate of 36.4%, caution should be utilized in interpretation of results and generalizations to other populations should not occur. However based on this benchmark data it is recommended all parties involved consider the following:

1. Fed beef industry employers who participated in this study valued the importance of integrity, honesty and dependability over all other skills. Additionally, survey participants believed new professionals entering the field had received good preparation in this area. However the greatest discrepancy between skill importance and preparation was found between these three items. With this in mind, new fed beef industry professionals need not take the significance of character for granted. Further, those teaching and training future employees must remember the importance of not only teaching character skills, but also of modeling these characteristics. With this all business professionals should recall education of students or even employees does not just include training associated with technical skills, but also personal attributes such as honesty and integrity (Harvey, 2000).
2. Each year PNC members meet at their annual conference in order to share information and exchange ideas. This gathering includes industry professionals, university faculty and masters and

doctoral students looking to enter the profession on a full time basis. One feature of the conference is a poster competition for the graduate students in attendance. This study supports the inclusion of this activity to enhance the student's communication skills. Discussions of research along with follow up questions and answers can promote better listening and oral communication skills. In this study a slight discrepancy was shown between importance and preparedness for listening which ranked as the most important communication by employers but was in the bottom half of this category for preparation. Findings also showed employers valued all verbal skills ahead of either writing construct with exception of ability to speak a second language. Additional communication within the conference is recommended between personnel in private industry and our educational institutions. Although informal conversations occur between these two groups, round table discussions might provide a formal avenue to address best opportunities to enhance and update curriculum along with other educational activities. Past research supported discussions such as this (Graham, 2001; Oded and Moav, 2002; Becker, 1975; Knight and Yorke, 2003).

3. General work experience rated as the most valuable experiential learning opportunity by participants in this study. This information should be shared with undergraduate or even high school age students. Career internship opportunities should also be explored by both graduate and undergraduate students alike based on study findings. It is plausible this experiential education will heighten student's abilities in understanding and following directions, initiative and problem solving.
4. In line with the profession, nutrition courses were ranked as most important to entry-level employees with ties to the Plains Nutrition Council. However leadership courses came in second out of the 11 course options. This was ahead of research methods, biochemistry and statistics. However, leadership skills ranked near the bottom for preparation of all interpersonal items. With this university, faculty should look for curriculum opportunities to enhance leadership development of its graduate students. These opportunities could come in the form of course offerings, added responsibilities or even extracurricular type activities. PNC members should also explore potential leadership workshops at its annual conference or other educational events graduate students might attend.
5. This study provides baseline data regarding the perceptions of PNC members who make hiring decisions relative to new employees and their level of preparation for entry-level jobs. More in-depth research with employers should be performed to add to this pool of data (Graham, 2001). An additional study with new fed beef industry employees should also be conducted to analyze their self-perceived preparation level relative to their new career. Further, qualitative research methods such as one on one interview and focus groups should be considered as well. As previously stated, the more is known about the competencies required for the industry the more employable graduates there will be in the marketplace (Andelt et al., 1997).
6. Although entry-level employees were considered to be prepared for entry into the fed beef industry, room for improved training of graduate students was also shown. Industry employers should keep in mind all new employees no matter age or experience will require some level of training (Graham, 2001). Graduate students entering the fed beef industry should also keep in mind the value of personal initiative in learning a new career. All stakeholders should also be aware of the need for continual assessment of best educational practices for best preparation of future fed beef industry employees.

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PRIORITIES AND INTERPRETATIONS OF TECHNICAL EDUCATION

by Bruce W. Emanuel
Professor – Animal Husbandry
Division of Agriculture & Natural Resources
Agricultural and Technical College
Cobleskill, New York

From all segments of society comes mounting evidence against the status quo in education. Many observers are convinced that education is in need of significant reform. Citizens are demanding that educators be accountable for their use of public funds and for the outcomes of education. They are asking for evidence of student behavioral changes in response to educational programming.

In the past, educators have been concerned with program standards such as classroom size, availability of display equipment, the appropriateness of visual aids, and other items of a tangible nature. Process evaluation also examines student-teacher ratio, amounts of money budgeted for instructional materials, and salaries for instructors. In itself, however, a process evaluation is not an adequate measure of program effectiveness.

Accountability is readily accepted but rarely demonstrated by those in the classroom. Yet achievement of goals in technical education, when compared with a purely academic achievement, should be relatively easy to measure. Manipulative skill is allied to some degree with almost every technical program and the results of that skill can be quite evident. Such goals as the appropriate mathematical dimensions on a drawing can be measured to effectively evaluate the end product of classroom work.

What seems to be lacking is the instrumentation to carry out a thorough and complete evaluation. We do not have measures to show our accomplishments. The challenge is to draw up acceptable means of analyzing achievement of both a theoretical and performance nature. These would show that educators within the program are meeting their stated goals through proper instruction and curriculum.

Training for More than Skills

However, we must recognize that instructors as professionals are responsible for a level of learning which goes beyond training for technical skills. Professionals, by definition, do not subscribe to a fixed set of common beliefs and behaviors. Professionals do differ as to what constitutes sound professional practice. Dependence on accountability tends to limit the curriculum to those lesser learnings which are subject to classification and quantification. Critics of accountability deplore its seeming potential for neglect of the greater learnings such as development of capacities to raise questions, synthesize ideas, trust one's own insights, make independent critical judgments, make autonomous choices, and specify one's own goals. The professional educator assumes responsibility for these greater learnings along with his commitment to skill development.

In working toward more effective evaluation of their programs, instructors must know clearly the intent of each course they teach. In addition, they must faithfully adhere to the objectives entrusted to them, must develop effective methods to enable students to achieve those objectives, and must realistically test progress and accomplishment. In other words, a good accountability program is one that not only establishes goals but sets up procedures for reaching those goals.

The following are some suggested factors that can be used to evaluate student performance in a viable technical program.

1. Knowledge of subject matter
2. Quality and quantity of achievement
3. Ability to work independently
4. Creativity and imagination
5. Acceptance of responsibility
6. Ability to communicate and work with others

The Technical Student

In evaluating technical education programs, it is important to remember that educational institutions and programs exist primarily for the purpose of educating individuals. So much is said and written about curriculums, physical plant, equipment, faculty, and similar topics that one could easily get confused about the ultimate purpose of education. In evaluating the worth and efficiency of technical education, we must remember that the primary goal is to answer the needs of individual students.

In order to gain a better understanding of the technical student as an individual we must look for the answers to some specific questions about him. Where do students come from, what kind of people are they, and what do they want? What do they actually achieve in school and what is their place in industry? Where do they fit into society and what recognition does society give to them?

Factors in Choosing a Technical Education

Federal-state expenditures are projected toward a student capacity in two-year technical institutes of 750,000 by 1975. Will we have the enrollment to fill this capacity? A student's preference for a technical education is often the result of a desire both for constructive achievement and to please others. But a survey conducted at the University of Syracuse indicated that the desire to please others often dominates the drive for achievement. If a student has a choice of being either a good technician or a poor lawyer, too often his parents would rather have him be a poor lawyer – and that is what he becomes. The chief conclusion of a majority of student surveys is that parents play the major role in their children's choices of (1) post-secondary education as well as later career decisions – much more of a role, for instance, than guidance counselors.

Peer-group opinion is a critical factor in the way the technical school program is perceived by students. The chance to enter a well chosen career field, to learn an occupation and to assume an adult role should be emphasized. Satisfied and successful technical education students are the one best advertisement the program can have. Well trained, productive graduates will provide the community with an important on-going positive evaluation of their education.

Individual Interests

It is often very difficult to discover just which students would prefer the job of the technician over that of the engineer or scientist. Most young people are not really sure just what it is they prefer to do. They are confused at the many possibilities available to them in their choice of schools. In addition, those who advise young people are not always entirely aware of what the job of an engineer or scientist entails. A special aptitude in science and mathematics would certainly indicate a capacity for one of these professions. But is this what the student really wants?

Some advisors seem hesitant to recommend a good student to a program of higher education which does not qualify him for a bachelors degree. Students themselves are also unlikely to select a technical institute program as a higher education goal. Smith and Lipsett (4) point out that on questionnaires many students unrealistically will list prestige occupations such as physician, lawyer, and accountant as career goals. Even though they may not really prefer the professional field, they feel the social pressure for the bachelors degree. This concept was further discussed in the report of the Panel on Two-Year Programs (3) in the June 1971 issue of the NACTA Journal.

Characteristics of the Technical Student

In this discussion of evaluating technical programs, it may be helpful to summarize some of the characteristics common to many technical students. The majority of these students are 18 to 20 years old. At this age a person is still learning who he is, and what he really feels. It is the time during which he differentiates himself from his culture, though on the culture's terms.

In many respects the college is not an agent which influences changes in society through its students; rather, it is an arena in which social forces interact, with students, instructors, and administrators playing familiar roles. The college provides its graduates with a degree which is becoming increasingly important in the search for a decent job in an impersonal society.

The college also transmits some of the knowledge, intellectual skills, and attitudes on which the tradition of Western civilization depends. It continues to contribute to the development of a middle class with some background in the arts, discriminating in consumption, and anxious to maintain a broad interest in its involvement in world affairs.

Another important function of the college for the young adult is to clarify for its students the meaning of their experience of life in their society. The young people of the community need a firm and solid philosophical apparatus for making sense out of their lives, and for communicating with other people.

Growth of the college student can and should lead to a completely human adulthood, defined as the development of a stable sense of self. Our colleges should be places where you can not only learn to be a repairman, a store manager, a food inspector, or a laboratory technician, but learn that you are good at it, and in which your awareness and pride in being good at it become a part of your sense of being you.

The greatest safeguard to any democracy is a continuing community of self-respecting young people who understand and accept their relationship to society. The basic unit of such a community is a stable self to respect. How can all professional members of the educational community cooperate most effectively in the use of their talents to help our young people achieve this goal? In our concern to improve the evaluation of technical programs, we must keep in mind not only the content but also the concepts to be promoted through the educational process.

Use of Student Committees in Evaluation

Student involvement in planning and evaluation can be of significant benefit to a forward-looking technical program. Students represent an untapped source of assistance in the management of the educational system.

Student committees could be set up in an advisory capacity for the technical educational programs in the college. Some of the areas in which these student committees would be most effective are discussed below.

1. Participation in conducting follow-up studies of former students. Student committees could design instruments for follow-up studies, locate former students, respond to items on the questionnaire before distribution, help to analyze follow-up returns and make recommendations based on responses from former students. These activities could be used to help students gain valuable insights into their own future career problems and opportunities.
2. Discussing and reacting to the college's statements of philosophy, goals and objectives. Students could review philosophy, incorporate concepts of their own, and make recommendations that would add a touch of student realism. If students are given a say in philosophy, policy, rules, and procedures, their actions are more likely to support the decisions made.
3. Assisting in evaluating the technical program and formulating recommendations for improving the educational program. Students can provide remarkable insights for improving educational programs. Students holding part-time jobs related to their training have a unique background for appraising the merits of their educational experiences.

The mechanics of formulating and organizing student committees can be very important to the success of such a program. Student committees should be formulated on the basis of selection by instructors and selection by students with staff approval. Committee members should meet predetermined standards based on citizenship, scholarship, school activities, and attendance. The committee should be representative of the student body and should include students from all ethnic, social, and economic groups represented. Guidance and support from faculty advisors is of paramount importance for the successful performance of such a committee.

Committees should hold regular meetings, with a well planned agenda for each meeting worked out by the committee officers and advisors. Without sufficient planning, committee meetings can easily degenerate into gripe sessions. With proper planning, they can be valuable to all concerned. The successful operation of a student committee depends to a great extent on the attitudes and openness of instructors and administrators. Students have much to contribute to our program improvement efforts. They should be helped to do so in a systematic, organized manner.

Evaluating the Performance of Graduates

Evaluation of technical programs by instructors, administrators, and students can give data that fills in only part of the total picture. Still another area must be explored in greater detail. What is actually happening to our graduates? Are our graduates finding employment consistent with their aspirations, capabilities, and interests? Do the dropouts find satisfactory employment? If not, what does happen to them?

We need to increase our use of external measures to evaluate the performance of students after they complete their undergraduate training. The follow-up study is still the best technique available. Such evaluations must be conducted over a substantial period of time – much longer than a single year or two. Concentrated use of a variety of these measures would provide hard data to support the value of the many programs training personnel for responsible positions in the technical field.

Students who leave college without completing their programs should be included in these studies. Many technical college students enter employment before graduation. Some of the questions which should be answered are: why did they leave college, are they employed in the field of specialization for which they were training, did their post-secondary training help them on their present job, and would a degree have been of additional benefit.

Questionnaires should be carefully planned. For maximum efficiency, information available in college records should not be included elsewhere. This would reduce the length of the surveys, and might encourage greater response.

Another important factor which should receive consideration is undergraduate employment experience. Many college students are employed part time, and this employment is often directly related to their field of study. In reporting post-college circumstances such as salaries, position levels, and career advancement, sensitive evaluation requires that distinctions be made between students who attended college to gain career

entry skills and those who already had work experience when they enrolled. Certainly the progress students make and comparisons between student potential and actual accomplishment must also be taken into account.

In evaluating the performance of graduates, more attention should be given to long-range follow up studies. Lifetime career development information in the occupational fields of the graduates is needed to fully understand the educational preparation most suitable for students in given occupational areas.

One example of a long-term follow up of graduates of vocational training is that done by Dr. L. O. Brockmann in 1970(2). Dr. Brockmann sent questionnaires to 615 former students of Fergus (Montana) High School, who had enrolled in the cooperative training program between 1930 and 1944. Approximately 70% of these were returned, and formed the basis for Dr. Brockmann's report, **Cooperative Work Experience Education – A Study in Success Twenty-Six to Forty Years Later.**

Surveys of this type could be very helpful in evaluating the results of our technical programs, giving a more complete and valid picture of the strengths and weaknesses than can be seen from a survey of graduates of only one or two years. Consideration should be given to selecting a representative sample of each class who would be surveyed at specified intervals after graduation. Continuing studies and reports on their progress and changes in attitudes could be most helpful in evaluating the worth of educational programs in our schools. Dr. Brockmann establishes excellent guidelines that could be used to good advantage in preparing long-range follow-ups of technical students.

Conclusion

In an educational climate which is operating on increasingly limited resources, those programs that can prove their worth through concrete data will have the best chance for survival. The big hurdles to educational program improvement are the barriers in the minds of people. Unless citizens, students, and educators are personally involved in designing and conducting the effort to improve educational programs, it is not likely to result in much success.

Research in technical education has been minimal. The need for broad, in-depth research is apparent in such areas as the process of technical education, individualized instruction, core curriculum development, uses of community facilities, program cost, optimal number of students, and individual versus group hands-on training.

The strength of technical education programs has come from their flexibility and responsiveness to changing needs of students and industry. These qualities can only be maintained through continuing evaluation of the effectiveness of the programs now being offered. Most important of all, this work needs to be carried on with an increasing depth of perspective and a clear sense of purpose and commitment.

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Coaching Student Teams: Guiding Students Through Team-Based Learning Experiences

Many of my student's most impactful learning experiences aren't necessarily the ones that happen in the classroom, but rather the ones that build on those in-class experiences through team-based competitions. Not only do I form the strongest connections to the students that are on teams that I have coached, but it seems that those experiences stay with the students much longer than a typical class as well. From case study competitions to being on a livestock judging team, these experiences challenge students to apply concepts, make decisions, and to think on their feet, as well as develop communication and leadership skills. Competition against other university teams can be a very motivating experience for students, however successful management of those teams can help facilitate an even more impactful learning experience for students and help to develop self-efficacy skills that will be essential for them to become lifelong learners. The steps outlined below highlight my techniques for helping students to get the most out of their team based experience.

Develop a Strong Commitment Early

Regardless of the number of students interested in being on a team, making interested students work to show their commitment creates a strong buy-in from the beginning. Students on my teams apply for a spot on the team with a written application and then, if they make it past that round, have a scheduled try-out presentation and interview. The students that are awarded a spot on the team, have already showcased their willingness to put in effort to the team and, likely, feel proud of their accomplishment of making the team (even if only a small number of students apply to be on the team). This process creates buy-in from the beginning and contributes to the team's motivation.

Team Building

Once the team has been formed, I like to structure opportunities for the students to get to know the contest, their team members, and their own skill sets. By creating opportunities for students to assess where their skills may come in valuable, it also creates an opportunity for them to get to know each other better and value the individual contributions of each team member. Some examples of the tools for assessing personal strengths I have used include Myers-Briggs, Strengths Finder, and the Fascination Advantage.

Identification of Learning Goals

As students get a little more comfortable with the project, the team, and their role, I ask them to identify at least five personal learning goals that they would like to personally accomplish through participating on this team. Establishing learning goals requires students to reflect on areas of weakness, as well as skill sets that are going to be valuable as they move into the real world. Through the metacognitive process of identifying learning goals, individual team members develop a clearer sense of what they are working towards, beyond just "winning" the competition.

Weekly Progress and Feedback

A critical part of becoming a lifelong learner is the ability to be self-regulated toward individual learning goals. By asking students to assess their progress toward their learning goals each week, the students are forced to go through a self-assessment process. In addition, as coach of the team, I gain a better sense of the efforts going into the project and an opportunity to provide personalized feedback to each student.

Reflection on Progress and Learning

Regardless of the outcome of the contest the team was preparing for, the process of reflecting on the experience and the student's progress to their learning goals, typically reveals significant learning. While often that learning occurs related to specific skills necessary for the nature of the competition (e.g. marketing, finance, livestock evaluation), perhaps even more significant is the learning related to the development of soft skills (e.g. communication, leadership, conflict management). In addition, by reflecting on how far they have come toward their learning goals(or in some cases, how far they still have to go to achieve their learning goals), students obtain a better sense their own self-efficacy.

Coaching student competition teams can take a lot of time but, for me, it is some of the most rewarding time invested in teaching. The growth and the skills

that the students gain through the team experience, is worth every minute spent invested in the experience. The process of building a strong foundation through commitment, team building, and goal setting, followed by active self-assessment and reflection on the growth seems to maximize the return on that investment for both the coach and the students as lifelong learners.

Submitted by:
Lindsey M. Higgins
Assistant Professor
Department of Agribusiness
California Polytechnic State University
San Luis Obispo, CA
higgins@calpoly.edu

Git 'er Done: Publish Those Dusty Papers

More often I hearing reports that contemporaries of mine are changing jobs or retiring. Much of this is due to age, but some of the career volatility is due to a lack of funding to keep a viable research program alive at an academic institution. In many cases, it is easier to become an administrator--or, to simply retire, and a significant number of meat scientists/muscle growth biologists (and likely others in different fields) are fading away, and their scientific voices are becoming quiet.

I have heard some say that if they cannot keep a grant funded, then they are a failure. Wow! Really? I have written numerous articles for this (and other) journals suggesting that academic institutions are broken [1,2], that faculty members are the institution (college or university) banker [1], and that there are other ways to accomplish research goals [3], or to be happy in an academic situation even in light of dismal funding success [4]. Lack of funding is a universal problem, right now, but there are many things we still need to do right [5] in order for students [6] to have a successful academic experience.

With these things in mind, and considering that once diverted into a different area (administration or retirement) your scientific presence [7] will begin to diminish. Your residual discoveries may fade and whatever you have not published [8] will (likely) not be published by others. So, as an offering from someone that has been in academia for 30 years--please publish residual, partial, semi-completed papers prior to leaving your position. Why? No one will ever remember how much grant dollars that you generated in your lifetime of academic struggles. People will remember teaching, advising, learning, career, scientific and other papers that you published. Your final offerings may excite someone else to enter the field, or to make a career decision. One does not know. However, finishing this kind of work will allow you to leave on your terms--knowing that you left it all (at work). Consequently, it is my advice to Git 'er Done: Publish those dusty papers.

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Submitted by:
M.V. Dodson
Professor of Animal Science and Scientist
Washington State University

Communicating Expectations

Reviewing end-of-term student evaluation comments called into question my tried and true method of one-way communication of course expectations. When a dozen students, over ten percent of one class, submitted a comment indicating instructions were not clear on one or more of the activities or products on which they were evaluated, I initially was puzzled. It is rare when I cannot answer a student's query or claim regarding unclear expectations with a quick reference to the syllabus or other written instructions. And, students have traditionally been satisfied by my reminder reference to where they can find the instructions we have previously covered.

I expect accountability of students, but I also put considerable value in the concept that if the student is not learning, the instructor is not teaching. I had to work to facilitate student-accountability for course expectations. I have long made available to students in writing my detailed expectations. I needed to make sure they were motivated to access, understand, and follow them. I have had success in doing so using three methods.

First, I spent considerable time explaining the source of my expectations in the hope understanding the purpose of an assignment, requirement or course rule will better motivate them to do their best to complete or follow it.

Second, I test students over my expectations. Students take a quiz over the contents of the course syllabus. To successfully complete the quiz, students must conduct a careful review of the key expectations and procedures of the class, both covered in detail in the syllabus. Currently, I ask detailed questions and therefore allow students to use the syllabus while taking the quiz, but one might also offer an unaided test of their understanding.

Third, I have students grade examples of the products they will submit. In one class, I require two papers, each of which comes with a specific grading rubric designed to test their ability to translate an assigned experience in the context of course material. Prior to this exercise, students not following formatting or content instructions would often explain that they did not know about or understand them. Grading a paper based on their assignment prior to submitting their own helps empower them with the knowledge and an understanding of my exacting expectations.

While some have questioned the value of the last two activities, student work has benefited from including them in my class and student frustration with the level of detailed guidance I provide has decreased. The students benefit when I ask them not only to listen to or read my expectations but to recall and translate them in the context of their application. Even in teaching, perhaps especially in teaching, leadership is stronger with two-way communication.

Submitted by:
Cheryl J Wachenheim
Associate Professor
Agribusiness and Applied Economics
North Dakota State University
cheryl.wachenheim@ndsu.edu

The Golden Ticket: A Strategy for Time Management and Decision-Making

Introduction

Time management and decision-making are life skills that instructors encourage in students to make the most of their college experience and prepare for the demands of new careers. Developing time saving and decision-making strategies can be easier for students if they have options to help them as they consider priorities and time allotment for classes and projects. I encourage students in my landscape design class to plan their semester work schedules as much as possible in advance, including establishing pre-deadline due dates and accounting for outside activities that may conflict with their course work schedule. To help them, the course syllabus includes a “golden ticket” that students can use as a time management/decision-making tool.

Procedure

The golden ticket–a form printed on gold colored paper–can be used to request additional time to complete any one of the required class projects, with the exception of the last project of the semester. If a student needs more time to complete a project they can fill out the ticket to request a later due date. However, the ticket can only be used one time, so students must give serious deliberation and consider the possible need for the ticket in the future. The request must be made no later than the class period before the project is due. For example, my class meets on Mondays and Wednesdays and projects are due on Wednesdays, so they must present their ticket for approval no later than the Monday before the Wednesday due date. Once the ticket request has been approved, they have until the next class period, on Monday, to turn in the project with no penalties.

To make a request the student must bring the golden ticket form to class and ask for the deferred date in person. The instructor notes the revised due date on the form and the student and instructor both sign the form. Signatures go on the top and bottom of the form and the instructor keeps the bottom half of the ticket for their records. It is important to keep the bottom half of the ticket for proof that the student has already used a ticket, which will deter them from borrowing another student’s ticket to make a second request. The students are encouraged to review their semester class schedule and save the ticket to use when they might need it most -- when multiple assignments are due at the same time in their classes, when the big game is coming up, or simply because they want more time to work on the project – the ticket can be used for any reason, no questions asked.

Assessment

Some students plan ahead and know exactly when they will use the ticket, saving it for a particularly busy time in the semester, which is typically around mid-term exam time. Others simply save it as an emergency back-up in case the need comes up; however, most students never use it. As the instructor I have recommended to students on a few occasions to consider using their ticket for additional time (usually over the weekend) to work on their project and improve it. Most students will take my recommendation if they have time- knowing that their grade will probably improve- while others choose to save it or simply don’t have the time to work on the project. For some students it’s a point of pride to not use the ticket, but all students, even if they don’t use the ticket, say it’s nice to know they have the option if they need it.

Submitted by:
Gail Hansen de Chapman
University of Florida- Gainesville
Environmental Horticulture Department
ghansen@ufl.edu

A Resourceful and Interactive Method to Teach Students about Cell Division

Cell division is a biological process that is covered in a multitude of science courses, from the introductory to the advanced levels. Classes often cover different aspects of cell division at multiple levels, including mitosis and meiosis. Despite continued exposure and repetition to the topic of cell division during students' academic careers, they continue to trivialize the process. Anecdotal observations indicate that a large proportion of undergraduate students find cell division a mundane, unimportant and obsolete topic. Perhaps students perceive cell division in a negative connotation because it continues to be a difficult concept to understand despite repetitive exposure to the topic. When discussing mitosis or meiosis with an undergraduate student, it is often quickly apparent that they are insecure about the mechanisms of the process. Rather than trying to improve their understanding by increasing the frequency of teaching mitosis and meiosis during their education, perhaps the way in which cell division is taught should be reevaluated.

Creating multiple ways in which students can connect with the material being presented increases the understanding and retention of the material. Howard Gardner (1993) identified the different intelligences that can be stimulated during learning to increase understanding. Having students recreate or demonstrate biological mechanisms through in-class guided performances or skits, targets the visual-spatial and bodily-kinesthetic intelligences.

Recreating complex processes using students and props during class can be used as a vehicle for learning in multiple instances in numerous courses. This teaching tip will explain how learning mitosis through active movements was implemented in an introductory animal science course in an effort to improve students' understanding of the basic mechanisms of mitosis. Students enrolled in the course are traditionally first semester freshman; however this method could be utilized in any course with minor modifications.

Procedure

Prior to the activity, 1.8 meter long polyethylene foam cylinders (swim or pool "noodles") of various colors are cut in half. Each cylinder represents a chromosome. Depending on the number of different colors you can find will determine the number of chromosomes that can be implemented. There must be four cylinders for each color. Name tags that are color coded and labeled as "maternal/paternal" or "dam/sire" are useful when teaching about or tracking ancestry and/or heredity. Finally, an assortment of different color elastic hair bands are used to represent different genes, which can be placed on the cylinders at specific locations to illustrate the concept of loci.

After first discussing DNA replication and cell division at a level the teacher believes necessary for the specific class, two cylinders of each color are randomly passed out to students. The class is then guided through the understanding that each cylinder is a specific chromosome and each pair of same colored cylinders is a maternal and paternal set, at which time the students receive their appropriate name tags. Based on time and course content, genes and loci could be introduced at this time by the placing of the elastic hair bands on the cylinders. In this specific introductory course, this is delayed until the genetics lecture. The student chromosomes are then encouraged to wander in front of the class until DNA replication takes place, at which point the additional pair of color-coded cylinders appear and are distributed to other students in the class. Finally, cell division can be demonstrated and the students can form two daughter cells or four germ cells. Depending on the time allotted for this method and topic, the process could be replicated again without the teacher's input which causes the class to teach themselves about cell division through common consensus.

Assessment

There was no empirical assessment conducted to evaluate if students increased their understanding and knowledge of cell division based on this interactive method in the classroom. Based on personal observation, the students appear more engaged during the lecture when using this method compared to previous semesters or upper level courses where I used handouts and traditional lecture pedagogy. This should not be unexpected, since based on a scale where 1 = strongly disagree and 10 = strongly agree, undergraduate students enrolled in my classes (n=47) want (8.89 ± 1.44) and prefer (9.25 ± 0.79) classes to utilize active learning experiences.

Based on the feedback from students and colleagues, implementing active learning methods to illustrate and explain complex biological concepts improves students understanding of the concept and willingness to be an active participant in the learning process. Active learning methods can be a high-impact strategy that carries little risk to the teacher or student if planned and organized ahead of time.

Submitted by:
Brian D. Whitaker
University of Findlay - Ohio
whitaker@findlay.edu

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CFAVM & CADAP
Kent Mullinix, Kwantlen Polytechnic University, Surrey, BC

CAPICU
Ed Brokaw, Abilene Christian University, TX

International Committee
Laura White
New Mexico State University
lmwhite@nmsu.edu

Nominating
Jeff Hattey
The Ohio State University
hattey.3@osu.edu

NACTA Foundation Advisory Council
Jeff Hattey
The Ohio State University
hattey.3@osu.edu

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