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**Rick Parker, Editor**  
[nactaeditor@pmt.org](mailto:nactaeditor@pmt.org)

# NACTA Journal

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

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# Attracting an Eclectic Set of Students into a Science-based Agriculture Course Using Terrorism as the Context

N.S. Hill<sup>1</sup>, D.G. Shilling<sup>2</sup>, and J.A. Bertrand<sup>3</sup>  
University of Georgia  
Athens, GA



## Abstract

Attracting non-agricultural students into agricultural courses is challenging because many do not think agriculture is relevant to them. A course was developed entitled 'Terror in the Food Supply' to attract a diverse group of students into an agricultural venue to increase dialog between agricultural and non-agricultural majors. The course has been taught on a yearly basis since 2007. Students were surveyed at the beginning of each semester and asked questions about their class status and majors, how they found out about the course, what attracted them to the course, what they expected to gain from the course, number and types of courses they had completed, and their understanding of the 'farm to fork' food supply system in the US. Data were analyzed by analysis of variance and regression to establish yearly trends. The percentage of non-agricultural majors increased from 8 to 52% and the number of students enrolled increased from 12 to 33 over a four-year period. Fewer students had an understanding of agriculture as the class grew in size but students who had three or more college-level science courses increased from 5 to 50% over time. Students were attracted to the course because of the subject matter, and the percentage learning about the course from their advisor or a University webpage increased from 0 to 50% with time. Those who learned about the course from friends decreased from 75 to 30% over time. We were successful at attracting non-agriculture majors by applying science to current events.

## Introduction

Agricultural students are required to complete courses from a diverse array of disciplines in order to fulfill the requirements for their degree programs. Few institutions require students from outside agriculture to enroll in agriculturally-related courses despite agriculturally-related controversial subjects such as food safety, centralized production systems, pesticide use, animal welfare, water quality, greenhouse gas emissions, and use of genetically modified organisms (Terry and Lawver, 1995). These socio-scientific issues are typified by conflict within the scientific community as well as society at large

(Bingle and Gaskell, 1994) and differences in perceptions of agriculturally-related issues exist among students from various colleges within the University (Terry and Lawver, 1995). Agricultural issues are germane to institutional commitments towards scientific literacy, and agricultural students tend to perform better in science classes than the general student population (Chiasson and Burnett, 2001). But scientists often have narrow understandings of their scientific disciplines and fail to (or are unable to) portray science to the overall social or scientific perspective (Shamos, 1995). Thus, it is not surprising that the term 'science' has different meanings to the diversity of students among the various colleges within the University.

Recognizing that agricultural issues are part of the overall scientific literacy effort at the University, administrators in the College of Agriculture and Environmental Sciences at The University of Georgia (UGA) challenged faculty to develop general interest courses to appeal to students from outside the College, in part, to increase public knowledge of scientific issues related to agriculture. One obstacle to fulfilling the challenge is to identify a theme in which a general interest agriculture course might be taught. In 2004, the outgoing Secretary of Health and Human Services, publicly stated that he was surprised terrorists had not attacked the food supply (Branigin et al., 2004). This was a shocking statement that further delineated our inability to secure remote or rural landscapes, and illustrates that vertical integration of our food production, processing, and distribution systems, make our food supply vulnerable to terror attack using plant and animal disease organisms (Cupp et al., 2004). A successful attack on our food supply will likely undermine confidence in local, state, and federal governments which could result in anarchy or, at least, cause chaos (Chalk, 2001). While the impact of an agricultural attack might be less shocking than the horrific images of September 11, 2001, there is evidence that terrorists considered attacking our food supply because it is a low-risk, cost-effective means to disrupt our lives (Chapman, 1999; Chalk, 2001; Cupp et al., 2004; Segarra, 2004). Superficially, terrorism is related to political, military, or law enforcement disciplines.

<sup>1</sup>Professor, Department of Crop and Soil Sciences, University of Georgia, Athens, GA 30602

<sup>2</sup>Professor and Head, Department of Crop and Soil Sciences, University of Georgia, Athens, GA 30602

<sup>3</sup>Assistant Dean of Academic Affairs in the College of Agricultural and Environmental Sciences, University of Georgia, Athens, GA 30602

However, the broader issue of how to protect ourselves from an attack to the agricultural sector requires an understanding of the biological and chemical agricultural infrastructure, chemical and biological agents which could be used in an attack, detection of potential agents of attack, and how to mitigate or provide prophylactic protection to such an attack. Developing prophylactic protection against such attacks requires knowledge of physical and chemical properties of chemicals (Michaels, 1999), biological (plant, animal, and human pathology and epidemiology; virology, immunology) sciences (Bonaparte et al., 2005; Fabian, 2006; Mead et al., 1999), and chemical and histochemical technologies (Hill et al., 1998; Wu et al., 1997), and to mitigate attacks requires knowledge of the food production and distribution system (USDA- AFTA-ATA, 2004). Thus, understanding the threat of agricultural terrorism may be an opportunity to disseminate scientific principles in a current events classroom venue.

The objective of this project was to develop a general interest science-based course centered on the threat of terrorism to the food supply and determine whether it appealed to students whose majors were in colleges other than the College of Agricultural and Environmental Sciences.

## Methods

Upon hearing concerns about security and terror threats to the U.S. food supply from the Department of Health and Human Services, an electronic literature search was performed to obtain reference materials regarding food safety and the threat of terrorism. A draft syllabus was developed and compared to the agenda for the first International Symposium on Agroterrorism, held in Kansas City, Missouri in May, 2006 (<http://www.fbi-isa.org/background.html>). Minor modifications were made to the syllabus based upon subject matter of the symposium, the course titled "Terror in the Food Supply" was submitted to, and approved, as an introductory level

**Table 1. Subject Matter Presented and/or Discussed in a University of Georgia Course Titled "Terror in the Food Supply."**

**Introduction:** How this course evolved. What I have done to prepare this course?  
**Terrorism:** What is it and what types are there?  
 The sociology and psychology of terrorism.  
 Who are US and International terrorist groups and how active are they?  
**US farm production** - Animal, Row Crop, and Vegetable  
 Efficiency of production and vertical integration of the agricultural sector  
 Feed lots and slaughter facilities and transportation  
 Grain production, handling, storage, and transportation  
 Diversity and protection against terrorism in the horizontally integrated agricultural sector  
 Mosaics vs. monocultures of crops and diseases: A better scenario?  
 Pasture-raised vs. feedlot finished beef cattle  
**Infrastructure protection in the agricultural sector**  
 Animal and Plant Health Inspection  
 - protecting against introduction of unknown diseases  
 Food Safety and Inspection Service  
 - production, processing, storage, and distr. of foods  
 Customs and Border Surveillance  
 International shipping protocols  
**Model agents for terrorists**  
**Biological background:**  
 Viral recognition of cell surfaces, attachment, and replication  
 Cell signaling and gene expression  
 Cellular interactions of the immune system  
**Case studies for biologicals:**  
*Non-zoonotic animal pathogens:* Foot and Mouth Disease, Avian influenza, Exotic New Castle disease  
*Zoonotic pathogens* - Nipah virus, Rift valley fever  
 Acquisition and culturing biological agents  
**Chemical background:**  
 Chemical and physical characteristics of gases  
 Case study: anhydrous ammonia  
 Chemical and physical characteristics of pesticides  
 Case study: methyl isocyanate and the Bhopal tragedy  
 Chemical properties of heavy metals  
 Case study: chromium toxicity to dairy cows  
**Methods of detecting unseen biological weapons**  
 Antibodies (ELISA, immunoblot, dipstick), Real-time PCR  
**Mitigating the effect of biological weapons**  
 How do we develop cost-effective testing protocols to provide security assurances?  
**Group attack and defense practicum**

**Table 2. Survey Questions to Determine Student Profiles and Knowledge of Subject Matter**

1. How did you find out about this course?
2. Describe how your advisor responded when you informed him/her that you had signed up for the "Terror in the Food Supply"?
3. What attracted you to the course?
4. At what level are you familiar with farming?
5. How many high school science courses have you completed (ie. biology, chemistry, physics, etc.)?
6. How many college/university level science courses have you completed?
7. In what College/School is you major?
8. What is your current University academic classification?
9. What do you think you will gain from taking this course?
10. Before you enrolled in this course, how confident were you in the safety of our food supply?
11. Describe at what level you understood the flow of food from the US farm to the dinner plate before you took this course.
12. Describe at what level you understood the flow of food from an international food source to the dinner plate before you took this course.
13. Prior to taking this class, how aware were you of programs and protocols used to test fresh food imports for possible contamination?
14. Prior to taking this class, how aware were you of the methods used to identify food contamination by the Center for Disease Control and Food and Drug Administration?
15. Prior to taking this class, how aware were you of the frequency of food recalls by FDA /USDA?
16. Prior to taking this class, how aware were you of the number of agencies which are responsible for the security of our food?

## Attracting an Eclectic

course by the University of Georgia Curriculum Affairs Committee, and the course was first offered during the spring semester of 2007. Subject matter from the syllabus is presented in Table 1. In addition to being responsible for the subject matter in the syllabus, students are assigned to teams of 5-6 students each and are required to 1) develop an attack against a sector of the U.S. food supply using a means of their own choosing and 2) develop a defense against one of their peer group attacks. Group defenses and attacks are presented to the class and graded by professionals affiliated with the U.S. Department of Homeland Security, The Federal Bureau of Investigation, and/or the Georgia Emergency Management Agency using rubrics developed by the professor. The external evaluators were asked to provide feedback as to whether the attacks and defenses simulated credible threats received by their organizations.

Student recruitment was conducted by placing advertisements on the university transit system, by placing information about the course on the University web page, and seminar presentations in agricultural classes. Students were surveyed at the beginning of the semester to gain information on their academic profiles (academic year, majors, etc), what attracted them to the course, how they found out when and where the course was offered, and what they expected to learn from the course using a multiple choice format (Table 2). Students were also surveyed at the end of the course using the Department of Crop and Soil Sciences course evaluation materials to evaluate the professor, and how the students valued the course (Table 3). All students were surveyed in each of the four years the course has been offered. Data from the surveys were statistically analyzed using the PROC ANOVA procedure of the SAS Institute (Cary, NC) using years as replications. Some data were not consistent among years, so regression analysis was conducted to establish whether trends existed across years using the PROC REG procedure of SAS. The response variables were used as the dependent variables and years in which the survey was conducted as the independent variable.

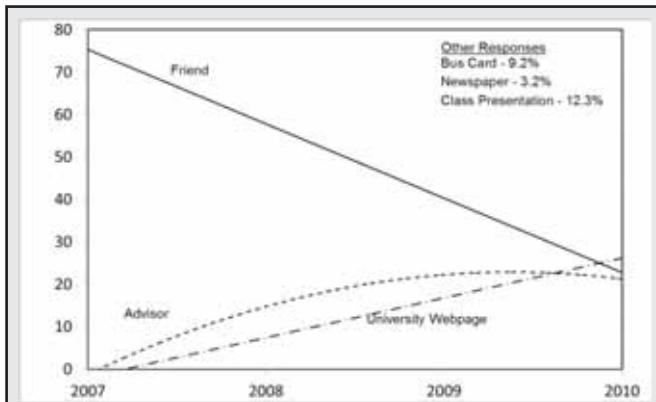
## Results and Discussion

The number of students who enrolled in the class increased linearly from 12 in 2007 to 34 in 2010. Nearly 80% of the students who enrolled in the course in 2007 learned about the course from a friend, but by 2010 recruitment of students were equally distributed among recommendations from friends, suggestions by academic advisors, students surfing the University webpage, and seminar presentations in other classes (Figure 1). Surprisingly, 50% of the

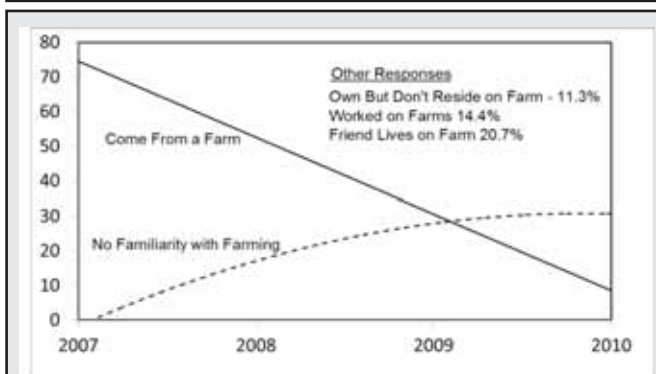
**Table 3. Student Expectations of the Outcomes They Will Acquire from the Course when Responding to the Question “What do You Expect to Gain from the Course?”**  
Students were Queried to Respond to all Answers that Applied to Them.

Answer	% of responses
A better understanding food security/vulnerability	96
A better understanding of agents which can be used to attack our food supply	84
A better understanding of political issues affecting food safety	80
A better understanding of terrorism	79
Improved critical thinking skills	53
A better understanding of farming	38
LSD (0.05) †	17

† Least significant difference at the 0.05 level of probability



**Figure 1. Student responses to the question: “How did you find out about the ‘Terror in the Food Supply’ course?”**



**Figure 2. Student responses to the question: “How familiar are you with farming?”**

students enrolled in the class did so without their advisors' knowledge, a trend which was consistent among years. Therefore, student recruitment was based as much on preferences of the student as it was their advisors. The primary reason for students enrolling in the class was because of their interest in the subject matter (70%), but recommendations from students who had taken the class (15%) and a potential for jobs (13%) were also factors that motivated students to enroll. Seventy-five percent of the students who enrolled in the course in 2007 were from a farm and 92% had majors within the College of Agricultural and Environmental Sciences. However, the percentage of students who resided on a farm decreased linearly with each successive year, and in

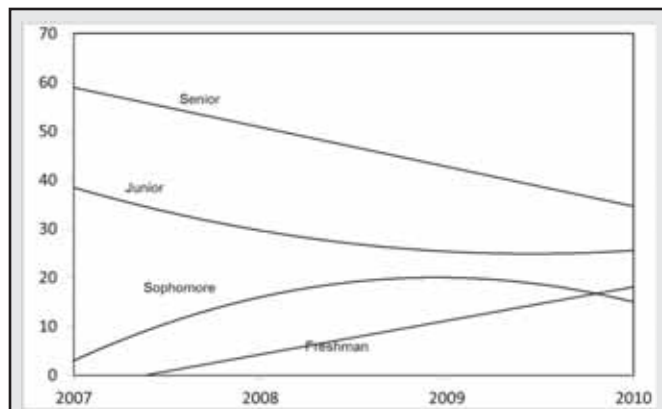


Figure 3. Student responses to the question: "What is your academic standing at the University?"

2010 only 8% of the students who enrolled in the class resided on a farm (Figure 2). There was a concomitant decrease in percentage of students from within the College of Agricultural and Environmental Sciences as the percentage of enrolled students who resided on the farm decreased. In 2010 the students from outside the College represented 42% of those enrolled in the course. Despite the decrease in percentages of students from the College of Agricultural and Environmental Studies, the total number of students from within the College increased from 11 in 2007 to 20 in 2010. The number of students from outside the College increased from 1 in 2007 to 14 in 2010. Students from outside the College had majors in the College of Arts and Sciences (15%), the School of Public and International affairs (15%), and Business (10%). Students from the College of Arts and Sciences had an eclectic collection of majors including math, religion, biology, and psychology. Therefore, the course attracted students from a wide array of majors, including those which are not traditionally steeped in science-based curricula.

There were some interesting trends regarding student academic standing across years. Nearly all students who took the class in 2007 were either juniors or seniors (Figure 3). However, the number of students with an academic rank of freshman or sophomore increased to 33% of the class in 2010. Nearly all students surveyed (96%) completed three or four high school science-based courses, a statistic that was consistent among years. Surprisingly, the proportion of students who have completed three or more university level science courses increased from <10% in 2007 to 55% in 2010 even though a) the proportion of students from non-scientific majors increased over time

and b) the students were earlier in their academic careers (Figure 4). This suggests that students who were are not from traditional science-based curriculums tended to have an interest in science and enroll in science courses regardless of their major. It also suggests that the younger students in the class may have been better prepared for college because of advanced placement science courses they completed in high school for which they received University credit. Therefore, it appears that students enrolling in the class were more scientifically literate than the academic profiles would suggest.

Students who enrolled in the class had varied expectations from the course. They were more interested in learning about terrorism and food safety issues than they were learning about farming or acquiring critical thinking skills (Table 3). There was a positive correlation between the percentage of students who resided on a farm and their familiarity with farming ( $r=0.95$ ), their understanding of the production and distribution system of food in the U.S. ( $r=0.89$ ), and their confidence in the safety of our food supply ( $r=0.74$ ). However, most students (>50%) were either unaware that food was tested for contaminants, or the methods used to identify food contaminants (>90%) regardless of whether they were from the farm or not. Eighty percent of the students were confident that our food is safe to eat, despite a record number of food recalls (over 7000 products total) because of *Salmonella spp.* contamination in peanut and vegetable protein products

Table 4. Student Responses to Questions used by the College of Agricultural and Environmental Sciences in Their Course Evaluations. Mean scores are Averages over the Five Years the Course was Taught and the Standard Deviation Represents the Variation among Years.

Evaluation Question	Mean Score	Standard deviation
Did the instructor increase your interest in the subject matter?	1.17 <sup>†</sup>	0.11
Was the instructor knowledgeable of the subject being taught?	1.24	0.06
Was the instructor enthusiastic about the subject?	1.16	0.06
Did the instructor provide individual assistance outside the classroom?	1.44	0.28
Did the instructor encourage you to think for yourself?	1.20	0.03
Did the instructor present the basic principles of the class in a clear and logical manner and take time to explain difficult concepts?	1.49	0.09
Was the instructor receptive to questions and discussion in the classroom?	1.15	0.08
Did the instructor recognize when students had difficulties in understanding new material?	1.56	0.14
Did the instructor keep the course moving at a steady pace?	1.27	0.21
Did the instructor give tests on materials covered?	1.41	0.18
Was the instructor prompt in returning graded materials?	1.22	0.12
Did the instructor clearly describe the grading procedures?	1.74	0.11
Compared to other instructors, how would you rate the teaching ability of this instructor?	1.33	0.12
Compared with other courses you have had at the University, how would you rate this course?	1.35	0.19
How many hours per week did you devote to this course outside of class?	2.05 <sup>‡</sup>	0.05

<sup>†</sup> 1 = excellent, 5 = poor  
<sup>‡</sup> 1 = 0-2 hours, 2 = 2-4 hours, 3 = 4-6 hours, 4 = 6-8 hours, 5 = 8-10 hours

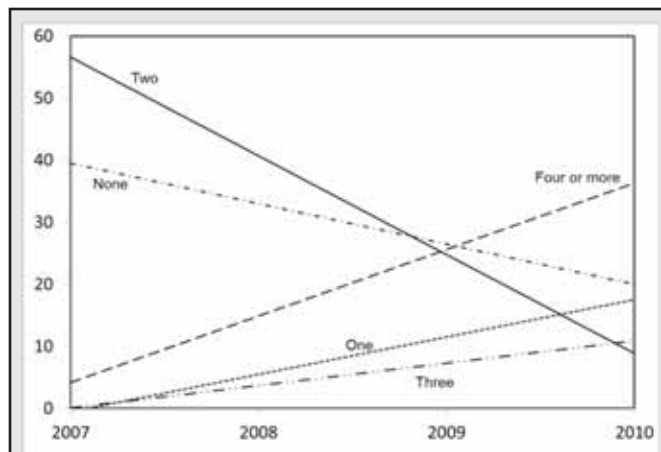


Figure 4. Student responses to the question: "How many University level science courses have you completed?"

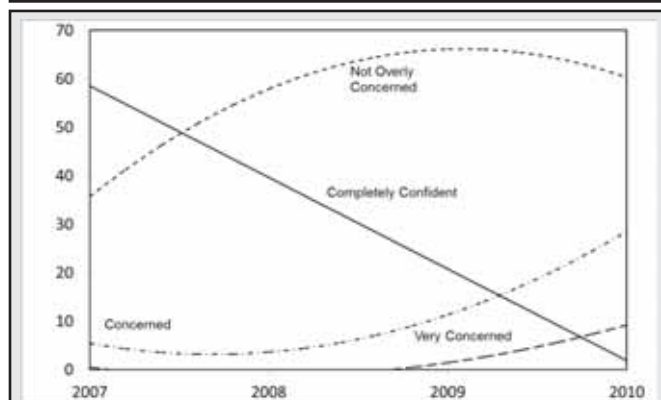


Figure 5. Student responses to the question: "How confident are you in the safety of our food supply?"

(<http://www.accessdata.fda.gov/scripts/peanutbutterrecall/index.cfm>; <http://www.fda.gov/Safety/Recalls/EnforcementReports/ucm208729.htm> ) in 2009 and 2010, respectively (Figure 5).

The subject matter in the course included specific information regarding cellular receptor sites, cell signaling and gene expression, the immune system, viral replication, the chemical/physical properties or biological properties of potential agents of attack, and molecular and immunological methods of detection (Table 1). While each of these subjects are topics for courses themselves and may appear to be disparate, the students were challenged to understand how biological systems worked and why chemical and physical properties of viruses and toxins might interact at the cellular level to elicit harm to living organisms. Amalgamating that information by students who do not have extensive scientific training can be daunting, and potentially manifest itself with poor evaluations of the course and instructor. However, student evaluations of the course were very good to excellent (Table 4). We interpret this to indicate that, if presented in a format by which they can apply the technology, students willingly respond to the challenge of learning these scientific concepts regardless of their academic background. Student comments such as: "I'm a Management/Insurance major and the professor got me excited about, and

interested in, the food supply and that scary subject of .....science!", "As an international affairs major, it brought a new perspective to my education about terrorism and how it can be applicable to agriculture industry," and "The course was interesting, and the professor made the material understandable for students who lacked scientific or agricultural backgrounds" corroborate our finding that students will motivate themselves to learn if they can identify with the subject matter.

As educators we should challenge students to explore subject matter outside of their traditional major-related curricula to fully engage in the "University experience." Students in agriculture are required to take humanities, social science, and (in some cases) business management courses but rarely do they have an opportunity to engage students from outside the college in courses that are more germane to their degree programs. By using terrorism in an agricultural context we were able to recruit students from outside the college to enroll in a science-based course. In addition, the course provided students with an agricultural background a rare opportunity to interface with students from multiple academic disciplines about an agriculturally related subject.

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# Student Perceptions of Hybrid vs. Traditional Courses: A Case Study in Plant Identification

William A. Hoch<sup>1</sup> and Tracy A.O. Dougher<sup>2</sup>  
Montana State University  
Bozeman, MT



## Abstract

Hybrid course formats provide a means of incorporating an online component into courses requiring hands-on learning. In 2009 and 2010 an herbaceous plant identification course was taught in a hybrid format at Montana State University, with the only in-class component being a weekly lab. This was the first online learning experience for more than two-thirds of the students. In 2009, 81.8% of students preferred an in-class format to this hybrid format, but in 2010 student preference for an in-class format dropped to 32.0%. While student attitudes towards the hybrid course improved between years, reasons for course format preference were constant. Most students who preferred a traditional in-class course disliked the reduced instructor contact of a hybrid course, while 76.5% of students who preferred a hybrid course favored the greater independence of this format. Preference for an in-class format was correlated with having previously taken the in-class woody plant identification course. Learning outcomes were not statistically different from when the course was taught in-class. This study demonstrates the utility of the hybrid format for a plant identification course and how student attitudes towards online learning are affected by perceived learning skills, and previous online and in-class experiences.

## Introduction

Web-based instruction provides several advantages to students, including accessibility to resources, facilitation of peer communication and collaboration, and accommodation of different learning paces and student schedules. Web-based instruction may also reduce demands on teaching resources. However, problems associated with certain learning styles (particularly dependent learners), difficulty in assessing student progress, reduced instructor contact and class discussion, and fewer hands-on activities can decrease student learning and satisfaction with web-based courses (O'Malley and McCraw, 1999; Rovai and Jordan, 2004).

Hybrid, or blended, course formats are intended to combine the advantages of both web-based and traditional in-class instruction. Results from hybrid courses have been equivocal, with some studies showing improved student satisfaction and performance (Gunter, 2001; Sanders and Morrison-Shetlar, 2001), while others have found either no difference

(Delialioglu and Yildirim, 2007; Olapiriyakul and Scher, 2006) or even reduced satisfaction, motivation and attendance (Biggs, 2006; Delialioglu, 2005; O'Malley and McCraw, 1999; Yudko et al., 2008). O'Malley and McCraw (1999) found that, in general, students preferred an in-class format, but wanted greater access to web-based instruction because they believed these courses saved them time, fit better with their schedules and enabled them to take more courses.

A major difficulty in analyzing and comparing hybrid courses is the broad range of potential variation in blending and balancing the web-based and in-class components, which can be compounded by course-dependent factors. Plant identification courses offer a challenge to web-based learning because of the necessity of student contact with plant material. In 2009 Montana State University converted a traditional in-class herbaceous plant identification (ID) course to a hybrid format. In this study we investigate student perceptions over two years of this hybrid course relative to traditional in-class courses, including a traditionally-formatted woody plant ID course.

## Methods

Montana State University teaches both woody plant ID and herbaceous plant ID courses. Woody plant ID is taught during the fall semester as a traditional in-class course, with weekly lectures, quizzes and plant identification reviews. In the spring of 2009 the herbaceous plant ID course was converted to a hybrid course format, with all lecture and supplemental materials available online, and the plant material maintained in a teaching greenhouse where it was available to students at all times. The only in-class component was a weekly lab where students took quizzes and exams, were introduced to new plant lists by three undergraduate teaching assistants, and participated in a number of lab activities. Students did not have face-to-face classroom contact with faculty instructors. Overall, course material such as plants, lecture content and student projects, and student interaction with teaching assistants, remained virtually unchanged from the previous two years (2007 and 2008) when the course was taught in a traditional manner. The same lead teaching assistant was used for both years, and thus errors in teaching manner, organization,

<sup>1</sup>Assistant Professor

<sup>2</sup>Associate Professor

and communication made in 2009 were modified in 2010.

Students enrolled in the herbaceous plant ID course were surveyed at the end of the spring 2009 semester (n=22) and spring 2010 semester (n=25). The survey consisted of 13 questions addressing student perceptions of this hybrid course relative to traditional in-class courses, course attendance, expected grade, student demographics, and whether the student had already taken the traditional woody plant identification course (Table 1). Students were allowed an opportunity to explain their answers to Question 1 (“Disregarding course content, overall, did you like the organization of this course better or worse than traditional in-class courses?”) through the option of selecting several possible justifications and also to write a brief explanation (Table 2).

Analysis of correlations among answers was performed using Fisher's Exact probability test to determine a two-sided p-value, and measure of associations between answers were determined using a Cramer's V coefficient. Differences in final mean grade distributions for years 2007-2010 were analyzed using the Tukey-Kramer multiple comparisons test. All analyses were performed with SAS for Windows v. 9.2 (SAS Institute Inc., Cary, NC) using an experiment-wise error rate of  $\alpha = 0.05$ .

## Results and Discussion

Overall, the majority of students in 2009 (81.8%) preferred an in-class format to a hybrid format, but in 2010 the preference for an in-class format dropped to 32.0% (Table 1, Q1). There was a shift in responses to questions pertaining to in-class versus hybrid courses

between 2009 and 2010 (Table 1, Q1 thru Q4). Students in 2009 were polarized in their choice of in-class versus hybrid format, whereas in 2010, more students felt they could learn in either environment, with 32% of students indifferent to the format. Overall satisfaction with the class (Q13), also shifted between 2009 (50%) and 2010 (83.3%) (Table 1).

Despite the change in course format preference between years, reasons for format preference were similar (Table 2). The most common answer to explain a preference for a traditional in-class format was dislike of the reduced instructor contact (100% in 2009 and 87.5% in 2010), and this theme carried through to the comments written for the “Other” option. These remarks, while addressing several issues, were most often fundamentally related to a lack of interaction with an instructor. The most common explanation among the students who preferred this hybrid course format was the greater independence relative to an in-class course (75% in 2009 and 77.8% in 2010).

Although the overall perception and satisfaction with this course improved in

Table 1. Responses to Student Survey for 2009 and 2010

Question	Answer Choices	2009 Overall Response (%)	2010 Overall Response (%)
Q1: Disregarding course content, overall, did you like the organization of this course better or worse than traditional in-class courses?	Better	18.2 <sup>a</sup>	36.0 <sup>a</sup>
	Worse	81.8	32.0
	Same	0.0	32.0
Q2: This course required you to work more independently than a traditional course, therefore you needed to work online and study plants in the greenhouse on your own initiative rather than on the class schedule. Did you prefer this to a more traditional class?	Yes	31.8	44.0
	No	63.6	24.0
	Indifferent	4.6	32.0
Q3: Relative to traditional courses, do you think you learned more or less in this course?	More	13.6	12.0
	Less	68.2	24.0
	Same	18.2	64.0
Q4: Relative to traditional courses, did you have a greater or lesser commitment to this course?	More	31.8	24.0
	Less	59.1	32.0
	Same	9.1	44.0
Q5: Where did you most often access the internet for this course?	Home	72.7	50.0
	Campus	27.3	50.0
	Work	0.0	0.0
Q6: How much time per week did you spend online for this course?	less than 1hr	13.6	20.8
	1-2 hrs.	50.0	50.0
	2-3 hrs	36.4	29.2
	more than 3hrs	0.0	0.0
Q7: Have you taken an online course before this one?	Yes	31.8	28.0
	No	68.2	72.0
Q8: What is your academic standing?	Freshman	0.0	0.0
	Sophomore	45.5	48.0
	Junior	50.0	36.0
	Senior	4.5	16.0
Q9: What is your gender?	Male	63.6	64.0
	Female	36.4	36.0
Q10: Have you already taken Woody Plant Identification?	Yes	77.3	60.0
	No	22.7	40.0
Q11: How many labs did you miss this semester?	0-1	90.9	91.6
	2-3	9.1	4.2
	more than 3	0.0	4.2
Q12: What grade do you expect to receive in this course?	A	27.3	33.3
	A-	4.4	4.2
	B+	9.0	12.5
	B	45.3	37.5
	B-	0.0	0.0
	C+	0.0	4.2
	C	14.0	4.2
	C-	0.0	4.2
Q13: Overall, were you satisfied with this class?	Yes	50.0	83.3
	No	50.0	16.7

<sup>a</sup>n = 22 (2009) and n = 25 (2010). Students were given the opportunity to explain this answer to Question 1 in more detail, see Table 2.

## Student Perceptions

the second year of the course offering, they were nevertheless much lower than the traditional in-class woody plant ID course. This is consistent with other studies that found student learning is similar between

online and in-class formats, but that students are generally less satisfied with the online learning experience (Carr 2000; Kim and Bonk, 2006; Rivera et al., 2003; Summers et al., 2005; Teclehaimanot et al., 2007). An important part of the learning experience for many students is classroom discussion, which has been correlated with both student success and course satisfaction (Nath and Anderson, 2007; VanDeWeghe, 2005; Voelkl, 1995). Maki and Maki (2003) concluded that students who enjoyed classroom discussion performed significantly poorer in online courses. Among students who preferred an in-class format in this study, only 33.3% in 2009 and 25.0% in 2010 indicated that they missed classroom discussion in this hybrid course.

Four correlations were significant across both years: Q1 + Q2, Q1 + Q13, Q3 + Q10, and Q12 + Q13 (Table 3). The correlation between Q1 and Q2 demonstrated the relationship between student dislike of working independently and dislike for the hybrid course format. A positive correlation between Q1 and Q13 in both years indicated students preferring the hybrid course were also satisfied with the class in general. Across both years, of the students preferring a traditional course, 44.4% expressed overall satisfaction with this hybrid course, while 100% of the students who preferred a hybrid course indicated overall satisfaction with the course. The correlation between Q3 (Did you learn more or less in this course?) and Q10 (having previously taken woody plant ID) changed from being negative in 2009 to positive in 2010 due to a greater number of students answering 'Same' to Q3 in 2010. However, the percentage of students answering

**Table 2. Student Explanations for Answers to Question 1 of Survey for 2009 and 2010**

Q1: Disregarding course content, overall, did you like the organization of this course better or worse than traditional in-class courses?	2009 Percent of Possible Responses <sup>z</sup>	2010 Percent of Possible Responses <sup>z</sup>
<b>If answer to Question 1 was Better:</b>		
more independence relative to traditional courses	75.0	77.8
less interaction with peers	25.0	11.1
less contact with instructor	0.0	0.0
Other	25.0	22.2
<b>If answer to Question 1 was Worse:</b>		
less contact with instructor	100.0	87.5
more independence	16.7	0.0
less interaction with peers	5.6	0.0
my self-motivation and self-discipline were lacking	27.8	12.5
I missed classroom discussion	33.3	25.0
Other	72.2	62.5

<sup>z</sup> n = 22 (2009) and n = 25 (2010). Percentages total more than 100 because students could choose all answers that apply.

**Table 3. Correlations among Student Survey Answers for 2009 and 2010**

2009 <sup>z</sup>	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
<b>Q2</b>	0.690*											
<b>Q3</b>	0.316	0.388										
<b>Q4</b>	0.105	0.303	0.112									
<b>Q5</b>	-0.241	-0.020	0.239	-0.303								
<b>Q6</b>	0.170	0.102	0.327	0.392	0.059							
<b>Q7</b>	-0.069	0.162	-0.316	0.121	-0.239	0.325						
<b>Q8</b>	0.483	0.321	-0.357	0.400	0.274	0.227	0.200					
<b>Q9</b>	0.111	0.111	0.051	-0.043	-0.039	0.310	0.111	0.433				
<b>Q10</b>	-	-0.328	-	-0.157	0.155	0.513*	-0.095	0.403	0.041			
<b>Q11</b>	0.588*	0.149	0.216	0.158	-0.105	0.516	0.137	-0.123	0.071	0.090	-0.172	
<b>Q12</b>	0.366	0.549	0.283	0.542	0.524	0.495	0.505	0.353	0.549	0.516	0.486	
<b>Q13</b>	0.471*	0.488*	0.447	0.179	0.000	0.274	-0.098	0.318	-0.189	-0.325	0.000	0.696*
<b>2010<sup>z</sup></b>	<b>Q1</b>	<b>Q2</b>	<b>Q3</b>	<b>Q4</b>	<b>Q5</b>	<b>Q6</b>	<b>Q7</b>	<b>Q8</b>	<b>Q9</b>	<b>Q10</b>	<b>Q11</b>	<b>Q12</b>
<b>Q2</b>	0.480*											
<b>Q3</b>	0.493*	0.390										
<b>Q4</b>	0.427	0.269	0.620*									
<b>Q5</b>	0.427	0.097	0.199	0.313								
<b>Q6</b>	0.310	0.402	0.281	0.349	0.231							
<b>Q7</b>	0.147	0.070	0.231	0.172	0.014	0.511						
<b>Q8</b>	0.239	0.053	0.228	0.251	0.161	0.482*	0.310					
<b>Q9</b>	0.168	0.186	0.436	0.378	0.175	0.567*	-0.089	0.224				
<b>Q10</b>	0.456	0.213	0.482*	0.271	-0.066	0.373	-0.218	0.471	0.238			
<b>Q11</b>	0.275	0.269	0.165	0.232	0.255	0.292	0.174	0.275	0.389	0.389		
<b>Q12</b>	0.603*	0.501	0.513	0.493	0.535	0.561	0.558	0.565	0.521	0.391	0.279	
<b>Q13</b>	0.633*	0.433	0.775*	0.697*	-0.151	0.100	0.000	0.281	-0.346	-0.346	0.135	0.733*

<sup>z</sup> n = 22 (2009) and 25 (2010) \* indicates significance at  $\alpha = 0.05$  by Cramer's V coefficient.

'More' remained comparable (13.6% in 2009 and 12.0% in 2010).

The most interesting correlation among student responses was the bias of having taken the traditional in-class woody plant ID course prior to this hybrid course and preference for an in-class course (Q10 + Q1). In 2009 a significant negative correlation existed between answers to Q1 and Q10, strongly indicating that students who had taken the woody plant ID course preferred an in-class format. Among students who preferred an in-class format, 88.9% of them had already taken the woody plant ID course. Of the students preferring the hybrid format, only 25% had already taken the in-class woody plant ID course. The correlation between these questions was not statistically significant in 2010 (P-value = 0.10) due to the confounding effects of more students answering with a 'Same' response to Q1, however the association between woody plant ID and format preference was comparable to that of 2009: of the 2010 students that preferred an in-class format, 87.5% had already taken the traditional-format ID course, whereas of the students that preferred the hybrid format, only 33.3% had previously taken the traditional-format ID course. Of the 32% of students in 2010 who answered 'Same' to Q1, 62.5% had taken woody plant ID.

Subsequently, in 2009 a significant negative correlation also existed between responses to Q3 (Did you learn more or less in this course?) and Q10 (having previously taken woody plant ID): of the 68.2% of students indicating that they had learned less than in a traditional course, 93.3% had taken woody plant ID. In 2010 the correlation of Q3 and Q10 shifted to a positive one as more students felt they had learned the same amount in the two types of courses. Of the 24.0% that felt they had learned less than a traditional-format course in 2010, 100% had taken the in-class woody plant ID course.

Our results suggest that students who perceived themselves as independent learners were more satisfied with this hybrid format course. A positive correlation was found between responses to Q2 (preference for working independently) and Q13 (overall satisfaction with the course) in 2009. Among the 50% of students who expressed overall dissatisfaction with this hybrid course (Q13), only 9.1% indicated in Q2 that they preferred the independent initiative required of this hybrid course, while 85.7% of students who were satisfied with this course indicated a preference for working independently. In 2010 this correlation was not significant (P-value = 0.09) due to the statistical effect of a larger number of 'Indifferent' responses to Q2, although an association

was evident: 100% of students who expressed satisfaction with the hybrid course preferred working independently and none of the dissatisfied students indicated this preference.

The mean final grades for this hybrid course in 2009 and 2010 were not significantly different from the two previous years when the course was taught in an in-class format, while a significant difference did exist for final grade means between 2007 and 2008 (Table 4). In general, student satisfaction decreased as expected grade decreased in both years, which is similar to observations by other studies of online learning (Bower and Kamata, 2000; Kupczynski et al., 2010). Among the students expecting an "A" (A and A-) grade, 71.4% in 2009 and 88.9% in 2010 expressed overall satisfaction. Among students expecting a "B" grade, 50% in 2009 and 91.7% in 2010 expressed overall satisfaction. Among the students expecting a "C" grade, only 0% and 33.3% in 2009 and 2010, expressed overall satisfaction with this hybrid course.

**Table 4. Grade Means for Herbaceous Plant Identification from 2007 to 2010**

Year	Format	N	Mean <sup>z</sup>
2010	Hybrid	27	85.6 ± 2.01ab <sup>y</sup>
2009	Hybrid	23	83.8 ± 1.50 ab
2008	Traditional	30	82.9 ± 2.47 b
2007	Traditional	31	88.0 ± 1.16 a

<sup>z</sup>mean of final grades ± SEM  
<sup>y</sup>means with the same letter are not significantly different at  $\alpha = 0.05$  by the Tukey-Kramer multiple comparisons test.

While the learning outcomes between in-class and hybrid formats in this study were similar, an analysis of over one thousand empirical studies of online learning (Means et al., 2010) concluded that student outcomes were generally greater in hybrid courses than either in-class or online formats. The authors emphasized that this success should not be attributed to the media per se, but to additional learning time and instructional elements often included in hybrid courses that are not received by students in the other formats. In a comparison of in-class and online sections of the same course, Teclehaimanot et al. (2007) concluded that face-to-face encounters with instructors increased motivation for students to complete course requirements, which may be an additional advantage of hybrid vs. purely online formats. More than half of the students in our study perceived that face-to-face instructor contact helps in their ability to learn.

This was the first online learning experience for more than two-thirds of the students in this hybrid course (68.2% and 72.0% in 2009 and 2010), and of the students who had previous online experience, only 15% had taken more than one online course. Overall satisfaction rates among students who had previously taken an online course was somewhat less than students with no previous online experience in 2009 (42.9% vs. 53.3%) and identical in 2010 (83.3%).

## Student Perceptions

The lack of experience with online learning among the students participating in this hybrid course likely affected their perceptions of the format and overall satisfaction with the course. Fry (2007) found that students who had previously taken an online course were more satisfied with the online learning experience, and suggested that a student's first online course may be a "weeding out" process if students perceive they are not capable of learning in an online environment. There was no possibility for a course selection bias in our study, as it is a required course within the horticulture major and students did not have a choice between online and in-class formats. In a study that followed students through multiple online courses over a four year period, Arbaugh (2004) observed significant changes in perception occurred between the first and second times students participated in online courses. Arbaugh recommended that students should not form opinions about this medium until after taking at least two online courses. Delaying judgment of online learning may be especially important in a hands-on major such as horticulture, where student apprehensions of this medium may be heightened. In our study, overall satisfaction with the hybrid course among students with previous online experience was not greater than the mean, although more insight into this relationship would have been gained had the students been asked about their attitudes towards their prior online experience.

We believe that at least some of the improvement in student attitudes towards this course in the second year was due to small modifications in course organization and increased experience of the teaching assistants. The quality of the teaching assistants was particularly important because it was the only face-to-face instructional contact students had in this course. It is possible that had the face-to-face component been with teaching faculty, student perceptions and satisfaction would have been higher, although the amount of student interaction with teaching assistants in this course was equivalent to when it was taught in-class and to the woody plant ID course, where the primary interaction with teaching faculty was during lecture. In this regard, this hybrid course was comparable to purely online courses, where there is no regular contact with teaching faculty.

## Summary

Hybrid course formats provide a means of incorporating an online component into courses that require significant hands-on learning, such as many courses in a horticulture curriculum. This study demonstrates the utility of the hybrid format for a plant identification course and how student attitudes towards online learning are affected by perceived learning skills, and previous online and in-class experiences. Specifically, regarding one's self as an independent learner and having previously taken the in-class woody plant ID course were most associated

with satisfaction with this hybrid course and with a preference for an in-class format, respectively. The equivalent learning outcomes and lower student satisfaction relative to traditional in-class courses is consistent with the findings of other studies, and suggests that the reduced student satisfaction may be more the result of student biases than the actual efficacy of an instructional medium.

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# Using the Myers-Briggs Type Indicator (MBTI®) in the Teaching of Entrepreneurial Skills at an Iranian University

**Kiumars Zarafshani<sup>1</sup>**  
**Razi University**  
**Kermanshah, Iran**



**Jamie Cano<sup>2</sup>**  
**The Ohio State University**  
**Columbus, OH**

**Lida Sharafi<sup>3</sup>, Somayeh Rajabi<sup>3</sup>, and Adel Sulaimani<sup>3</sup>**  
**Razi University**  
**Kermanshah, Iran**

## Abstract

This study examined the relationships between students' personality styles and their intentions to become an entrepreneur after completing a course in entrepreneurship education. Results indicated that the majority of the students in the class were ENTJ, ISTJ, ESFJ, or ESTP. The students in this study had moderate intention in a new business start-up. The researchers found that students with extraversion and sensing personality types had higher level of entrepreneurial intentions than students with introversion and intuitive styles. The results of this study have implications for higher education which entrepreneurship educators should not adopt a "one style fits all" approach in the classroom. Clearly, the evidence indicated that various personality styles were evident in the classes, and thus one could suppose that various personality styles are evident in every college classroom.

Key words: Entrepreneurship education, cognitive styles, intentions, personality types, MBTI®

## Introduction

In recent years, the government of Iran has shown interest in entrepreneurship because of its relationship with regional economic development through new ventures and job creation. Thus, colleges and universities across Iran have been challenged by the Ministry of Science, Research, and Technology (MSRT) to establish Centers for Entrepreneurship as part of the country's Entrepreneurship Development Program (EDP). The Centers for Entrepreneurship offers academic training at both undergraduate and graduate level to support students along the continuum of thinking and behaving entrepreneurially. The Centers' goals

may vary, but they hold a premise that entrepreneurship education is not just about teaching someone to run a business. It is also about encouraging creative thinking, enhancing levels of innovation, and promoting a strong sense of self-worth and accountability (Heinonen et al., 2006).

According to Alvarez and Busenitz (2001), if universities do not promote entrepreneurship education, it should then be expected that students would be less likely to pursue efforts towards starting a new venture. Therefore, universities aware of the importance of developing entrepreneurial potential (Vyakarnam, 2005) and competencies (Kirby, 2005; Gibb, 2006), are focusing on how to equip all students with the entrepreneurial skills. Furthermore, creating an awareness that there is an alternative way of employment other than being employed or self-employment (Galloway et al., 2005), which may not be for everyone, but all may use these skills as an employee (Vij, 2004) through the provision of transferability of skills (Vyakarnam, 2005; Galloway et al., 2005; Gibb, 2006).

It is commonly assumed that the personal characteristics (Bechard and Toulouse, 1998; Gorman et al., 1997) and skills of the entrepreneur can be developed through education. Indeed, some studies have suggested that entrepreneurial behavior can be stimulated through formal education programs. Research (Bonnett and Furnham, 1991; Gorman et al., 1997; Hansemark, 1998; Krueger and Dickson, 1994; Rasheed, 2003) has also shown that education can stimulate the development of entrepreneurial behavior in different ways. On the one hand, education for self-employment can increase knowledge about the setting up and management of businesses and promote personal characteristics associated with entrepreneurs, such as motivation to achieve, internal locus of control, or self-efficacy.

<sup>1</sup>Associate Professor; Address: P.O. Box 67155-1473; Tel: 0098-831-7240666; Email: zarafshani2000@yahoo.com

<sup>2</sup>Associate Professor

<sup>3</sup>Graduate Student



Moreover, Vesper (1982) claimed that formal education about self-employment careers at universities facilitated the process of business creation, since it helped to raise students' awareness of the viability of self-employment as a professional option. In fact, different studies (Ede et al., 1998; Hatten and Ruhland, 1995; Kourilsky and Walstad, 1998; Walstad and Kourilsky, 1998) have shown how such education increases positive attitudes towards entrepreneurship as an alternative professional career. In a similar line, Dyer (1994) argued that education for self-employment puts students in contact with role models (such as successful entrepreneurs) that make entrepreneurship more attractive as a professional career. In this sense, education for self-employment can be considered as a socializing factor within the process of becoming an entrepreneur.

Of course, definitions of what the terms “entrepreneurship” and “entrepreneurial” mean also vary among scholars and practitioners. Nevertheless, in the Centers for Entrepreneurship, entrepreneurship is generally seen as an attractive career choice that also affords the opportunity to contribute to society through the introduction of innovative new products, services, and technological processes. Not surprisingly, one question that often interests entrepreneurship educators in the Centers for Entrepreneurship is how to stimulate entrepreneurship through training.

### **Purpose and Objectives**

The purpose of this study was to describe the personality type preferences of students enrolled in an introductory entrepreneurship course in the College of Agriculture at Razi University, Iran. Currently, Introduction to Entrepreneurship is an elective course in the College of Agriculture at Razi University, and is well known for: (a) the rigorous nature of the course curriculum, and (b) the wide interest of students in the course. The following specific research questions were addressed:

1. Describe the students' MBTI® personality type.
2. Describe the students' MBTI® personality dimensions.
3. Determine the entrepreneurial intention level of students after completing a course in entrepreneurship.
4. Describe the relationship between students' personality style and entrepreneurial intentions.

### **Related Research**

Related to entrepreneurship training, previous research (Alvarez and Jung, 2005; Franke et al., 2004) has indicated that entrepreneurship education results in higher levels of entrepreneurial intentions. Entrepreneurial intention is defined as the conscious state of mind that precedes action and directs attention towards business start-up as the goal (Bird, 1988; Shook et al., 2003). In turn, intentions have shown to play a very relevant role in the decision to

start a new firm (Lee and Wong, 2004). The intention to start up, then, would be a necessary precursor to performing entrepreneurial behaviors (Fayolle et al., 2006; Kolvereid, 1996).

Intention is considered the single best predictor of behavior (Ajzen, 1991, 2001; Fishbein and Ajzen, 1975). In turn, the intention of carrying out entrepreneurial behaviors may be affected by several cognitive factors, such as needs, values, wants, habits, and beliefs (Bird, 1988; Lee and Wong, 2004). In particular, the cognitive variables influencing intentions are called motivational “antecedents” by Ajzen (1991).

More favorable antecedents would increase the start-up intention (Linan, 2004). However, while previous research demonstrated the connection between cognitive variables and intentions to start a business, previous research has also overlooked other individual differences (in particular, personality types) that should be taken into account when designing and implementing training programs in entrepreneurship. Moreover, little has been done to examine the relationship between personality types and entrepreneurial intentions.

### *Entrepreneurial Cognition and Personality Type*

One important aim of entrepreneurship education and training is to develop sound entrepreneurial cognitions, which are defined as “... the knowledge structures that people use to make assessments, judgments, or decisions involving opportunity evaluation, venture creation, and growth” (Mitchell et al., 2002, p. 97). These entrepreneurship cognitions are formed through an individual's perception and interpretation of information, which, in the context of entrepreneurship, refers to any information (about the marketplace, the technology, social, political, regulatory, and economic changes, etc.) that ultimately enable the discovery and exploitation of new business opportunities (Shane and Vankataraman, 2000).

To develop entrepreneurial cognition, students need to perceive entrepreneurship as fun, challenging, thrilling, exploratory, exciting, and fulfilling. To achieve this, entrepreneurship educators should use innovative approaches to entrepreneurship teaching.

A large number of entrepreneurship scholars have suggested a variety of teaching methods to support effective entrepreneurship learning. For example, one may include the use of live case studies (Mahlberg, 1995), business plans and projects (Miettinen, 2007; Solomon et al., 2002), an entrepreneurship club (Gillingham, 2005), self-directed learning (Christie, 1992), action learning (Antonities, 2001), computer assisted learning (Teubner, 1992), artificial intelligence (Kirchoff and Teubner, 1992), or fieldtrips and videos (Klatt, 1988). More recent developments include the use of work-based learning and blended learning (Gillingham, 2005) and whole-brain thinking (Bragg, 2005).

Researchers have postulated that personality

style has the potential to make a significant contribution to the study of entrepreneurship (Mitchell et al., 2002; Baron, 1998; Busenitz and Barney, 1997; Allinson et al., 2000; Allinson and Hayes, 1996). For example, an individual's personality style may influence the preference for different types of learning, knowledge gathering, information processing, and decision making, many of the critical behaviors with which an entrepreneur is confronted on the daily basis. Kickul et al. (2007) concluded that individuals who prefer the intuitive style of information processing, reported higher entrepreneurial self-efficacy, which was significantly associated with their entrepreneurial intentions.

However, individuals with the divergent preferred mode of thinking reported less confidence in their capacity to identify and create a new idea or opportunity. Ulrich and Cole (1987) found that entrepreneurial learning preferences tended toward active experimentation with some balance between concrete experience and abstract conceptualization. Zaidatol et al. (2007) studied students' learning strategies in entrepreneurship teaching. Results revealed that lecturers should understand students' learning strategies to help them improve their teaching and learning process. Routamaa and Miettinen (2006) concluded that there were some psychological types that tended to more likely become entrepreneurs, than others. Based on a data of 2930 occupations in Finland et al. (2006) used Jung's and Myers-Briggs typologies to differentiate between entrepreneurs and non-entrepreneurs.

The theory of psychological types advanced by Jung and operationalized by Myers and Briggs, through the development of the Myers-Briggs Type Indicator (MBTI®), provided the theoretical framework and research base for the study. The MBTI® is used to understand personality difference and basically describes various behavior patterns. These behavior patterns in turn affect how we function in the world. This system of understanding different patterns of behavior is grounded in the idea that people are unique individuals and are born with preferences. The word preference refers to the ways in which individuals naturally prefer to do certain things (Baron, 1998).

Gregorc (1985) suggested that 95% of individuals had specific learning style preferences. If true, Gregorc's has major implications in entrepreneurship education. Entrepreneurship educators should focus on matching their teaching style with that of students' personality styles. Furthermore, Cano et al. (1991) concluded that not all students learn the same; therefore, entrepreneurial educators need to be cognizant of personality style differences and teach in such a way in which all personality styles are considered.

Despite the amount of related research regarding personality styles in the United States, entrepreneurship educators in Iran may be unable to fully utilize

the results for two reasons. First, because Iranian students have never been the subject of any MBTI® work, it is truly unknown until the undertaking of this study if Iranian students could align themselves with the MBTI® profiles. Secondly, evidence was not found which extrapolated or indicated that Iranian students were, or were not, similar or dissimilar to any other students elsewhere in the world.

## **Procedures**

### *Population and Sample*

The target population for the descriptive study was senior students in Department of Agricultural Extension and Education who have completed an introductory entrepreneurship course during the academic year, 2007 (N = 1076). The entrepreneurship course is an optional course offered by the College of Agriculture at Razi University to increase the number of students having enough knowledge about small enterprises, self-employment, and entrepreneurship.

An up-to-date list of seniors who completed an introductory entrepreneurship course was obtained from the Department of Agricultural Extension and Education in the College of Agriculture at Razi University and served as the frame of the study. A sample of 280 students was randomly drawn from the population of senior students. The sample consisted of 155 females and 125 males. The sample size (n = 280) was determined using Krejcie and Morgan's (1970) table of sample sizes, specifying a 5% margin of error.

### *Instrumentation*

The Myers Briggs Type Indicator (MBTI®), Form G (Myers, 1977) was used in this study. As a Persian language version of the MBTI® did not exist, the authors engaged the back-translation technique as suggested by Sperber et al. (1994). The English version of the MBTI® was first translated into Persian. Then the Persian version was back translated into English. A panel of experts in the Department of English compared the original version with the back translated version in an effort to solve discrepancies. Finally, the MBTI® was completed by a different student, who found no problems in understanding and answering the questions.

The model developed by Myers-Briggs is based on Jung's theory about perception and judgment, and the attitudes in which perception and judgment are used by different types of people (Myers, 1977). The Myers-Briggs model lists four different pairs of opposite preferences (Extroversion – Introversion; Sensing – Intuition; Thinking – Feeling; Judging – Perceiving). These preferences can be combined to form 16 different “types.” By taking one preference from each pair, a four-letter code is established that defines an individual's personality type. For example, one student may be an ESTP (extravert, sensing, thinking, perceiving) while another can be INFJ

(introvert, intuitive, feeling, judgment). For individual descriptions of each of the 16 different types, the authors recommend the reader see the manual by Myers and McCauley (1985).

#### *MBTI® Validity and Reliability*

The MBTI® has been described and validated through almost 40 years of research (Cano and Garton, 1994) and has been accepted by researchers throughout the world. Split half reliability coefficients computed on continuous scores run between .80 and .92 across all four dimensions for groups aged 15 through 60 plus years (Myers and McCauley, 1985). Test-retest reliability coefficients have been estimated based on the percent of agreement between personality type profiles over time intervals from five weeks to six years. The test-retest coefficients run from .69 to .92 across all personality type profiles (Myers and McCauley, 1985).

#### *Entrepreneurial Intention Questionnaire*

The Entrepreneurial Intention Questionnaire (EIQ) (Linan and Chen, 2009) was used to analyze students' intention towards entrepreneurship after their completion of the introductory entrepreneurship course. Entrepreneurship intention was measured with six items using a Likert-type scale of 1 (total disagreement) to 7 (total agreement). The items were translated into Persian language using back translation method described for the MBTI®. An expert panel was used to determine the instrument's face and content validity. The instrument was pilot tested with a sample of 25 agricultural students. Post hoc reliability analysis of the pilot instrument resulted in a Cronbach's alpha of 0.84.

#### *Data Collection and Analysis*

The MBTI® and EIQ were administered during the academic year 2008. Both instruments were administered by one of the researchers during class sessions of the introduction to entrepreneurship class. The MBTI® was hand scored by one of the researchers. Frequencies, percentages, means, and standard deviations were used to describe students' personality type preferences and entrepreneurial intentions. A Pearson product-moment correlation coefficient was used to describe the relationship between personality type preferences and entrepreneurial intentions. An alpha level of .05 was used. The aggregate data were analyzed using SPSS.

## **Results**

Table 1 denotes the findings relative to the dimensions. The data indicate that the Extroversion, Sensing, Thinking, and Judging (ESTJ) were the dimensions with the greatest percentages. A gender analysis revealed that all four dimensions were more predominant among female students than their male counterparts (Table 3).

**Table 1. Frequency and Percent of MBTI® Dimensions (n=280)**

Dimension	f	Percent
Extroversion (E)	171	61.1
Introversion (I)	109	38.9
Sensing (S)	161	57.5
Intuition (N)	119	42.5
Thinking (T)	171	61.0
Feeling (F)	109	39.0
Judging (J)	172	61.4
Perception (P)	108	38.6

The MBTI® function indicating preferred style of perception was obtained from the MBTI® personality type profiles. The MBTI® personality type profiles of the students indicated that 32.1% preferred ST, 29.0% preferred NT, 25.4% SF, and 13.5% preferred an NF style of perception (Table 2). A gender analysis indicated that male students were predominantly ST whereas female students showed a tendency to be more NT, SF, and NF (Table 3).

**Table 2. Frequency and Percent of MBTI® Function Indicating Preferred Style of Perception (n=280)**

Function	f	Percent
Sensing - Thinking	90	32.1
Intuition -Thinking	81	29.0
Sensing - Feeling	71	25.4
Intuition -Feeling	38	13.5
Total	280	100.0

The students who completed introductory entrepreneurship course during the academic year 2007 reflected all 16 personality type profiles measured by the MBTI®. The most common profiles among students were ENTJ (19.64%), ISTJ (15.36%), ESFJ (12.50%), and ESTP (6.80%). Nearly 55% of students had a profile of ENTJ, ISTJ, ESFJ, or ESTP. The least common profiles were ENFJ (1.1%), INFJ (0.7%), INTJ (2.5%), INTP (3.6%), and ENTP, and ISFP, which accounted for 3.2% each. A gender analysis (Table 3) indicated that among ENTJ students, 10.7% were female whereas 8.92% were male. There were more male (8.21%) students with ISTJ personality type than their female (7.14%) counterparts. The ESFJ personality type was more prevalent in female students (6.78%) than male students (5.71%). The ESTP personality type was almost evenly distributed among male (3.57%) and female students (3.21%).

The students in the sample who completed an entrepreneurship course in College of Agriculture showed a moderate level of entrepreneurial intention ( $\mu = 4.10, SD = 0.86$ ).

The relatively small standard deviation was also an indicator that, indeed, there was a small deal of variation in students' intention to become an entrepreneur. Next, relationships between personality style of students participated in entrepreneurship

**Table 3. Rank Ordered of Frequency and Percent of MBTI® Personality Type Profiles (n=280)**

Profile	Male		Female		Total		Cumulative Percent
	f	%	f	%	f	%	
ENTJ	25	8.9	30	10.7	55	19.6	19.6
ISTJ	23	8.2	20	7.1	43	15.4	35.0
ESFJ	16	5.7	19	6.8	35	12.5	47.5
ESTP	10	3.6	9	3.2	19	6.8	54.3
ENFP	9	3.2	11	3.9	20	7.2	61.5
ISTP	9	3.2	4	1.4	13	4.6	66.1
ESFP	6	2.1	9	3.2	15	5.4	71.5
INFP	6	2.1	7	2.5	13	4.7	76.2
ESTJ	5	1.8	10	3.6	15	5.4	81.6
ISFJ	4	1.4	8	2.9	12	4.3	85.9
ISFP	4	1.4	5	1.8	9	2.9	88.8
ENTP	3	1.1	6	2.1	9	3.3	92.1
INTP	2	0.7	8	2.9	10	3.6	95.7
INTJ	2	0.7	5	1.8	7	2.5	98.2
INFJ	1	0.4	1	0.4	2	0.7	98.9
ENFJ	0	0.00	3	1.2	3	1.1	100.0
Total	125	44.5	155	55.5	280	100.0	

course and their intention to become entrepreneurially involved were analyzed.

Table 4 presents the results of the ANOVA model tested in this investigation. No significant differences in entrepreneurship intention were manifested in relation to the dimensions of Judging-Perceiving or Thinking-Feeling. A significant main effect did emerge in relation to the Extroversion-Introversion dimension, ( $F = 5.20, p = 0.02$ ) and Sensing-Intuition dimension, ( $F = 4.80, p = 0.03$ ). Students with Extroversion and Sensing personality types, or cognitive styles, had higher level of entrepreneurial intentions than students with Introversion and Intuitive styles. In other words, E and S personalities were more motivated to start their own business.

**Table 4. MBTI® Personality Types and Entrepreneurial Intention**

Source	df	SS	F	p
Extroversion-Introversion	1	526.70	5.20	0.02
Thinking-Feeling	1	132.85	1.31	0.26
Sensing-Intuition	1	498.89	4.80	0.03
Judging-Perceiving	1	176.41	1.74	0.16

### Conclusions, Recommendations, and Practical Importance

The MBTI® results indicated that the majority of the students were ENTJ, ISTJ, ESFJ, or ESTP, ISTJ and ESFJ were also predominant among a sample of agricultural students at Ohio State University in the United States studied by Kitchel and Torres (2006). Characteristics of ENTJ include being frank, decisive, and leaders in activities. Individuals with ENTJ personality type profile are good at anything that requires reasoning and intelligent talk, such as public speaking. ENTJs develop and implement compre-

hensive systems to solve organizational problems. Moreover, ENTJs are usually well informed and enjoy adding to their fund of knowledge.

Characteristics of ISTJ include seriousness, quiet, and gain success through concentration and thoroughness. ISTJ individuals are practical, orderly, matter-of-fact, logical, and realistic. Individual with an ISTJ personality type see to it that everything is well organized and make up their mind as to what should be accomplished and work toward it steadily, regardless of protests or distracters.

Characteristics of ESFJ include being warm-hearted, talkative, popular, conscientious, cooperative, and active committee members. ESFJ individuals need harmony. Individuals with an ESFJ personality type profile are always doing something nice for someone and work best with encouragement and praise. In addition, ESFJ individual's main interest is in things that directly and visibly affects people's lives.

Characteristics of ESTP include quickness, ingenious, and good at many things. ESTP individuals are able to do almost anything that interests them. They are quick with a solution to any difficulty and ready to help anyone with a problem. Individuals with an ESTP personality type profile often rely on their ability to improvise instead of preparing in advance. They are good at finding compelling reasons for whatever they want.

The dimensions (EI, SN, TF, JP) data indicated that the majority of the students were E (61.1%) followed by T (61.0%), J (61.4%), and S (57.5%). The dimension of E indicates that individuals are interested in people and things in the world around them. The T dimension describes a preference for making rational judgments by using rational analysis. The J dimension shows a preference for acting by organizing, planning, and deciding. The S dimension indicates that an individual is more objective and enjoys concrete learning. Interestingly, the E, T, J, and S personality type preference were more dominant among female students.

The MBTI® function (ST, NT, SF, NF) data indicated that the majority of the students were either ST (32.1%) or NT (29%). This finding is in direct agreement with the Barrett et al. (1987) findings. Barrett et al. (1987) found that many colleges of agriculture students exhibited an "action" learning style. The Sensing mode of cognitive perception involves attending to concrete reality and focusing on things that are tangible, practical, and

observable. Persons with a preference for this style exhibit a tendency to restrict their attention to matters with which they are immediately confronted and tend not to think a great deal about future circumstances and events.

Moreover, the findings in this investigation connect in interesting ways to findings in the learning style literature. Those connections begin to suggest important relationships between MBTI® personality type profiles and learning style preferences of students (Cano and Garton, 1994). According to Barger et al. (1994), the combinations of Sensing/Feeling (SF), Intuition/Feeling (NF), Sensing/Thinking (ST), and Intuition/Thinking (NT) can be used to describe learning style, with Feeling (F) being very consistent with field-dependence, and Thinking (T) being very consistent with field-independence.

Therefore, the ST and NT students are said to be field-independent learners because T individuals in the study are related to field-independent learners. This is in agreement with the study of Cano (1999) and Torres and Cano (1994) in which they found the learning style of incoming freshmen and senior students in the College of Food, Agricultural, and Environmental Sciences tended to lean towards the field-independent learning style. Moreover, Miller et al., (1990) found that Asian students in the College of Agriculture at Ohio State University exhibited field independent learning styles.

This study revealed that those students who have completed a course in introduction to entrepreneurship have moderate intentions in a new business start-up. Miettinen (2007) in an international survey of collegiate entrepreneurship across 14 countries found that the relationship between students' entrepreneurial intentions and their participation in entrepreneurship courses was weaker than expected. Although researchers have found a positive impact of entrepreneurship education on entrepreneurial intention of students (Fayolle and Gailly, 2004; Fayolle, 2003; Kolvereid and Moen, 1997; Tkachev and Kolvereid, 1999; Noel, 2001; Varela and Jimenez, 2001), this study has not provided further evidence that entrepreneurship courses facilitate the formation of greater level of entrepreneurial intentions among students.

The lack of support in this study found for a greater level of entrepreneurial intentions as a result of the courses might be due to the fact that the students' entrepreneurial intentions before the beginning of course was not measured, so it may be premature to reach a conclusive result. However, the results of this study clearly indicate that there are some psychological types that tend to become entrepreneurs more likely than others. As could be seen, the Extroverted-Introverted and Sensing-Intuition preference was highly correlated with entrepreneurial intentions. This pattern may hold significant implications for entrepreneurship education. First of all, the results suggest that

entrepreneurship educators should recognize the distinct contribution of personality styles in their efforts to support the entrepreneurial development of students. Educational programs should not adopt a "one style fits all" (Kickul et al., 2007) approach and must take into account the variety of personality styles in the classroom.

Currently, a vast majority of the teaching of entrepreneurial skills tends to be technical, with insufficient attention paid to the personality and belief systems of the entrepreneur (Allinson et al., 2000). This is evidenced by the many entrepreneurship courses that focus on commonly identified entrepreneurial management and planning skills, but ignore the impact of personality style in the acquisition and development of entrepreneurial skills, including innovation and risk-taking.

The current research also suggests the importance of supporting would-be and nascent entrepreneurs in understanding their own personality styles, allowing them to recognize what particular stages of the entrepreneurial process their modes of thinking may preclude. The point is to teach the value of all the stages in new venture creation, so as to maximize the likelihood of future entrepreneurs' success.

In practice, there are generally two groups into which teaching techniques/methods fall into. There are group teaching techniques and individualized teaching techniques. The group teaching techniques would be suggested to use with students who, according to their MBTI® profile, included either SF or IF. The individualized teaching techniques would be recommended more-so for students with a MBTI® profile which included IT or NT.

Group teaching techniques work best when students have common needs and the knowledge, skills, and dispositions being taught are teachable in group settings. Examples of group teaching techniques include lecture, discussion, demonstrations, field trips, role playing, and resource people to name a few. Individualized teaching techniques are more individually centered than group centered. Some suggested basic individualized teaching techniques include supervised study, experiments, and independent study, and information or job sheets.

One implication that would make for an interesting classroom experiment is to assess personality style, and then require students to focus on those stages that they would seem to prefer the least (e.g., for extroverted: the opportunity identification stage, and for sensing students: the planning and marshaling stage). In this way, as educators we may be able to strengthen those cognitive processing modes that are most needed for each group of students to succeed in entrepreneurial endeavors. Moreover, in the entrepreneurship education classroom, creating a learning environment that offers students appropriate supports and challenges that match their personality styles may measurably increase their self-efficacy throughout their program.

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# Leadership Behaviors of Georgia Golf Course Superintendents: Implications for Post-secondary Programs

**Matt Lenhardt<sup>1</sup>**

**Citrus County Horticulture Extension Agent  
Lecanto, FL**



**John C. Ricketts<sup>2</sup>**

**Tennessee State University  
Nashville, TN**

**A. Christian Morgan<sup>3</sup> and Keith J. Karnock<sup>4</sup>**

**University of Georgia  
Athens, GA**

## Abstract

Employees who possess effective leadership skills are likely to motivate others around them and be more successful during their careers. Because of this, employers desire to hire college graduates who possess these skills, especially within careers associated with agriculture. This study sought to measure the transformational leadership behaviors of golf course superintendents, the outcomes of those behaviors, and determine if relationships exist between transformational leadership behaviors and leadership outcomes. Quantitative data was collected using Kouzes and Posner's Leadership Practices Inventory<sup>®</sup> questionnaire (LPI) and perceived outcome questions stemming from Bass and Avolio's Multifactor Leadership Questionnaire<sup>®</sup> (MLQ). Data analysis revealed that Model the Way was the transformational leadership behavior most widely used, followed closely by Enable Others to Act. The outcome of Effectiveness was highest, with the strongest practice/outcome correlation between Model the Way and Satisfaction. It was recommended that leadership education be included in undergraduate turfgrass curriculum, specifically to help prepare turf professionals for successful careers and that the turf industry implement professional development opportunities to increase golf course superintendent transformational leadership behaviors and employee outcomes.

## Introduction

Organizations in the agricultural industry take on a variety of forms and sizes, from entrepreneurial producers to multinational corporations, all of which require leaders with skill sets to guide individuals, departments, and entire companies (Washington

Post, 2010; Brooks et al., 2008). Today, more than ever before, businesses are interested in leadership development of their employees and they benefit from hiring employees who possess the leadership traits needed for their position (Light, 2010; Useem, 2010). Employees who possess and effectively apply leadership traits and skills have the ability to create a culture of success. Research has shown that successful leaders are personable, charismatic, influential, and have the company's and the employee's best interests at heart (Dubrin, 2007).

Within agriculture, leadership skills, behaviors, and knowledge have been investigated for over three decades, primarily with youth and academic populations (Brannon et al., 1989; Dormody and Severs, 1994; Ladewig and Thomas, 1987; Luft, 1986; Ricketts and Newcomb, 1984; Ricketts and Rudd, 2004; Spotanski and Carter, 1993). Ricketts and Newcomb (1984) studied the leadership behaviors of 12th grade students and found that those engaged in FFA had significantly higher leadership behaviors. When looking at adults, Brannon et al. (1989) found that community leaders attributed much of their leadership success to participation in FFA either as youth or through adult volunteer activities. Similarly, Ladewig and Thomas (1987) surveyed adults and found that participation in organized youth activities, including 4-H, has a positive impact on self-perceived leadership skills.

The study of leadership and its correlation to success in business has produced many opinions and theories. According to a study by Moore and Rudd (2005), everyone agrees leadership is important, but a consensus of which skills are most important has not been established. From those studies, many skills of a successful leader have been identified, such as self-confidence, humility, trustworthiness, warmth,

<sup>1</sup>M.A.L., 3650 W. Sovereign Path; Suite 1

<sup>2</sup>Extension Associate Professor, 3500 John A. Merritt Blvd

<sup>3</sup>Assistant Professor, 130 Four Towers

<sup>4</sup>Professor, 3111 Miller Plant Sciences Building

sense of humor, enthusiasm, extroversion, assertiveness, and emotional stability (Dubrin, 2007).

In today's business world a shift has occurred as to how leadership is viewed. In years past a traditional view of leadership tended to be a "top-down," autocratic affair; but today, industry sees leadership as more participative and engaging (Moore and Rudd, 2005). When employees are more personally involved in the decision making processes they show more enthusiasm and ownership of their work. This new form of leadership, known as *transformational leadership*, makes an employee feel more self-confident and valued which, in turn, makes them more dedicated employees. In addition, they report increased job satisfaction and elevated feelings towards co-workers and leaders (Bass, 1996; Kouzes and Posner, 2007). "Transformational leaders motivate others to do more than they originally intended and often even more than they thought possible. They set more challenging expectations and typically achieve higher performances" (Bass, 1996, p. 4).

Bass and Avolio's (1994) research emphasized not only transformational leadership behaviors but also the *outcomes* of these behaviors (Bass, 1985). These outcomes are *Effectiveness*, *Satisfaction*, and *Extra Effort* exhibited by employees as a result of successful leadership behaviors. Effectiveness can be described as *the ability of a person to perform job functions in a careful, complete, and efficient manner*. Bass also found that "Generally ... the transformational factors were more strongly associated ... with Effectiveness, particularly to the extent the superior was seen to contribute to meeting the requirements of the organization and to meeting job related needs" (p. 224). Satisfaction is *the positive feeling an employee has for his or her job, leader, or work environment*. Satisfied workers tend to take a sense of pride and ownership in their position and have a higher opinion of their leader. From his research, Bass notes that transformational leadership was a "more satisfying" form of leadership than some of the other leadership styles (p. 224). Extra Effort is the third outcome that was measured by Bass to show *"how highly a leader motivates subordinates beyond expectations"* (p. 213). This is a result of the amount of dedication and motivation an employee has towards his or her job and the leader. The study also emphasized that the transformational leadership factors of charisma and intellectual stimulation were most related to Extra Effort (Bass, 1985).

Based upon Bass and Avolio's (1994) research of transformational leadership and their own empirical study of thousands of company leaders, Kouzes and Posner (2007) uncovered what they call "The Five Practices of Exemplary Leadership" (p. 14) that identify the behaviors that exemplary leaders possess. They explain that not all great leaders are born great, and that anyone, in any position, can become a leader.

The first practice is for leaders to *Model the Way*. This practice asks the leaders to set the example for their employees by how they lead. Kouzes and Posner (2007) state that, "To effectively model the behavior of others, leaders must first be clear about guiding principles. They must clarify values" (p. 15). The values a leader exemplifies set the tone for the entire organization to follow. To Model the Way, a leader also needs to find his or her voice, meaning that they need to find their own style of communicating their beliefs to their followers.

The second practice is to *Inspire a Shared Vision* (Kouzes and Posner, 2007). In order to inspire followers, a leader must be passionate and excite their employees with this vision. In this second practice, communication is especially important when sharing and inspiring a vision. Kouzes and Posner state that "To enlist people in a vision, leaders must know their constituents and speak their language. People must believe that leaders understand their needs and have their interests at heart. Leadership is a dialogue, not a monologue" (p. 17).

Practice three is to *Challenge the Process*. Effective leaders seek new directions and experiments, and take risks in order to achieve greatness (Kouzes and Posner, 2007). Innovation requires leaders to listen and stay in touch with the market by promoting good internal and external communication. Leaders do this to get the best out of themselves and the organization. In this sense, credibility is then crucial for a leader because innovation and experimentation can be risky.

The next practice is *Enable Others to Act*. A leader cannot achieve success without a good relationship and the full support from employees; this behavior involves a leader fostering collaboration and building trust with their followers (Kouzes and Posner, 2007). Team effort is required for successful leadership to occur. By building confidence in your team and giving them the education and tools they need, they will become responsible for their own assignments and have the ability to complete their work to a higher level. If they fail occasionally, they'll know they will be supported and guided to perform better next time.

Kouzes and Posner's (2007) research also determined that leaders who recognize their employees' successes publicly, such as by giving a party or celebration, will make employees feel empowered and appreciated. This will in turn make the employee want to continue to produce high quality work and give them a sense of pride in their accomplishments (Kouzes and Posner, 2007). This fifth practice of leadership is *Encourage the Heart*. As touched on earlier, meaningful recognition of employee contributions is a very important leadership behavior and responsibility. This practice emphasizes that leaders need to expect the best from themselves and encourage their employees to do their best.

Empirical research also shows that organizations with leaders who exhibit the Five Practices of

Exemplary Leadership have higher employee morale, higher productivity, and strong economic growth (Kouzes and Posner, 2002). According to one study “Companies with a strong and consistent application of these five leadership practices had a net income growth of 841% versus -49% for companies with a low incident of leadership practices” (p. 4). Other research found that “Based upon mean scores, Enable is the leadership practice most frequently reported being used. This is closely followed by Model; with the average scores for Challenging and Encouraging being fairly similar. Inspiring is perceived (both by respondents and their constituents) as the leadership practice least frequently engaged in” (p. 4).

Transformational leaders must also have the technical knowledge of their industry to be perceived as credible, which in turn gains their employees' respect (Kouzes and Posner, 2007). Without credibility, followers struggle to accept the vision of the leader (Kouzes and Posner, 2007). Moreover, a successful leader will perform at a high level and also expect a similarly high level of production from their followers. Kouzes and Posner (2007) state that “High expectations lead to high performance” (p. 284).

Bass and Avolio's (1994) research of transformational and transactional leadership lead them to develop the Multifactor Leadership Questionnaire© (MLQ), an instrument used to measure leadership behaviors and their outcomes on individuals and organizations. Bass (1996) notes that transformational leadership has four components and transactional leadership has three, all of which can be identified by using the MLQ©. The four transformational components are *idealized influence* (charisma), *inspirational motivation*, *intellectual stimulation*, and *individual consideration*. Conversely, the three components of transactional leadership are *contingent reward*, *management-by-exception* (passive or active), and *Laissez-Faire*. Transformational leaders aspire to achieve greater results than just a simple transaction of work and reward among co-workers by bringing out the best of themselves and their employees through creating an inspiring and meaningful organizational environment (Bass, 1996).

Kouzes and Posner's (2007) research of transformational leadership lead them to form the Leadership Practices Inventory© (LPI) which measures the performance of the five leadership practices: *Model the Way*, *Inspire a Shared Vision*, *Challenge the Process*, *Enable Others to Act*, and *Encourage the Heart*. Both the MLQ© and the LPI© have been used extensively by researchers as a measuring tool for leadership and have continually produced valid assessments of leadership practices among managerial leaders (Greimann et al., 2007; Jones and Rudd, 2008; Kass, and Grandzol, 2010; Schriesheim et al., 2009; Sinasky and Bruce, 2005, 2006). “The MLQ© and LPI© measure the compe-

tencies leaders are currently using successfully and what areas may provide opportunities for improvement” (Sinasky and Bruce, 2006, para. 10).

The LPI© has been used successfully with a variety of populations. To assess the impact of community leadership programs in underserved populations Walker and Gray (2009) conducted a phone survey which revealed that respondents who had attended leadership programs scored significantly higher in the behaviors of Challenge the Process and Encourage the Heart, than did those that did not. In addition, Rudd (2000) used the LPI© to assess the leadership styles of county Extensions directors, who ranked themselves highest in Enable Others to Act. Likewise, Spotanski and Carter (1993) asked department executive officers to assess themselves with the LPI© and found they scored highest on Enable Others to Act as well. Executives with greater administrative responsibilities scored significantly higher on the leadership behaviors Inspiring a Shared Vision and Encouraging the Heart than those with less administrative responsibilities. Those who had attended leadership training had significantly higher scores for Enable Others to Act and Encourage the Heart than those with who had not received training.

The MLQ© has also been used within agricultural circles (Greiman, 2009). Greiman et al. (2007) assessed agricultural education teachers and determined they preferred transformational leadership style. When teachers were grouped by gender, years of experience, or education, no significant difference were found in the styles preferred. Further, Jones and Rudd (2008) found academic administrators (deans) utilized transformational leadership skills most, with males scoring themselves higher than females in all leadership areas.

While much research has been conducted in the discipline of agriculture to study leadership styles, youth leadership, and leadership in the context of Extension and academia, little research exists studying the effects of transformational leadership behaviors of agricultural professionals, such as golf course superintendents or their employees. This may be a problem for leaders wanting to transform agricultural organizations, especially if they are unable to find research suggesting the best ways to bring about the positive outcomes of leadership such as Effectiveness, Satisfaction, and Extra Effort by employees (Bass, 1998). Likewise, this information may help to inform faculty who are preparing students to become leaders in their field. This study is conducted in the context of the turf industry –a \$40 billion industry that ranks 3rd in total acreage nationwide, which is replete with problems (i.e., water management) in need of sound leadership. In fact, Seagle and Iverson (2002) conducted a Delphi study of turfgrass industry experts and discovered that when teaching about the industry, “human resource management and ethics,” “business

management,” and “communication skills” should all be included in the curriculum.

The purpose of this study was to describe the self-perceived transformational leadership behaviors (Kouzes and Posner, 2007) used by golf course superintendents in the state of Georgia, and the leadership outcomes of those behaviors (Bass, 1998). By doing this, golf course superintendents' leadership behaviors and perceived impacts of those behaviors may be better understood, and the relationships between these behaviors and outcomes could be explored. In addition, professional development workshops and undergraduate curriculum might be developed to address needed leadership behaviors of current superintendents and future turfgrass professionals. The following objectives guided this study:

1. Describe the self-perceived leadership behaviors of Georgia golf course superintendents.
2. Describe the self-perceived leadership outcomes that these leaders generate among their followers.
3. Determine if relationships exist between transformational leadership behaviors and leadership outcomes.

## Materials and Methods

To conduct this descriptive survey research, an online questionnaire consisting of the LPI© (Kouzes and Posner, 2007), a researcher-adapted outcome questions from the MLQ©, and demographic questions, was administered to the entire population of turf professionals who received emails via the Georgia Golf Course Superintendents Association (GGCSA) listserv ( $N = 278$ ). The University of Georgia Institutional Review Board approved the research protocols used in this study and a web-based informed consent was provided as part of the online survey.

The LPI© consists of thirty transformational leadership behavior questions, within which there are six questions for each of the five constructs. The participants rate themselves for each behavior on a scale ranging from 1 (*almost never*) to 10 (*almost always*). The LPI© is calculated by summing the construct scales (range 6-60). The internal reliabilities of the constructs are: .74 for Model the Way, .88 for Inspire a Shared Vision, .79 for Challenge the Process, .73 for Enable Others to Act, and .86 for Encourage the Heart (Posner, 2009). Validity for the LPI© was established by experts and through extensive use and testing (Posner, 2009, 2010; Shoemaker, 1994). Permission to use the LPI© was asked of and granted by Drs. Kouzes and Posner prior to this study (personal communication, April 12, 2009).

To measure the three leadership outcomes the MLQ© used nine questions, with one construct consisting of only two questions. To tailor the questions to turf professionals, the researchers

developed a series of additional questions for each outcome, which were pilot tested with 25 students in a leadership development course. The participants rated themselves for each question on a scale ranging from 1 (*almost never*) to 10 (*almost always*). Cronbach's alpha was used to determine reliabilities for the three scales. After removing one item from the *Effectiveness* outcome (five items) and one item from the *Extra Effort* outcome (four items), the Cronbach's alpha reliability of these scales was .83 and .88, respectively. The seven-item *Satisfaction* outcome scale had a reliability of .95, so all items were retained. The researcher-modified portion was standardized by determining the means for each construct and then multiplying by 10 to give a standardized score for each outcome of 10-100.

A post hoc reliability analysis was conducted using Cronbach's alpha. Model the Way was .76, Inspire a Shared Vision was .81, Challenge the Process was .75, Enable Others to Act was .73, Encourage the Heart was .87, Effectiveness was .83, Extra Effort was .75, and Satisfaction was .85.

The Tailored Design Method (Dillman, 2007) was utilized for data collection. The questionnaire was placed on SurveyMonkey© and then an email containing a link to the instrument and a note describing the survey and its importance, was emailed to the population, along with two reminder emails during the subsequent three weeks. To increase participation, emails were sent from a respected University of Georgia turf grass professor and member of the Georgia Golf Course Superintendents' Association (GGCSA). A 24% response rate was achieved ( $n = 67$ ). A comparison of early and late respondents was conducted to account for non-response error (Armstrong and Overton, 1977). Early ( $n = 21$ ) and late ( $n = 40$ ) respondents were compared on LPI© constructs, outcomes, and key demographic variables using a t-test and no significant differences were found between the groups.

## Results and Discussion

The participants were 100% male, and of those providing demographic data, 19.6 % listed a high school diploma as their highest degree, 33% an associate's degree, and 48% a bachelor's degree. The mean age was 42.7 years, with a range of 26-60 (Table 1). The range of years in the golf industry was 5-44, with a mean of 20.5, while the mean years as a golf course superintendent was 12.3 with a range of 1-36. Participants were also asked how many years of managerial experience they had in the golf course industry, as well as beyond the golf course industry (“any type”). Respondents managerial experience in the industry ranged from 3-36 years ( $M = 15.5$ ) and beyond the industry was 3-36 years ( $M = 17.9$ ).

The first objective was to describe the self-perceived leadership behaviors of Georgia golf course superintendents. The mean overall transformational

**Table 1. Demographics of Survey Participants (n = 46)**

	M	SD	Min	Max
Age	42.7	9.54	26	60
Years in the golf course industry	20.5	8.70	5	44
Years as a golf course superintendent	12.3	9.27	1	36
Years of golf course management experience	15.5	7.82	3	36
Years of any type of management experience	17.9	8.67	3	36

*Note: All participants did not complete all questions*

leadership behavior score from the LPI© was 241.3 of a possible 300 (Table 2). The LPI© score was made up of five constructs, with Model the Way garnering the highest score, which ranged from 36 to 60 ( $M = 51.2$ ), a high (72nd percentile) level based on Kouzes and Posner's (2007) findings. The other constructs' scores were in the middle percentile levels. The construct scores for Enable Others to Act ranged between 33 and 60 ( $M = 50.6$ , 53rd percentile), and Encourage the Heart ranged from 12 to 60 ( $M = 47.5$ , 44th percentile). Similarly, the constructs Challenge the Process and Inspire a Shared Vision ranged from 29 to 58 ( $M = 46.6$ , 53rd percentile) and ranged from 29 to 60 ( $M = 45.5$ , 51st percentile), respectively.

**Table 2. Leadership Practices Inventory Constructs and Total Scores (n = 64)**

Leadership Behavior	M	SD	Min	Max
Model the Way (MTW)	51.2	5.21	36	60
Enable Others to Act (EOTA)	50.6	5.36	33	60
Encourage the Heart (ETH)	47.5	8.29	12	60
Challenge the Process (CTP)	46.6	6.53	29	58
Inspire a Shared Vision (ISV)	45.5	7.35	29	60
Total Transformational Behavior	241.3	26.49	178	295

*Note: Possible scores had a range from a low of 0 to a high of 60.*

These results compare favorably to results presented by Posner (2010), in which the total LPI© behavior score was 233.3 ( $N = 241,000$ ). However, when analyzing individual means, some differences do emerge. Posner's research produced the following results: Model the Way was 47.3, Enable Others to Act was 49.8, Encourage the Heart was 46.4, Challenge the Process was 45.3, and Inspire a Shared Vision was 44.5. When the results of the current study are compared to the means found by Posner, golf course superintendents scored 3.9 points higher at Model the Way and about one point higher at the other practices.

Because the practice of Model the Way was strongest among participants, it could be interpreted that this practice is the most important for influencing positive outcome from followers. Moreover, it supports transformational leadership theory in that behaviors are a valuable and relevant way of building effective working relationships and credibility with the superintendent (Dubrin, 2007). Shoemaker (1994) found

that Model the Way had the most important effect on role clarity, which suggests effective transformational leaders need to lead by example or model how roles should be fulfilled by their employees. For this study it appears that Model the Way, as exhibited by showing crew members how to perform

their tasks to the superintendent's expected standards, is a key to effective follower performance.

The other four leadership behaviors ranked in the upper-middle percentile, as established by Kouzes and Posner (2003). Enable Others to Act was the second strongest leadership behavior, which may be common among leaders who assemble teams. In the turf maintenance industry, as in many professions, it is common for crew members to be put into small groups to accomplish required tasks. Once the crew has been trained, the most important way to ensure everything gets done on a daily basis is to delegate responsibilities, or Enable Others to Act, so it was plausible to see this being a top ranked leadership behavior. Similarly, Hacker and Roberts (2007) noted how empowering employees can instill a deeper meaning to their tasks. Perhaps, as a member of a maintenance crew, there may be a certain amount of pride that builds inside the employee who has been entrusted or empowered with a duty they are expected to perform well.

Encourage the Heart was the third highest transformational leadership score. In the context of golf course maintenance encouraging followers is needed and beneficial. Leader behaviors such as a verbal compliment or "thank you" can encourage followers. Formal recognition, such as awards, brings appropriate, positive attention to employees which is often a form of encouragement to the recipient as well as their peers. Other studies have found the transformational leader will utilize their position to encourage workers to find personal gratification in their work (Hacker and Roberts, 2007).

The fourth highest scored transformational behavior exhibited was Challenge the Process. From the data, it would seem this construct is not as highly used because a large part of golf course work is routine, sometimes daily, maintenance, so not much innovation may be needed. However, creating an atmosphere in which followers may suggest ways to improve the work environment, increase efficiency,

etc., may be an effective way to demonstrate this behavior.

Finally, the fifth highest scored transformational behavior exhibited was Inspire a Shared Vision. Although this is an important leadership behavior, it may be the least used behavior for similar reasons that Challenge the Process was a lesser used behavior. It may be inferred that due to the daily schedule of maintaining a golf course, the “vision” is achieved daily; therefore achieving the vision becomes more routine.

The second objective was to describe the leadership outcomes that Georgia golf course superintendents believe they generate among their followers: Effectiveness, Satisfaction, and Extra Effort. The mean overall outcome score was 250.4 indicating that

for this analysis (Clason and Dormody, 1994; Miller, 1998). Davis (1971) suggested adjectives to describe the magnitude of correlations: 1.0 signified a *perfect* correlation, .70-.99 was *very high*, .50-.69 was *substantial*, .30-.49 was *moderate*, .10-.29 was *low*, and a score of .01-.09 was a *negligible* correlation.

Several substantial relationships were found with the outcomes Satisfaction and Extra Effort. The leadership practice Model the Way had strongest correlation in the table with Satisfaction ( $p = .64$ ). The strengths of other relationships ranged from .33 (moderate) to .60 (substantial). In general, the relationships between leadership behaviors and the outcome Satisfaction were substantial (.54-.64), while the behavioral relationships with Effectiveness were moderate to substantial (.33-.52), as were the relationships with Extra Effort (.46-.60).

**Table 3. Leadership Outcomes Constructs and Total Scores (n = 64)**

Leadership Outcome	M	SD	Min	Max
Effectiveness	88.0	10.61	53	100
Extra Effort	82.7	11.79	38	100
Satisfaction	79.7	13.02	43	100
Total Leadership Outcomes	250.4	30.45	152	300

Note: Possible scores had a range from a low of 0 to a high of 100.

**Table 4. Spearman’s rho Correlations of Transformational Leadership Behaviors and Leadership Outcomes (n = 64)**

Outcome	CTP	ISV	EOTA	MTW	ETH
Effectiveness	.33 **	.37 **	.42 **	.52 **	.35 **
Satisfaction	.59 **	.54 **	.58 **	.64 **	.56 **
Extra Effort	.60 **	.57 **	.54 **	.48 **	.46 **

Note: \*  $p < .05$ ; \*\*  $p < .01$

The correlations between transformational leadership behaviors and outcomes were all positive, with Model the Way showing the strongest correlation with Satisfaction (.64) and Effectiveness (.52). Perhaps this is more common within labor intensive industries, such as turfgrass, in which good leaders will lead by example, showing followers how to accomplish a task and willing to “get their hands dirty” if needed. The other leadership behaviors have positive relationships with the outcomes, which is similar to the findings of Brown et al. (1996) who

overall employee outcomes were “usually” realized (Table 3). When viewing the individual constructs, the score for Effectiveness ( $M = 88.0$ ) ranged from 53 (*occasionally* employee Effectiveness was an outcome) to 100 (*almost always*), and was the highest outcome. The Extra Effort score ranged from 38 to 100 ( $M = 82.7$ ) and Satisfaction ranged from 43 to 100 ( $M = 79.7$ ).

Three employee outcomes were measured in the study. Of these, the Effectiveness and Extra Effort outcome scores were similar, and the Satisfaction scores were the lowest. Based on these findings, it would appear that transformational leadership behaviors among golf course superintendents tend to generate Effectiveness and Extra Effort outcomes at similar levels. Similar results were found by Tucker et al. (1999) who used the MLQ© to measure leadership outcomes and found that Effectiveness and Extra Effort were higher than Satisfaction.

The final objective was to determine if relationships existed between transformational leadership behaviors and leadership outcomes. The scale data was treated as ordinal and Spearman’s rho was used

found substantial to very high relationships with transformational behaviors. However, Tucker et al. (1999) found a very high relationship with Extra Effort but negligible relationships with Effectiveness and Satisfaction.

**Summary**

Perhaps the greatest finding of this investigation was determining the self-perceived level of transformational leadership behaviors used by golf course superintendents and the perceived employee outcomes that were positively related to those behaviors. From this study it appears that transformational leadership behaviors have a positive effect on how golf course superintendents lead their employees. These findings were consistent with the theory that transformational leadership practices have a positive and beneficial effect on leadership outcomes (Kouzes and Posner, 2007).

The results of this study have implications for educators as they prepare students to enter the turf profession. Previous authors have posited that

leadership education can lead to improved leadership behavior (Barker, 1997; Blackwell, 2006; Day, 2001; Hill, 2006). Indeed, military organizations have their foundation in this supposition (Brinsfield, 1998). With this in mind, it is recommended that post-secondary instruction include leadership coursework to help students understand the importance of leadership skills and equip them with the transformational leadership behaviors necessary to be effective golf course superintendents or supervisors in the turf industry. Likewise, professional development workshops and seminars that provide leadership knowledge and skills could also be beneficial to turfgrass industry professionals. As noted earlier, studies have illustrated the benefits of leadership training for successful outcomes (Spotanski and Carter, 1993; Walker and Gray, 2009). They noted that when study participants had previously engaged in formal leadership courses, a higher level of beneficial leadership behavioral practices were used, as opposed to participants that had not taken leadership training courses. Granted, the correlations revealed in this study cannot be assumed to be causal, nonetheless, by increasing transformational leadership behaviors, positive employee outcomes may occur, which would produce many benefits including a more enduring and meaningful working relationship between superintendent and employee, potential cost savings and financial benefits from an increase in employee performance and employee retention, and overall industry success.

Further research in this area would be useful to determine if an increase in transformational leadership behaviors result in additional employee outcomes. Similarly, more studies of this topic among a larger population would help determine how professionals from other agricultural disciplines rate their leadership behaviors and outcomes. In addition, future studies should utilize "observer" questionnaires, which allow a leader's followers and peers to assess the leader's leadership behaviors and outcomes. Finally, because Satisfaction was the lowest rated outcome, additional research should be conducted to determine if this outcome is ranked lower with other populations and if so, what steps (e.g., training) might be conducted to increase this outcome.

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# Resiliency and Achievement Goal Orientation among Agricultural Students

Rebecca K. Splan<sup>1,3</sup>, Ryan M. Brooks<sup>1,4</sup>,  
Shea Porr<sup>1,5</sup> and Thomas W. Broyles<sup>2,6</sup>  
Virginia Tech  
Blacksburg, VA



## Abstract

Resiliency and achievement goal orientations can influence academic achievement and self-regulated learning, but neither has been described in agricultural students. The objective of this study was to characterize both constructs in undergraduate students (n=107; 28 male) enrolled in an introductory agricultural economics course. Students completed 7-point Likert scale goal orientation and resiliency instruments. Non-parametric tests of mean differences evaluated fixed effects of gender and class standing, and relationships among variables were investigated via Spearman rank correlations. Mastery-approach means were greater than those for other forms of goal regulation. Female students scored themselves higher for mastery-approach goals, and freshman rated themselves higher in mastery-approach and mastery-avoidance goals than more advanced students, indicating greater emphasis on learning and achieving intrapersonal measures of success, rather than proving competence relative to peers or external criteria. No effect of gender or class standing on mean resiliency was observed. Resiliency and mastery-approach goal orientation were positively and moderately correlated. Attunement of instructors to apparent student resiliency and achievement goal orientation could allow for more learner-centered instruction or identify those potentially at risk for academically self-handicapping behaviors. Further work is needed to investigate relationships between these constructs, academic performance and aspects of self-regulated learning among agricultural students.

Keywords: Self-regulated learning, learner-centered, motivation

## Introduction

Achievement goal orientations represent motivation behind achievement behaviors in particular contexts (Dweck and Leggett, 1988; Nicholls, 1984), and have been associated with academic performance and self-regulated learning in under-

graduates (Coutinho and Newman, 2008; Elliot and McGregor, 2001; Pintrich, 2005). In the early literature, achievement goals were divided into two conceptual contexts: *mastery goals*, which focus on task-based and intrapersonal standards of competence, and *performance goals*, which focus on normative or interpersonal standards of competence (Dweck, 1986; Nicholls, 1984). More recently, a 2x2 framework was developed (Elliot and McGregor, 2001) in which the binary constructs of mastery and performance have been bifurcated relative to approach and avoidance dimensions. *Approach goals* focus on attainment of a positive possibilities or results. Contrastingly, *avoidance goals* focus on evasion or prevention of undesirable outcomes. The valence depends on costs and benefits of the activity within the larger context as perceived by the student, and each goal orientation will have different patterns of antecedents and consequences (Cury et al., 2006; Van Yperen et al., 2008). Achievement goals are expected to be positively correlated when they share a dimension and uncorrelated when they do not (Elliot and Murayama, 2008).

Resiliency, in contrast, indicates an individual's ability to maintain, improve and recover mental health following stressful events (Neill and Dias, 2001; Wolin and Wolin, 1993), or one's capacity for positive transformation in the face of uncertainty or change (Lifton, 1993). Resilient individuals are marked by self-determination, emotional intelligence, adaptability and problem-solving skills (Connor and Slear, 2009; Neill and Dias, 2001). College students with higher resiliency were more likely to persist to graduation (Donald et al., 2004) and explicit training in resiliency yielded improved metacognitive development and academic performance (Harnish, 2005).

It is not unreasonable to suspect that individuals with a strong mastery-approach orientation would also exhibit high resiliency. Both are functions of internal locus of control, self-efficacy and self-esteem. Individuals with a strong internal locus of control believe that they direct events which affect them, while those with high self-efficacy believe they are

<sup>1</sup>Current address: Middleburg Agricultural Research and Extension Center, 5527 Sullivans Mill Road, Middleburg, Virginia 20117

<sup>2</sup>Current address: 268 Litton Reaves Hall, Virginia Tech, Blacksburg, Virginia 24061

<sup>3</sup>Associate Professor, Animal and Poultry Sciences

<sup>4</sup>M.Sc., Animal and Poultry Sciences

<sup>5</sup>Assistant Professor, Animal and Poultry Sciences

<sup>6</sup>Assistant Professor, Agricultural and Extension Education

capable of achieving desired outcomes (Bandura, 1977; Schunk and Zimmerman, 2006). The two constructs differ in that locus of control is generally less situation-dependent, but both can be significant predictors of goal attainment. Self-esteem is a key intrapersonal component to goal orientation choice. Students with low self-esteem toward to an academic task are likely to resort to performance, rather than mastery goals, in an attempt to secure normative validation for their efforts (Peixoto and Almeida, 2010). Low self-esteem is also strongly correlated with low resiliency, along with increased anti-social and self-handicapping behaviors (Donnellan et al., 2005).

There has been little work exploring connections between resiliency and achievement goal orientations, two constructs which have been shown to contribute to undergraduate academic success. It is hypothesized that students who are inherently resilient will also score highly for mastery-approach goal orientations. Further, although resiliency and achievement goal constructs have been individually described for undergraduate students, they are typically characterized in psychology students, which under-represent populations' naïve to metacognition (Jackson et al., 1989). Few studies involving undergraduates in the life sciences, and no studies involving undergraduate students in the agricultural sciences, were found in the literature. Therefore, the purpose of this study was to characterize resiliency and achievement goal orientations among undergraduates in an agricultural economics course, and investigate relationships between the two constructs.

**Materials and Methods**

Undergraduate students (n=107; 28 male and 79 female) enrolled in an introductory-level agricultural economics course at a land-grant university completed a goal orientation questionnaire developed and validated by Elliot and McGregor (2001) and a resiliency instrument developed and validated by Neill and Dias (2001). This particular course was chosen for its large size, class level representation (12 freshmen, 54 sophomores, 29 juniors and 12 seniors) and instructor amiability. Further, the course is a pre-requisite for all majors within the College of Agriculture and Life Sciences and is unlikely to be taken by non-majors, although this was not investigated as part of this

study. The research protocol was approved by the Institutional Review Board and consent of recruited students was implied from completion of the self-report instruments. The 12-question self-report measure for achievement goal orientation included three questions related to each factor within the 2x2 mastery/ performance and approach/avoidance framework. Questions were randomized and participants indicated level of agreement on a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). The resiliency instrument consisted of 15 self-report questions answered on a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). Mean differences were tested via PROC NPAR1WAY of SAS (SAS v9.2, Cary, NC). Relationships among variables were investigated using Spearman rank correlations. Significance is reported at the P<0.05 level.

**Results and Discussion**

*Achievement Goal Orientations:* Overall, means for achievement goal orientations were above the midpoint (Table 1), indicating students generally agreed with instrument statements. These means are higher than those reported for psychology (Edens, 2006; Elliot and McGregor, 2001) or engineering (Wang et al., 2010) students. Overall, mastery-approach means were greater than those for other forms of goal regulation. Correlations among achievement goal orientations were moderate (Table 2) and similar to previous studies (Coutinho and Neuman, 2008; Wang et al., 2010; Young, 2007).

Female students scored themselves higher for mastery-approach goal orientations than males, but gender differences were not significant for other goal orientations (Figure 1). In schoolchildren, girls are often more likely to use mastery strategies, while

**Table 1. Achievement Goal Orientation Means**

Achievement goal item	Mean	SD
<b>Mastery Approach</b>		
I want to learn as much as possible from this class.	4.87	1.50
It is important for me to understand the content of this course as thoroughly as possible.	5.60	1.61
I desire to completely master the material presented in this class.	6.16	1.01
<b>Mastery Avoidance</b>		
I worry that I may not learn all that I possibly could in this class.	5.41	1.25
Sometimes I'm afraid that I may not understand the content of this class as thoroughly as I'd like.	5.12	1.36
I am often concerned that I may not learn all that there is to learn in this class.	4.82	1.38
<b>Performance Approach</b>		
It is important for me to do better than other students.	4.87	1.50
It is important for me to do well compared to others in this class.	4.63	1.69
My goal in this class is to get a better grade than most of the other students.	4.79	1.54
<b>Performance Avoidance</b>		
I just want to avoid doing poorly in this class.	5.60	1.61
My goal in this class is to avoid performing poorly.	5.36	1.67
My fear of performing poorly in this class is often what motivates me.	4.98	1.62

**Table 2. Achievement Goal Orientation Means and Intercorrelations<sup>1</sup>**

Variable	Mean	SD	Variable			
			1	2	3	4
1. Mastery Approach	5.75	0.92	---			
2. Mastery Avoidance	5.11	1.19	0.35**	---		
3. Performance Approach	4.77	1.43	0.45**	0.27*	---	
4. Performance Avoidance	5.31	1.37	0.21*	0.35**	0.22*	---

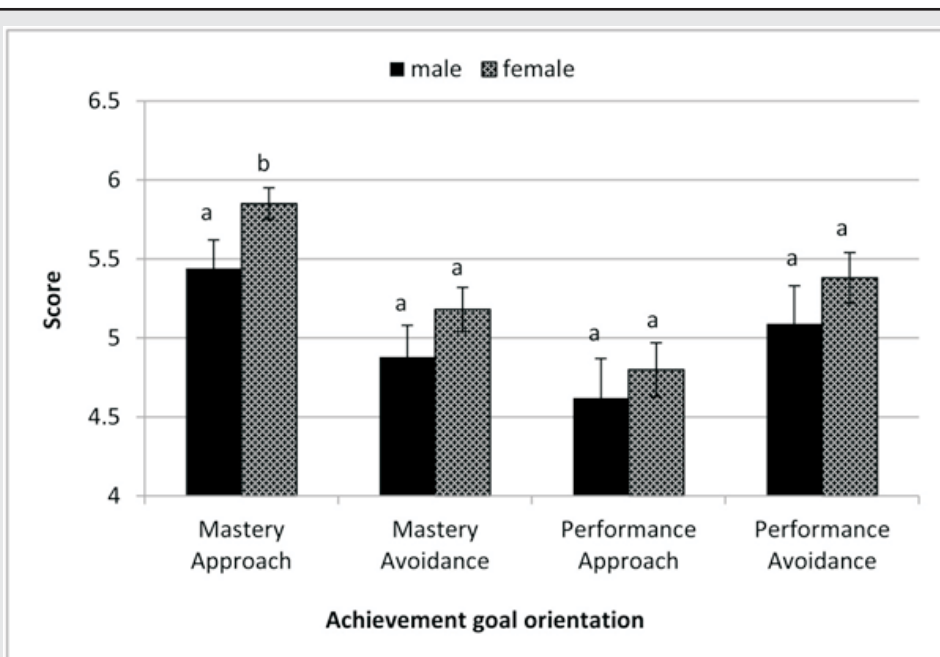
<sup>1</sup>\*, \*\*Significant at  $P < 0.05$ ,  $0.01$ , respectively using Spearman rank correlations

boys tend to adopt performance goals (Brdrar et al., 2006; Thorkildsen and Nicholls, 1998), consistent with the notion that boys are more ego- and competitively-oriented while girls favor cooperative efforts (Marsh et al., 2003). Also, boys tend to attribute success to ability, while girls are more likely to attribute success to effort (Ames, 1992). Significant effects of gender on goal orientation have not been prevalent in literature related to undergraduate students (Roebken, 2007; Wang et al., 2010), although agricultural and life sciences students have not been traditional populations for study. Students within the College of Agriculture and Life Sciences are predominantly female and enrolled in curricula strongly influenced by science, technology, engineering, and mathematics (STEM) fields (Food and Agriculture Education Information System, 2010).

minimum performance criteria or avoiding excess work (Brdar et al., 2006). This is consistent with the theory that as students develop academically, they become more concerned with obtaining good grades rather than mastering course content (Roebken, 2007). However, other studies have found the opposite effect of age on goal orientation. Roebken (2007) found freshmen were more likely than students from other classes to fall into performance or work avoidance orientations, while seniors exhibited strong mastery goals. This may be explained by professional development associated with increased class standing. As students mature and approach graduation, the proportion of courses directly applicable to their career choice increases, causing a stronger internal drive for achievement. Further, as people age, especially during the late adolescent period, they tend to move away from achievement based on expectations of others, and toward a more internal value system (Kohlberg, 1976).

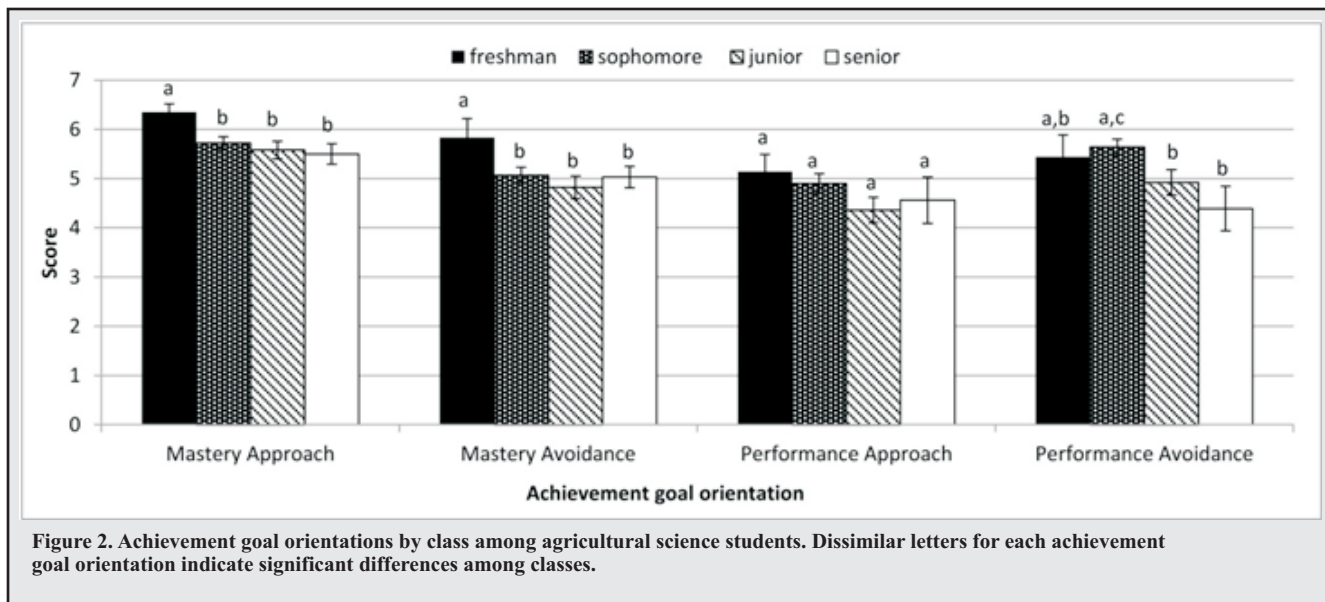
It is important to note that this study took place during fall, rather than spring, semester. Thus, freshmen participants were enrolled in their first semester at the university. An interesting avenue for further research would be to investigate whether second-semester freshmen displayed the same goal orientations as those newly-arrived on campus. In this study, sophomores were higher for mean performance-avoidance goal orientations than juniors or seniors, which may indeed indicate a shift toward more emphasis on normative

assessment once students begin their second year. Additional work is needed to determine if this trend is consistent across the college, or persists for non-agricultural majors.



**Figure 1. Achievement goal orientations by gender among agricultural science students. Dissimilar letters for each achievement goal orientation indicate significant differences between genders.**

Despite their relatively small number, freshmen rated themselves higher in mastery-approach and mastery-avoidance goal orientations than more advanced students (Figure 2). This indicates they are more concerned with learning relevant course



Goal orientations are linked to student motivation and reflect standards by which students gauge and regulate learning efforts. Empirical evidence suggests students with a mastery-approach goal orientation engage in more self-regulated learning (Pintrich, 2005). Their willingness to take risks, use higher-order thinking skills, seek help and learn independently suggests aptitude for lifelong learning. Wang et al. (2010) found that students strong in mastery-approach goal orientation had stronger feelings of autonomy and value in their learning, exerted more effort and energy toward academic tasks, and were more likely to have incremental vs. entity beliefs about the nature of intelligence (Wang et al., 2010). Thus, these students, when faced with academic challenges, are more likely to show adaptive motivational patterns, persistence and problem solving strategies (Dweck, 1986; Mueller and Dweck, 1998) than students who believe intelligence is a fixed and uncontrollable trait.

Mastery-approach goals highlight intrinsic interest, and would seem optimal for contexts where intrapersonal standards are valued, such as learning, development, improvement and understanding. Other goal forms also have the ability to contribute positively to academic achievement. Performance-approach goals have been shown to result in higher grades (Church et al., 2001; Harackiewicz et al., 2000) and can be associated with more than just superficial learning strategies (Pintrich and Garcia, 1991). Performance-avoidance goals can provide compelling motivation for task completion and minimum competence (Elliot et al., 2005). Yet performance-approach or performance-avoidance mindsets are ultimately motivated by fear of failure (Elliot and Murayama, 2008), rather than need for achievement. While use of these strategies may result in task accomplishment or explicit recognition, they are ultimately maladaptive (Mattern, 2005). Their associated negative socio-cognitive effects of distress, anxiety, defensiveness and anger can outweigh

interpersonal benefits of achievement. Mastery-avoidance goal orientations can also yield inimical results, and have been found to have a deleterious effect on performance in repeated tasks (Van Yperen et al., 2008). Although early researchers considered factors in the 2x2 achievement goal framework as mutually exclusive and relatively static (Elliot and McGregor, 2001), contemporary work suggests that learners may employ multiple strategies simultaneously and that goal orientation is highly individual- and context-dependent (Elliot and Murayama, 2008; Mattern, 2005).

*Resiliency:* Resiliency means were all above the midpoint (Figure 3). Means were highest for items related to long-term self-validation: R13 (“My life has meaning”) and R3 (“I feel proud of the things I have accomplished in my life”); and humor: R10 (“I can usually find something to laugh about”). Scores were lowest for items related to intrapersonal lack of control: R6 (“I feel I can handle many things at a time”) and R15 (“I have enough energy to do what needs to be done”). Male students scored themselves higher for R4 (“I usually take things in stride”) than female students ( $p=0.05$ ), but no other differences were significant across gender. Gender effects have been mixed in the literature (Neill and Dias, 2001). Senior students scored themselves higher for R10 (“I can usually find something to laugh about”) than other classes, but differences due to class were not observed for other resiliency items. This single significant for seniors result may be an indicator of a maturing sense of humor as a result of age or successful persistence in the face of adversity during college years, or it simply may be spurious. There was no effect of gender ( $p>0.88$ ) or class ( $p>0.37$ ) on mean resiliency. In freshmen, resiliency has been shown to be significantly and positively correlated with persistence to degree (Donald et al., 2004), but no differences were observed in the present study between freshman, sophomore, and junior classes.

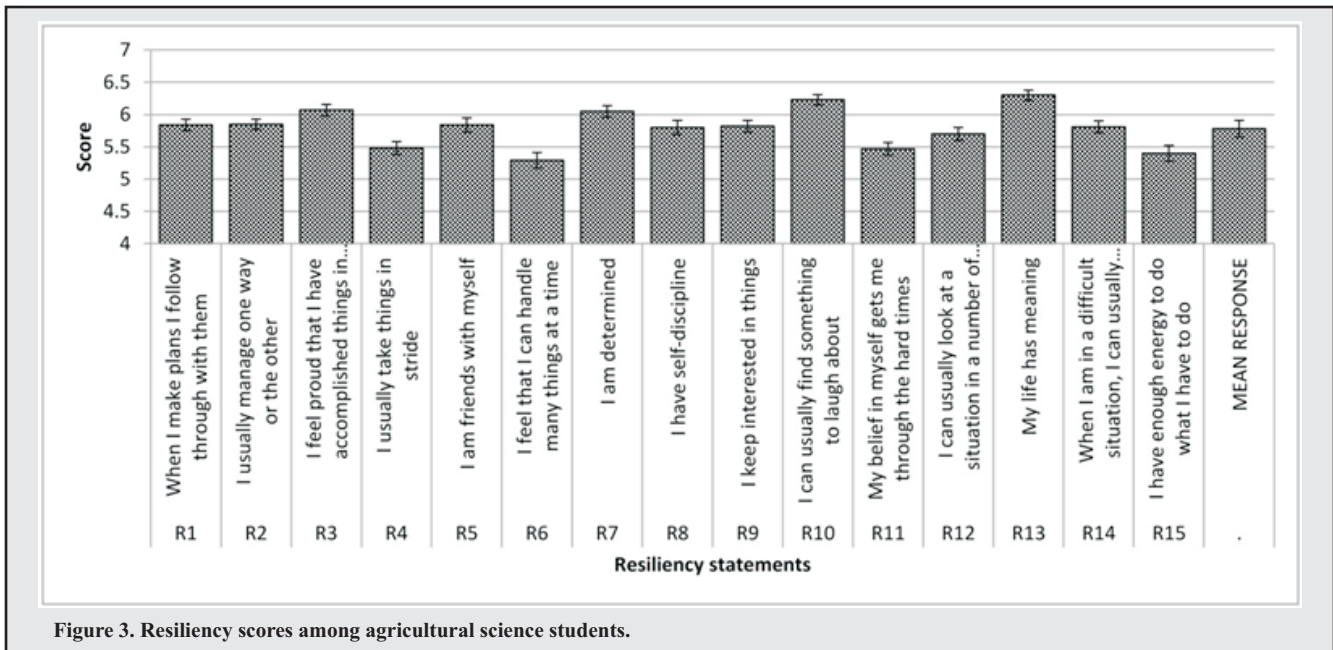


Figure 3. Resiliency scores among agricultural science students.

Historically, students engaged in agricultural majors were from rural or farming backgrounds (Buchanan, 2008). Farming families are inherently resilient (Darnhofer, 2010); coping with uncertainty and change is a necessary skill for those critically dependent on economic and climate variables they are unable to control. As a result, agricultural workers generally show lower levels of job-related stress and related mental health conditions than non-agricultural workers (King et al., 2009). Children from rural communities and farming families can be highly resilient as a result of their upbringing (Larson and Dearthmont, 2002). Today, however, the typical student enrolled in a college of agriculture at a land-grant university is from a suburban background, with little connection to traditional production agriculture (Buchanan, 2008), although a geographic bias is expected based on relative population density. Further research is needed to determine if students from farming families have significantly different levels of resiliency than those from non-agrarian backgrounds.

*Relationships between resiliency and achievement goal orientation:* As hypothesized, there was a significant positive correlation between overall resiliency and mastery-approach goal orientation, with significance reported for 10 of the 15 self-report items (Table 3). Three of the strongest correlations had to do with a strong sense of inherent persistence and tenacity (R7: “I am determined;” R8:

“I have self-discipline;” and R9: “I keep interested in things”). Resiliency involves adaptability and self-efficacy in the face of challenge or change, consistent with the intrapersonal need for achievement antecedent from which mastery-approach goals emerge (Elliot and Murayama, 2008). There is consistent evidence that there is a strong positive relationship between self-efficacy beliefs and mastery-approach goal orientations (Sakiz, 2011). Findings are mixed, however, with respect to self-efficacy and performance-approach themes. In this study, only two resiliency items were correlated with performance-approach goals in students. These results are consistent with the work of March et al. (2003) who found that non-traditional college students often employed learning goals and utilized task-oriented coping strategies, as a reflection of their desire to master material rather than simply achieve normative classroom success.

Table 3. Correlations between Resiliency Scores and Achievement Goal Orientations<sup>1</sup>

Resiliency Item	Achievement goal orientation			
	MAP	MAV	PAP	PAV
R1 – When I make plans I follow through with them	.22*	.01	.04	-.01
R2 – I usually manage one way or the other.	.18	.09	.11	.22*
R3 – I feel proud that I have accomplished things in my life	.45**	.10	.21*	.29**
R4 – I usually take things in stride.	.03	.00	.06	.12
R5 – I am friends with myself.	-.04	-.05	.02	.05
R6 – I feel that I can handle many things at a time.	.16	.02	.17	.05
R7 – I am determined.	.39**	.09	.18	.16
R8 – I have self-discipline.	.27**	.05	.05	.03
R9 – I keep interested in things.	.40**	.08	.21*	.11
R10 – I can usually find something to laugh about.	.08	.07	-.06	.14
R11 – My belief in myself gets me through the hard times.	.21*	.07	.10	.17
R12 – I can usually look at a situation in a number of ways.	.06	-.03	-.02	.14
R13 – My life has meaning.	.20*	-.01	.15	-.04
R14 – I can usually find my way out of a difficult situation.	.20*	-.04	.10	.12
R15 – I have enough energy to do what I have to do.	.21*	.06	.07	.12
TOTAL	.34**	.02	.18	.18

<sup>1</sup>\*, \*\*Significant at P<0.05, 0.01, respectively using Spearman rank correlations

Interestingly, the strongest correlation between resiliency and mastery-approach goal orientation was with R3 (“I feel proud of what I have accomplished in my life”). There was also a significant positive correlation between scores for this statement and both performance-approach and performance-avoidance goal orientations. The statement, while related to resiliency, can be interpreted to reflect achievement in its simplest form when taken alone. As a result, it is not unexpected that significant correlations would exist between it and all goal orientations except mastery-avoidance, which has been shown to negatively affect performance (Van Yperen et al., 2008). Despite evidence (Pintrich, 2002; Sakiz, 2011) that avoidance and performance strategies result in greater anxiety, anger, distress, and worry regarding a new challenge, there were no significant negative relationships between resiliency and either mastery-avoidance, performance-approach, or performance-avoidance orientations.

Today's agricultural classroom is increasingly learner-centered (Woods et al., 2004). Great strides have been made to recognize and accommodate individual learning styles, which have been shown to impact academic performance and student-teacher interaction in the agricultural sciences (Cano et al., 1992; Garton et al., 2005). Yet learning style is merely a descriptor of behaviors which indicate how a person learns or adapts to their learning environment (Gregorc, 1979). Ultimately, understanding and shaping the motivational factors behind those behaviors will provide the key to educator and student success. Constructs like resiliency and achievement goal orientation are measurable and inherently malleable. If agricultural educators can recognize motivational factors present in their classroom, they can foster positive change in learning behavior, or at the very least, identify students potentially at risk for academic self-handicapping.

### Summary

Students enrolled in an introductory agricultural economics class scored themselves higher for a mastery-approach goal orientation than other achievement goal forms. This is consistent with findings in other undergraduate student populations, and is associated with learning behaviors that support self-regulation and deep processing of information. Effects of gender and class standing were found for goal orientations, but did not appear to influence resiliency. Resiliency was positively associated with a mastery-approach orientation, indicating influence of common precursors such as self-efficacy, self-determination, and need for achievement. Achievement goals and resiliency speak to motivation and capacity for academic merit, and maladaptive strategies can hinder professional development of the student while jeopardizing mental health. Attunement of instructors to the apparent resiliency and achievement goal orienta-

tions of individual students could allow for more learner-centered instruction, especially for students who are performing poorly. Further work is needed to investigate relationships between achievement goal orientations, academic performance, and aspects of self-regulated learning among agricultural science students.

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# An Integrated Framework for Assessing Oral Presentations Using Peer, Self, and Instructor Assessment Strategies<sup>1</sup>

**Awoke Dollisso<sup>2</sup> and Vikram Koundinya<sup>3</sup>**  
**Iowa State University**  
**Ames, IA**



## Abstract

Instructors offering oral presentation courses are always looking for ways to give constructive feedback to students to help improve their presentation skills. In most cases, assessments by instructors and peers as well as self-assessments are used to evaluate student presentations. We used a combination of peer, self, and instructor assessment strategies in a presentation course offered at the Iowa State University. The first author developed a 10-point Likert type scale with 10 items related to presentation skills. A paired samples t-test analyzing student ratings of their perceived skill levels on these 10 variables indicated a statistically significant improvement between the beginning of the semester and at the mid-semester using data collected at the mid-semester. In addition, qualitative data was used to judge student improvements in presentation skills. The integrated assessment strategy that was employed in this presentation course is presented in this paper. This integrated assessment strategy has implications for instructors and students in oral presentation courses striving to improve presentation skills.

## Introduction

After graduation, students need oral presentation skills to succeed in the workplace. Employers are looking for graduates with excellent oral presentation skills (Alshare and Hindi 2004). Martin-Young (1996) stated that the business and industry leaders look for oral communication skills in all entry level workers. Ghimire (2010) concurred that communication skills are important for people entering the workforce. Therefore, it is imperative for the educational institutions to help students develop oral presentation skills. To achieve this end, the Department of Agricultural Education and Studies in the College of Agriculture and Life Sciences at the Iowa State University has designed a presentation course. This course titled 'Presentation and Sales Strategies for Agricultural Audiences' is a required course for all majors in the college.

Instructors offering such presentation courses design various strategies to maximize improvement

in students' presentation skills to the extent possible within a semester. In this case, instructor and student peers used presentation evaluation rubrics to assess each student's presentation performance. Peer feedback and an individual student presentation video record were given to the presenter at the end of his or her presentation for self-assessment. Instructor assessment alone was used for grading.

Patri (2002) stated that peer assessment and self-assessment techniques have significant merit in terms of pedagogical value, and have been found to improve various aspects of student learning (Dochy et al., 1999). These two assessment strategies add value to instructor feedback. Assessment by the instructor alone has been in use for a long time, and has its own strength of giving more reliable feedback and grades. Sterling (2008) opined that instructor assessment helps student to accurately understand the subtler things.

Literature suggests that each of these three assessment strategies has its own set of advantages and disadvantages (Papa, 2010; University of Technology Sydney, 2007). Peer assessment helps students become autonomous learners and critical analyzers (University of Technology Sydney). Furthermore, students consider peer assessments fair and relevant because input is from their peers (The University of Sydney, n.d.). In addition, peer assessments add cognitive and meta cognitive value to students (Topping, 1998). However, peer assessment may not always have the same quality as an assessment by an instructor (Topping) because students may not take the assessment process seriously and may allow friendships to influence their judgment (University of Technology Sydney, 2007). Similarly, self-assessment has been found to be biased by subjectivity, lack of accountability (Papa, 2010) and reliability, and it has the danger of inflating grades (University of Sydney, n.d.). Nonetheless, self-assessment does promote personal growth and gives insights into one's own strengths and weaknesses (Papa). Regarding the instructor assessment strategy, it gives a single perspective and may sometimes be prone to the subjectivity of one person. But, it eliminates any intentional biases. The inherent strengths and weaknesses in each of these assess-

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<sup>2</sup>Assistant Professor, Dept. of Agricultural Education and Studies, 229 Curtiss

<sup>3</sup>Postdoctoral Research Associate, Dept. of Agricultural Education and Studies, 223 Curtiss

ment strategies suggest the indispensability of an integrated approach for evaluating student oral presentations.

Different combinations of peer, self, and instructor assessments have been used in the field of education. It is very important for the instructors to have suitable and carefully designed assessment strategies to evaluate student presentation skills as White (2009) found that students hold strong views about assessment methods, and those views influence the way they approach various learning experiences (as cited by Majdoddin, 2010). Dochy et al. (1999) found that a combined use of assessment strategies enables students to become responsible for their learning. On a similar note, Sterling (2008) recommended that analyzing student presentations from the perspectives of peer, self, and expert assessments would give more useful feedback and learning opportunities.

A review of literature suggests that there are no known studies of these assessments in the agricultural education settings that have provided an integrated framework for assessing student oral presentation skills. In order to fill this lacuna, the authors developed an integrated framework based on their teaching experiences in a junior level presentation course in the Department of Agricultural Education and Studies at the Iowa State University. The purpose of this study is to describe and share this integrated assessment framework with instructors offering presentation courses. This framework has implications for instructors offering presentation courses both in agricultural education and in presentations/speech courses outside of agricultural education.

## Theoretical Framework

From an epistemological perspective, assessment strategies used in this presentation course align with social constructivist theory with elements from social cognitive theory. Shepard (2000) stated that a middle ground between cognitive, constructivist, and socio-cultural theories would give a proper framework for designing assessment strategies. Social constructivism assumes that knowledge is constructed through interactions in a social system, and stresses the co-construction of meaning through activities carried out in that system (Doolittle and Camp, 1999; Roberts, 2006). The importance of interactions in constructing knowledge was stressed by Vygotsky's sociocultural theory, which states: "Social interactions are critical; knowledge is co-constructed between two or more people" (Schunk, 2008, p.244).

The three different assessment strategies used in this course provided ample opportunities for student interactions. The feedback from peers and the instructor provided individual presenters with different perspectives on how to improve their presentations. Also, the group presentations gave an excellent opportunity for student-presenters to interact closely with group members and construct their presentation skills.

The importance of the social environment in learning is also a basic tenet of Albert Bandura's social cognitive theory. According to this theory, most of human learning occurs in a social environment (Schunk, 2008). Further, people learn vicariously by observing others (Schunk, 2008). An integrated use of peer, self, and instructor assessment strategies would provide a social environment for students to interact with each other and with the instructor and, by doing so, to develop their presentation skills.

## Methods

The first author taught the course 'Presentation and Sales Strategies for Agricultural Audiences' during the spring and fall semesters of 2010 at the Iowa State University. The quantitative data collected from students, qualitative data from student self-assessment (reflections), and the experiences of the instructor from these two semesters were used to interpret the results. Students were required to give five presentations (three individual and two group) and one poster presentation. The five presentations included a visual aid presentation, a demonstration presentation, a large group presentation, a one-on-one sales presentation, and a sales training presentation. These five presentations were designed to give undergraduate agriculture students a variety of presentation opportunities and experiences. Each presentation was critiqued by peers, the presenter him/herself, and the instructor with immediate feedback.

Students in the class observed and evaluated each other's presentations using pre-designed rubrics. An individualized rubric was used for each presentation based on the best fit. The same rubrics were used by the instructor to grade those presentations. It was made clear that peer assessment ratings were anonymous and would have no bearing on the presenter's grade. Students were given clear instructions about the criteria to be considered while rating peer presentations and were encouraged to identify presenters' strengths and weaknesses in a constructive manner. Completed rubrics were collected immediately after the presentation by the instructor and handed to the presenter with an exception that peers gave objective ratings to the presenter(s). The presentation itself was graded by the instructor alone to eliminate intentional grading bias and to complement objective assessment by the audience.

In addition to the peer and instructor ratings, each presentation was videotaped for self-reflection. As a part of this self-reflection process, each presenter was required to review and analyze peer feedback, watch his/her taped presentation, reflect on the entire presentation experience, and write a one to two page reflection paper on the entire experience. In this paper, each student had to answer four questions that served as a self-assessment: (1) What things went well in your presentation? (2) What concerns or problem areas did you experience? (3)

What did you learn from this presentation experience? and (4) How does your self-evaluation compare to the peer evaluations? Having students reflect on aspects like what could be improved in their next presentations would help develop their oral presentation skills (Moon, n.d.).

Further, the instructor developed a 10-item questionnaire (Figure 1) for the purpose of getting feedback data on students' perceptions regarding their learning and progress in this class (Dollisso, 2009). A 10-point Likert-type scale ranging from 1= Very Low to 10= Very High was used to record students' perceptions of their overall progress in improving presentation skills mid-way into the semester. These 10 variables (depicted in Tables 1 and 2) that reflected the desired outcomes from this class were identified by the instructor, and administered to students once mid-way through the semester. Each student compared and rated his/her perception on each of the 10 variables mid-way through the semester to beginning of the semester. Such a "post-then-pre" approach is recommended by Rockwell and Kohn (1989) as the respondents may not always have sufficient knowledge on what each variable means at the beginning of a course, and that affects the validity of the data. Further, this approach helps prevent pre-test sensitization. The data were collected at the middle of the semester to get feedback to help make any needed changes to improve learning.

The data were collected in spring and fall 2010 semesters from the 21 and 17 students, respectively, that were registered for the class. The questionnaire was not pilot-tested due to small sample size.

reliability according to George and Mallery (2003). The reliability of the findings that are presented in the next section was based on the assumption that students provided honest and objective ratings. Furthermore, qualitative data from students' reflection statements and the instructor's experiences from offering the course helped triangulate the findings from these tests and demonstrate the usefulness of the integrated assessment framework used for this presentation class.

## Results and Discussion

A paired samples t-test was used to test for any statistically significant differences in the mean scores on the 10 identified variables on student perceptions of presentation skills between the beginning and mid-way point of the semester. It was found that there was a statistically significant increase in the mean scores between the beginning and mid-point of both semesters on all 10 identified variables at 0.01 level of significance (Table 1 and 2), indicating that the course design was useful in achieving the desired presentation skills. It is important to note here that the influence of extraneous factors on higher scores in the data collected mid-way through the semesters cannot be ruled out. But, this does give an indication on the utility of the integrated assessment strategy used in this course. This paper is designed more towards sharing a teaching practice the authors feel would benefit teachers offering presentations/ speech courses, rather than extrapolating the findings to other populations.

In addition, the qualitative data from students' reflection papers indicated that students agreed with their peers' assessments of their presentations even when they were not highly rated. Students' self-assessment reflections showed that students accepted the feedback as a constructive educational process and suggested that they liked the design of the course. Students' reflection papers showed that they critically reflected on the four questions posed to initiate their reflection process. A few examples of student reflection statements are given below:

**Directions:** Below are ten statements for you to rate your progress AGEDS 311 class. Please compare and rate your perceptions of these statements at the beginning of the class verses today

Presume 1 = very low and 10 = very high

First Day of class	Today
1 2 3 4 5 6 7 8 9 10	Apprehensive about presenting in front of an audience 1 2 3 4 5 6 7 8 9 10
1 2 3 4 5 6 7 8 9 10	Presentation skill/knowledge 1 2 3 4 5 6 7 8 9 10
1 2 3 4 5 6 7 8 9 10	Use of variety of strategies 1 2 3 4 5 6 7 8 9 10
1 2 3 4 5 6 7 8 9 10	Presentation planning and organization 1 2 3 4 5 6 7 8 9 10
1 2 3 4 5 6 7 8 9 10	Confidence 1 2 3 4 5 6 7 8 9 10
1 2 3 4 5 6 7 8 9 10	Use of PowerPoint for presentations 1 2 3 4 5 6 7 8 9 10
1 2 3 4 5 6 7 8 9 10	Engaging audiences during presentations 1 2 3 4 5 6 7 8 9 10
1 2 3 4 5 6 7 8 9 10	Planning, preparing and presenting in groups 1 2 3 4 5 6 7 8 9 10
1 2 3 4 5 6 7 8 9 10	Evaluating others' presentations 1 2 3 4 5 6 7 8 9 10
1 2 3 4 5 6 7 8 9 10	See value/application of presentation skills 1 2 3 4 5 6 7 8 9 10

Figure 1. Questionnaire used for the study.

Cronbach's alpha values for reliability were computed upon the completion of data collection. This is an acceptable approach according to Schmitt and Bartholomay (2009). Alpha values of .825 and .854 were recorded for the spring and fall semesters, respectively, which are categorized as having "good"

### Example 1

Overall my experience in AGEDS 311 has been very positive and I'd recommend it for anyone who has the opportunity to take it. Not only does it give you valuable practice with presentations but the feedback is the greatest benefit. The feedback from

**Table 1. Paired Samples *t*-Test on Selected Statements Depicting Student Progress in AgEdS 311 Class between the Beginning and Mid-point of the Spring 2010 Semester (n= 21)**

Oral Presentation Related Skills	Paired Differences		<i>t</i>	df	P
	<i>M</i>	<i>SD</i>			
Apprehension about presenting in front of an audience	3.23	1.75	8.44	20	.000
Presentation skills/knowledge	-3.00	1.76	-7.80	20	.000
Use of variety of strategies	-3.52	2.11	-7.64	20	.000
Presentation planning and organization	-2.61	1.59	-7.51	20	.000
Confidence	-3.04	2.10	-6.62	20	.000
Use of PowerPoint for presentations	-1.66	1.74	-4.38	20	.000
Engaging audiences during presentations	-2.90	1.72	-7.69	20	.000
Planning, preparing and presenting in groups	-2.33	1.62	-6.58	20	.000
Evaluating others' presentations	-2.61	2.61	-4.58	20	.000
See value/application of presentation skills	-2.66	1.87	-6.50	20	.000

**\*\*P < 0.01**  
*(P values of 0.000 indicate that the mean difference was highly significant. SPSS outputs were not able to show numbers beyond three decimals)*

**Table 2. Paired Samples *t*-Test on Selected Statements Depicting Student Progress in AgEdS 311 Class between the Beginning and Mid-point of the Fall 2010 Semester (n= 17)**

Oral Presentation Related Skills	Paired Differences		<i>t</i>	df	P
	<i>M</i>	<i>SD</i>			
Apprehension about presenting in front of an audience	3.29	1.99	6.81	16	.000
Presentation skills/knowledge	-2.35	1.76	-5.49	16	.000
Use of variety of strategies	-2.82	2.09	-5.54	16	.000
Presentation planning and organization	-2.35	1.93	-5.01	16	.000
Confidence	-2.29	1.64	-5.73	16	.000
Use of PowerPoint for presentations	-1.05	1.08	-4.01	16	.001
Engaging audiences during presentations	-2.82	2.03	-5.71	16	.000
Planning, preparing and presenting in groups	-2.29	1.40	-6.73	16	.000
Evaluating others' presentations	-2.17	1.85	-4.86	16	.000
See value/application of presentation skills	-1.82	1.70	-4.41	16	.000

**\*\*P < 0.01**  
*(P values of 0.000 indicate that the mean difference was highly significant. SPSS outputs were not able to show numbers beyond three decimals)*

the audience had the biggest [impact] on how I felt my presentation did. When you see that multiple people make a comment on a single issue you know that that area went well or needs some improvement.

**Example 2**

I learned the most and got the most out of the presentations we did by watching myself present on the video that was taken of each of us. After watching myself in the video I saw that I had really good eye-contact with the audience, but I needed to move around more and have more activities to keep the audience interested in what I was speaking about.... You will learn more from your presentation with the more mistakes you make and you will see those

mistakes when you watch the video of yourself. I have already benefitted a lot from this class because I have gotten to see so many different presentation styles throughout our six different presentations.

**Example 3**

Watching videos of the presentation helped me see the difficulty of this task. In the middle of a presentation, I might feel like I was speaking in excited tones and smiling, but when I reviewed a video, I could see that the enthusiasm was not quite breaking through.

**Example 4**

I learned that I am able to improve basically week to week with my speaking skills and I will be able to ...with confidence anything that is asked of me in this class. I also learned from others presentations what was effective and what methods weren't for a certain type of demonstration. My self- evaluation was pretty much the same as those from my peers.

**Example 5**

I can now give presenters positive feedback on things they were doing right, and also be able to give them suggestions on what they can improve on.

**Example 6**

I am not a big fan on going back and watching myself, but this course required me to do so. I believe watching yourself and your mannerisms helped me improve on what not to do during a speech or presentation.... I believe the instructor did a great job in critiquing us after the presentation.

**Example 7**

When comparing myself to those that my peers gave me, they are closely related....for example I gave myself a lower score than my peers on such things as objectives, enthusiasm and organization.

*Example 8*

There is a lot I learned from this presentation that I know I will be able to implement into my presentations for the rest of the semester....There are a few things that I need I could improve on after reading the comments from my classmates.... I could also do a better job involving my classmates so they don't get bored during the presentation and there would be a better chance for them to remember the information.

*Example 9*

Professor [X] said that my presentation may have generalized too much when comparing whole countries. I agree, and I probably should have stressed...on real research. Professor [X] also said I sounded or looked nervous. I really did not feel nervous...

*Example 10*

...My presentation.... did not go perfect.... I stuck to my professional, monotone voice during my presentation. I need to get away from this tone. It is not enthusiastic enough. I really noticed this while watching the video.... Not a single student asked a question at the end; this could suggest that the class understood everything; however, I would have preferred it if some of the students had asked questions at the end of the presentation.

*Example 11*

With learning from my professor and classmates on what to improve on as the course progressed on, really influence me into putting in more effort into creating a great presentation that others understand and want to buy.

The examples of student work presented above indicate that students learned or benefitted from video, peer, and instructor feedback. They did not just blindly agree with everything in the feedback. They had their own views about each assessment strategy used and how it was useful to them.

The authors believe that integrated assessment strategies that were used in this class provided students opportunities to assess their own performance using feedback from multiple sources. Each of these assessment strategies makes its own contribution to student learning; therefore, an integrated use of a variety of strategies may help reinforce learning and further improve students' presentation skills. Sterling (2008) stated that feedback from multiple perspectives increases student self-awareness and offers them opportunities to grow. Also, peer and self-assessments have been found to impart meta cognitive and critical analytical skills (Sterling, 2008; Topping, 1998). Further, self-assessment reflection assignments can provide students with experiential learning, as reflection is an integral part of any experiential learning cycle (Roberts, 2006). Hence, we recommend that instructors adopt integrated

assessment strategies in their oral-presentation courses. The variables used in the feedback questionnaire can be modified based on the desired course outcomes, types of presentations, and the context of those presentations. We believe regardless of the outcomes, types of presentations, and the context, an integrated assessment approach like the one presented in this paper would provide a credible feedback to students and may motivate students to work towards continuous improvement in their presentation skills.

## Summary

Improving students' oral communication skills is a primary outcome of presentation/speech classes. Instructors offering such courses may integrate a variety of assessment strategies that provide more feedback to students on their presentation skills. This paper shares an integrated assessment framework the authors used in offering a presentation course at the Iowa State University. The findings indicated the utility of an integrated assessment framework in teaching presentation skills. The authors recommend that instructors offering presentation courses use this integrated assessment framework in presentation courses.

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# Undergraduate Students' Use of Time in the College of Agriculture and Natural Resources at Michigan State University

**Krishna M. Shrestha<sup>1</sup>**  
**Ministry of Government Services**  
**Toronto, ON Canada**



**Murari Suvedi<sup>2</sup> and Eunice F. Foster<sup>3</sup>**  
**Michigan State University**  
**East Lansing, MI**

## Abstract

College students' time use has been a concern of administrators, professors, academic advisors, and parents alike. Research in students' time use is especially limited in colleges of agriculture. This study assessed how undergraduate students in the College of Agriculture and Natural Resources (CANR) at Michigan State University use their time. Annually, from 2004 to 2008, students in the CANR received online surveys asking them to report their time use and demographic information. Over the course of five years, 2,803 students participated in the study. Data analysis revealed students' average use of time (hours/week) as: preparing for class (15.2), working for pay on-campus (13.5), working for pay off-campus (16.9), participating in co-curricular activities (6.1), relaxing and socializing (16.2), providing care for dependents (11.6), and commuting to class (5.0). The study showed significant differences in students' time use based on their academic year, gender, ethnicity, and home residence. These demographic differences in time use suggest that academic advising strategies should differ on the basis of student demographics. Study findings suggest that students need more counseling on time management strategies.

## Introduction

College students' time use has been a concern of administrators, professors, academic advisors, parents and guardians alike. Time is an important resource for all, but it is a critical resource for students' successful performance. Meredeen (1988) indicated that the secret of survival and success at college can be largely defined in terms of how well students organize their time. Managing time is a challenge for many college students. Unlike high school students, college students have less in-class time and more outside-of-class work. Many college students find their academic life very stressful (Macan et al., 1990).

College students' time management is directly correlated with academic performance and stress. A universal assumption is that college grades are affected by the amount of time students spend on study; however, the relationship between college grades and quantity of time spent on study has not been fully established. Schuman et al. (1985) found a very small relationship between college grades and amount of study. Britton and Tesser (1991) found that two time management components -- short-range planning and time attitudes -- were significant predictors of cumulative grade point average and concluded that time management practices may have a positive effect on college grades. They also have shown that time management is a better predictor than Scholastic Aptitude Test (SAT) scores of college performance -- i.e., grade point average.

Time management is a skill, and it can be taught to students to make them more effective learners (Trueman and Hartley, 1996; Macan, 1994). Macan et al. (1990) found that students who perceived control of their time reported greater evaluations of their performance, greater work and life satisfaction, less role ambiguity, less role overload, and fewer job-induced and somatic tensions.

Because time management and college performance have a causal relationship, understanding undergraduate students' time use is essential for college administrators, academic advisors, and parents to make sure that students are making balanced use of time and progressing toward accomplishing their personal and professional goals. Research in students' time use is especially limited in colleges of agriculture, except for a study done by Gortner and Zulauf (2000), who studied undergraduate students' use of time in agricultural economics courses at Ohio State University. In an effort to better understand this underdeveloped field, this study was undertaken to focus on the time use of undergraduate students in the CANR at MSU. Findings of this study may be useful to college administrators, academic advisors, and parents seeking to help students become engaged learners and facilitate comprehensive development.

<sup>1</sup>Policy Advisor, Human Resources Policy and Planning Branch, Ministry of Government Services, Toronto, ON M7A 1N3, Canada

<sup>2</sup>Professor, Department of Community, Agriculture, Recreation and Resource Studies, Michigan State University, USA

<sup>3</sup>Professor, Department of Crop and Soil Sciences, Michigan State University, USA

## Objectives

The general objective of this study was to seek information on how current undergraduate students in the CANR spend their time on various academic and extracurricular activities and to analyze differences in time use patterns by selected demographic characteristics. The specific objectives of this study were to:

1. Determine weekly time use profiles of CANR students in academic and non-academic activities.
2. Determine similarities and differences in time use patterns by selected demographic characteristics of respondents such as academic year, gender, ethnicity, and residence.

## Methods

College students' time use has been studied by several researchers. Researchers have often recommended and used the time diary method to measure use of time (Gortner and Zulauf, 2000; Robinson and Godbey, 1997). Robinson and his colleagues consider the time diary to be the gold standard of time management, but Jacobs (1998) maintains that a self-reported measure of working time is a useful alternative to the time diary measure because it is simple and as accurate as time diary measure. He found no patterned discrepancies between the two methods, but unlike self-reported measures, time diary measures are an extremely data-intensive research strategy for measuring use of time. This study utilized the self-reported time use (hours per week) of undergraduate students in the CANR at MSU.

This survey adapted the time-use section of the survey instrument used in the National Survey of Student Engagement (NSSE), developed by Indiana University (NSSE, 2004). For this survey, the response item scales of the NSSE survey instrument were modified with self-reported approximate hours used per week instead of eight-point scales of time use. Respondents were asked to indicate the approximate number of hours they spend per week in seven major activities: preparing for class, working for pay on-campus, working for pay off-campus, participating in co-curricular activities, relaxing and socializing, providing care for dependents, and commuting to class.

Preparing for class included activities such as studying, reading, writing, doing homework or lab work, analyzing data, researching, and other academic activities. Co-curricular activities included student organizations, campus publications, social fraternities or sororities, and intercollegiate or intramural sports. Providing care for dependents was defined as taking care of parents, children, or a spouse. The modified survey instrument was circulated to the CANR Assessment Committee members to ascertain its content and face validity.

The population of this study consisted of all undergraduate college students in the CANR from 2004 to 2008. Data were collected using an online survey during March-April of each study year. An email list maintained by the Office of the Dean served as the sampling frame for this study. The online survey was sent to 2,565 students in 2004, 2,439 students in 2005, 1,997 students in 2006, 2,406 students in 2007, and 2,311 students in 2008. Two reminder emails were sent to the survey population to increase survey response rates.

A total of 2,803 usable responses were received. The average five-year survey response rate was 24.5%. In 2004, ice cream coupons were provided as an incentive to complete the survey. No such incentive was provided in 2005. Response rates dropped significantly in 2005, so the ice cream incentive was again offered to survey respondents in 2006, 2007, and 2008.

Data were accessed from a web-based database and exported into Statistical Package for Social Science (SPSS) for analysis. Descriptive statistics were used to present findings. One-way analysis of variance (ANOVA) and independent sample t-tests were used to determine whether the weekly time use in various activities differed significantly by students' demographic characteristics. The level of alpha for significance was set at 0.05.

## Results and Discussion

### Description of the Respondents

Of the 2,803 respondents, about 14% were freshmen, 25% were sophomores, 40% were juniors and 21% were seniors. About 7% of the respondents indicated that they had second majors and fewer than 10% had second degrees. Sixty-four percent of the respondents were female. The ages of respondents ranged from 18 to 58 years. The mean age of respondents was 21 years. Nearly 90% of respondents were white; the rest were Hispanic followed by African-American, Asian-American, Native American, and others. More than half (54.6%) of the respondents indicated that they came to the CANR from suburban or urban communities. Nine out of ten respondents were in-state residents. About a quarter (24.4%) of the respondents had participated in 4-H and FFA. Over half of the respondents (55.3%) indicated that they were members of the National Honor Society in high school.

### Time use profiles of respondents

#### *i) Time spent preparing for class*

Respondents spent an average of 15.2 hours/week preparing for class (Table 1). Time use patterns indicate that time spent preparing for class increased over the five-year period. The time used preparing for class in this study is similar to the result of a study of the full-time university and college students' time use (16 hours per week) for educa-



tional activities from 2003 to 2006 (U.S. Department of Labor, 2007). The finding of this survey on time use for academic activities is also close to that of a time management study of students of the Literature, Science and Arts College at the University of Michigan conducted by Schuman et al. (1985), who found that the median study time was 14.5 hours/week (2.9 hours per weekday). But time use in preparing for class in this study is far less than undergraduate students' time use (21.3 hours/week) in three agricultural economics courses at Ohio State University as reported by Gortner and Zulauf (2000).

notable finding of this study is that respondents spent more time relaxing and socializing (16.2 hours/week) than they spent on academic activities (15.2 hours/week).

The U.S. full-time university and college students' time use, on an average weekday, on leisure and sports was 19.5 hours/week (U.S. Department of Labor, 2007). Gortner and Zulauf (2000) reported 19 hours/week in planned leisure and recreation activities and 10.3 hours/week in watching TV for undergraduate students in agricultural economics at the Ohio State University. Although it seems that

**Table 1. Respondents' Weekly Time use by Survey Year (hours/week)**

Activities	Survey year										Total	
	2004		2005		2006		2007		2008			
	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)
Preparing for class	756	12.8 (8.6)	222	14.8 (10.0)	489	15.4 (11.0)	505	17.4 (13.5)	780	16.0 (11.8)	2752	15.2 (11.2)
Working for pay on-campus	338	13.9 (6.7)	86	13.5 (7.3)	207	13.8 (7.5)	216	13.5 (6.4)	326	13.0 (5.7)	1173	13.5 (6.6)
Working for pay off-campus	312	17.6 (9.6)	89	19.7 (11.3)	180	15.7 (8.9)	163	16.7 (8.6)	260	16.2 (8.9)	1004	16.9 (9.3)
Participating in co-curricular activities	552	6.7 (6.9)	156	6.8 (8.0)	352	5.5 (5.6)	376	5.7 (6.2)	551	6.0 (6.4)	1987	6.1 (6.5)
Relaxing and socializing	748	16.0 (11.5)	215	15.1 (11.6)	479	16.1 (15.8)	504	16.0 (12.2)	771	16.9 (12.5)	2717	16.2 (12.8)
Providing care for dependents	97	13.7 (18.9)	34	15.0 (18.7)	66	11.4 (12.9)	79	10.7 (13.8)	127	9.8 (15.3)	403	11.6 (16.0)
Commuting to class	756	4.4 (3.2)	213	5.2 (3.2)	482	5.6 (5.7)	500	5.0 (3.5)	760	5.0 (3.8)	2711	5.0 (4.0)

#### ii) Time spent working for pay

Respondents were asked to indicate the approximate number of hours per week they spent working for pay on- and off-campus. Four out of ten respondents indicated that they did work on-campus. A similar proportion of respondents indicated that they did work off-campus. Working students spent 13.5 hours/week working for pay on-campus and 16.9 hours/week working for pay off-campus (Table 1). Today's college students are working more than ever before and this rise in work follows a trend of increasing tuition costs. According to a recent national survey of American freshmen, nearly 50 % of respondents planned to work to meet their college expenses (Higher Education Research Institute, 2009).

#### iii) Time spent participating in co-curricular activities

Co-curricular activities included involvement in student organizations, campus publications, student government, social fraternities or sororities, and intercollegiate or intramural sports. Analysis of the data indicated that nearly three quarters (73.8 %) of respondents participated in co-curricular activities, spending about six hours per week on these activities.

#### iv) Time spent relaxing and socializing

Relaxing and socializing activities included watching TV, exercising, and other activities such as partying. On average, respondents spent 16.2 hours/week relaxing and socializing (Table 1). A

respondents in this study spent more time relaxing and socializing than they did preparing for class, respondents of the CANR at MSU spent less time relaxing and socializing than other U.S. college students.

#### v) Time spent providing care for dependents

Respondents were asked to indicate the approximate number of hours/week they spent taking care of dependents living with them. About 15% of the respondents indicated that they spent time providing care for dependents living with them, with an average of 11.6 hours/per week (Table 1). Respondents' time use in providing care for dependents had the largest variation, as indicated by the highest standard deviation of 16.

#### vi) Time spent commuting to class

A high majority of respondents (98.5%) indicated that they commuted to class. The average commuting time for respondents is five hours/week. According to the college students and time use 2003-2006 report, full-time university and college students travelled for 7.5 hours/week on weekdays (U.S. Department of Labor, 2008). The finding of this study on average commuting time indicates that CANR students spent less time commuting than did average U.S. university and college students.

**Time Use and Demographic Characteristics**

Another objective of this study was to determine similarities and differences in the time use profile by selected demographic characteristics of respondents. The results of one-way analysis of variance (ANOVA) for time spent (hours/week) on various activities by academic year of respondents are presented in Table 2.

*i) Time spent preparing for class*

Table 2 shows that freshmen, sophomores, and juniors spent 15.7, 15.4, and 15.5 hours/week respectively, preparing for class. Although seniors spent 14.1 hours/week, an hour less than respondents of other academic years, no significant differences were observed for amount of time spent on academic activities by academic year of respondents. The NSSE 2008 survey results, on the other hand, showed that freshmen spent more time preparing for class than did seniors (NSSE, 2008).

*ii) Time spent working for pay on-campus*

Analysis revealed that respondents of various academic years spent significantly ( $F=9.158$ ,  $p<0.001$ ) different amounts of time working for pay on-campus. The Tukey's post hoc test was conducted for multiple comparisons to identify differences among respondents of various academic years. It indicated that seniors spent significantly ( $F=9.158$ ,  $p<0.05$ ) more time (15.0 hours/week) than did freshmen (12.7 hours/week) working for pay on-campus. This result is consistent with the NSSE 2008 results. Similarly, juniors spent more time (13.8 hours/week) working for pay on-campus than did sophomores (12.3 hours/week). The post hoc test also revealed that seniors spent more time (15 hours/week) than did sophomores (12.3 hours/week) on on-campus employment.

*iii) Time spent working for pay off-campus*

Respondents at various academic years were significantly ( $F=6.464$ ,  $p<0.001$ ) different in the amount of time spent working for pay off-campus. Seniors spent more time (18.1 hours/week) than did freshmen (13.9 hours/week) and sophomores (15.7 hours/week) working for pay off-campus. Juniors spent more time (17.4 hours/week) than freshmen (13.9 hours/week) in off-campus employment.

**Table 2. Time Use (hours/week) by Academic Year of Respondents in the CANR**

Activities	n	Hours/week Mean (SD)	F value	p value
Preparing for class			2.436	0.063
Freshman	379	15.7 (12.4)		
Sophomore	677	15.4 (11.0)		
Junior	1091	15.5 (11.3)		
Senior	600	14.1 (10.3)		
Working for pay on-campus			9.158	0.001***
Freshman	142	12.7 (6.8)		
Sophomore	300	12.3 (5.9)		
Junior	475	13.8 (6.0)		
Senior	256	15.0 (7.8)		
Working for pay off-campus			6.464	0.001***
Freshman	97	13.9 (8.2)		
Sophomore	184	15.7 (8.6)		
Junior	450	17.4 (9.2)		
Senior	270	18.1 (10.1)		
Participating in co-curricular activities			0.550	0.648
Freshman	247	5.8 (5.6)		
Sophomore	502	6.4 (6.9)		
Junior	796	6.2 (6.7)		
Senior	440	6.0 (6.4)		
Relaxing and socializing			3.153	0.024*
Freshman	374	17.6 (14.3)		
Sophomore	667	16.7 (14.1)		
Junior	1078	15.4 (11.9)		
Senior	593	16.2 (11.6)		
Providing care for dependents			3.614	0.013**
Freshman	45	9.8 (14.4)		
Sophomore	82	7.8 (9.2)		
Junior	171	11.7 (15.3)		
Senior	105	15.2 (20.6)		
Commuting to class			1.360	0.253
Freshman	372	5.3 (4.3)		
Sophomore	654	4.9 (4.5)		
Junior	1082	5.0 (3.7)		
Senior	598	4.7 (3.7)		

\* Significant at 0.05 level    \*\* Significant at 0.01 level    \*\*\* Significant at 0.001 level

*iv) Time spent co-curricular activities*

An ANOVA result revealed no differences among respondents of various academic levels in time use on participating in co-curricular activities.

*v) Time spent relaxing and socializing*

An ANOVA result indicated a significant ( $F=3.153$ ,  $p < 0.05$ ) relationship between respondents' academic years and time spent relaxing and socializing. Freshmen spent more time (17.6 hours/week) than did juniors (15.4 hours/week) on entertainment.

*vi) Time spent providing care for dependents*

An ANOVA result showed a significant ( $F=3.614$ ,  $p < 0.05$ ) difference between respondents at various academic years and time spent on providing care for dependents. Seniors spent more time (15.2 hours/week) than did sophomores (7.8 hours/week) taking care of dependents.

*vii) Time spent commuting to class*

An ANOVA result gave no difference in time spent commuting to class between respondents of various academic years.

One of the final objectives of this study was to determine if time use pattern varies by students' gender. There were significant differences between male and female respondents in time use for six out of seven activities (Table 3). Female respondents spent significantly ( $t = 7.361$ ,  $p < 0.001$ ) more time (16.4 hours/week) on class preparation than did their male counterparts (13.1 hours/week). Similarly, females spent significantly ( $t = 2.800$ ,  $p < 0.01$ ) more time (5.1 hours/week) on commuting to class than did males (4.7 hours/week).

Male respondents spent significantly ( $t=2.683$ ,  $p < 0.01$ ) more time (14.3 hours/week) working for pay on-campus than did female respondents (13.2 hours/week). Similarly, males spent significantly ( $t=3.877$ ,  $p < 0.001$ ) more time (18.3 hours/week) working off-campus than did females (16 hours/week). Males also spent significantly ( $t=3.492$ ,  $p < 0.001$ ) more time (6.8 hours/week) than

did females (5.8 hours/week) taking part in co-curricular activities. Additionally, male respondents spent significantly ( $t=5.620$ ,  $p < 0.001$ ) more time (18.1 hours/week) relaxing and socializing than did female respondents (15.2 hours/week). These results are consistent with the findings of the NSSE 2008 survey for ANR respondents (NSSE, 2008).

Results of this study indicate that male students were significantly more involved in various activities than female students. These findings are consistent with findings about ANR respondents in the NSSE 2008 survey. It was interesting to note that male students reported spending more time (12.2 hours/week) providing care for dependents than did female students (11.3 hours/week). The male respondents' time use in relaxing and socializing is also consistent with the findings of Gortner and Zulauf (2000) and the NSSE (2008). The American Time Use Survey 2007 results showed that men spent 39.9 hours per week in leisure activities such as watching TV, socializing, or exercising compared with 35 hours per week for women (U.S. Department of Labor, 2008). The findings of Robinson and Godbey (1997) on time use by employed Americans, however, indicate that there was no difference in time use between men and women in watching TV for those between the ages of 18 and 24 years old.

**Table 3. Time Use (hours/week) by Gender of Respondents**

Activities	n	Hours/week Mean (SD)	t value	p value
Preparing for class				
Male	990	13.1 (10.7)	7.361	0.001***
Female	1755	16.4 (11.3)		
Working for pay on-campus				
Male	359	14.3 (6.9)	2.683	0.007**
Female	813	13.2 (6.4)		
Working for pay off-campus				
Male	398	18.3 (10.3)	3.877	0.001***
Female	603	16.0 (8.5)		
Participating in co-curricular activities				
Male	674	6.8 (7.6)	3.492	0.001***
Female	1307	5.8 (5.9)		
Relaxing and socializing				
Male	975	18.1(14.7)	5.620	0.001***
Female	1735	15.2 (11.5)		
Providing care for dependents				
Male	141	12.2 (16.4)	0.525	0.600
Female	261	11.3 (15.8)		
Commuting to class				
Male	981	4.7 (3.5)	2.800	0.005**
Female	1723	5.1 (4.3)		

\*\*Significant at 0.01 level

\*\*\* Significant at 0.001 level

## Undergraduate Students'

Time use may differ by the sociocultural background of the student. To determine whether such a difference exists, respondents were grouped into two ethnic groups: white and students of color. In this study, "students of color" refers to all minorities, including African American, Hispanic, Asian American, and Native American respondents. Student's t-test was used to determine differences in weekly time use by ethnicity. Table 4 shows significant differences between these two ethnic groups in weekly time use for working for pay on-campus ( $t=2.848$ ,  $p < 0.01$ ), relaxing and socializing ( $t=4.579$ ,  $p < 0.001$ ), and commuting to class ( $t=1.979$ ,  $p < 0.05$ ). Students of color spent significantly more time (14.8 hours/week) working for pay on-campus and commuting to class (5.4 hours/week) than did their white counterparts (13.3 hours/week and 4.9 hours/week respectively). White respondents spent significantly more time (16.6 hours/week) relaxing and socializing than did students of color (13.3 hours/week).

This study also attempted to find out if time spent on various activities differed by home residence (rural vs. urban) of respondents. Student's t-test was used to determine the differences between these two groups. Findings indicated significant differences between the rural and urban respondents for time

use in preparing for class, relaxing and socializing, and commuting to class (Table 5). Respondents from urban communities spent significantly ( $t=2.034$ ,  $p < 0.05$ ) more time (15.6 hours/week) preparing for class than did respondents from rural communities (14.7 hours/week). Similarly, respondents from urban backgrounds spent significantly ( $t= 4.022$ ,  $p < 0.001$ ) more time (17.1 hours/week) relaxing and socializing than did respondent from rural areas (15.2 hours/week). Respondents from rural communities spent significantly ( $t=2.722$ ,  $p < 0.01$ ) more time (5.2 hours/week) commuting to class than did students from urban communities (4.8 hours/week).

## Summary

This study reveals that CANR students tend to spend more time on relaxing and socializing than on academic matters. This suggests that CANR students need counseling about how much time they should devote to preparing for class, including reading, doing homework or lab work, researching, analyzing data, and writing reports and/or papers. The college and academic departments could counsel students on how best to manage their time during their studies. Seminars, workshops and counseling sessions could be organized during orientations or annual events, such as CANR Student Senate meetings, and through meetings with academic advisors.

Students' time use patterns on various activities also varied by demographic characteristics. Seniors spent significantly more amount of time working for pay on-campus and off-campus, and providing care for dependents than did respondents from other academic years. Gortner and Zulauf (2000) argue that the reason that seniors spend more hours at work is that there are fewer scholarship opportunities for upperclassmen. Disproportionately more fellowships are directed at freshmen and sophomores as recruitment incentives.

Significant differences were found between male and female respondents in time use. Male respondents were more involved in work, participation in co-curricular activities and socialization, whereas females were more involved in academic activities.

**Table 4. Time Use (hours/week) by Ethnicity of Respondents**

Activities	n	Hours/week Mean (SD)	t value	p value
Preparing for class				
White students	2388	15.1 (11.0)	1.105	0.269
Students of color	352	15.8 (12.3)		
Working for pay on-campus				
White students	990	13.3 (6.5)	2.848	0.004**
Students of color	175	14.8 (6.9)		
Working for pay off-campus				
White students	910	16.8 (9.3)	1.436	0.151
Students of color	92	18.3 (9.8)		
Participating in co-curricular activities				
White students	1723	6.2 (6.7)	1.336	0.182
Students of color	254	5.6 (5.0)		
Relaxing and socializing				
White students	2356	16.6 (13.1)	4.579	0.001***
Students of color	350	13.3 (10.6)		
Providing care for dependents				
White students	331	11.9 (16.6)	1.010	0.313
Students of color	70	9.8 (12.7)		
Commuting to class				
White students	2357	4.9 (3.8)	1.979	0.048*
Students of color	343	5.4 (5.1)		

\* Significant at 0.05 level

\*\*Significant at 0.01 level

\*\*\* Significant at 0.001 level

**Table 5. Time Use (hours/week) by Residence Types of Respondents**

Activities	n	Mean (SD)	t	p value
Preparing for class				
Rural	1242	14.7 (10.8)	2.034	0.042*
Urban	1501	15.6 (11.5)		
Working for pay on-campus				
Rural	578	13.7 (6.7)	0.674	0.501
Urban	591	13.4 (6.4)		
Working for pay off-campus				
Rural	524	16.6 (9.4)	1.330	0.184
Urban	478	17.3 (9.3)		
Participating in co-curricular activities				
Rural	916	6.0 (6.2)	0.645	0.519
Urban	1063	6.2 (6.8)		
Relaxing and socializing				
Rural	1232	15.2 (12.3)	4.022	0.001***
Urban	1477	17.1 (13.2)		
Providing care for dependents				
Rural	198	11.1 (15.6)	0.728	0.468
Urban	202	12.2 (16.4)		
Commuting to class				
Rural	1226	5.2 (4.1)	2.722	0.01**
Urban	1476	4.8 (3.9)		

\* Significant at 0.05 alpha level \*\* Significant at 0.01 alpha level \*\*\* Significant at 0.001 alpha level

Findings also reveal significant differences in time use by the ethnicity of the respondents. White students spent significantly more time in relaxing and socializing than did students of color. Students of color were more engaged in academic activities and employment work than whites. Academic advising or counseling should focus more on male, white freshmen with urban backgrounds because they spent significantly more time on relaxing and socializing. Significant differences were observed between rural and urban respondents for time use. Respondents from urban communities were more engaged in academic activities, off-campus work, and co-curricular activities than the respondents from rural community backgrounds.

In this study, seniors and males were significantly different from others in time use. The differences in time use for selected demographic characteristics of respondents suggest that detailed time-management research studies be conducted to determine gender differences in time management and their impact on students' college performance (in terms of grade point average) and the relationship between time use profile and degree completion time and to compare self-reported online survey and weekly time diary methods of time use measurement.

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# Engaging Agriculture Students in the Publication Process through Popular Press Magazines

E. L. Walker<sup>1</sup>  
Missouri State University  
Springfield, MO



## Abstract

Traditional lecture based courses may not be the most effective in incorporating all the concepts of higher order thinking. Therefore, an alternative teaching method was created and incorporated into an upper division animal science feeds and feeding class which challenged students to obtain peer reviewed data and present it in a popular press type format. The objectives of this classroom assignment was to: 1) incorporate the concepts of Blooms Taxonomy into the teaching method of class and 2) assist undergraduate students in their understanding of core concepts discussed in class and 3) transform scholarly research into a popular press writing format. There were three phases of this assignment: 1) assignment of writing clusters based upon student interest, 2) edit and selection of papers, 3) publication of paper. In each of the three phases, students were graded by the instructor. This project has been conducted for three years, accounts for between 13-19% of the final grade, with five papers authored and edited by students published in popular press journals across three states. Popular press magazines can be a critical link between the scientific, university, and agriculture communities.

Keywords: popular press, Blooms Taxonomy, writing skills

## Introduction

A major dimension of Bloom's taxonomy consists of the cognitive domain which therein is comprised of knowledge, comprehension, application, analysis, synthesis, and evaluation. Knowledge and comprehension are considered *lower-order* and the remainder *higher-order* learning/teaching objectives (Bloom et al., 1956). Promotion of higher-order thinking/skills has been the focus of university teachers in order to improve the thinking skills of students (Ball and Garton, 2005).

Strong agricultural curricula must ensure that students are proficient in communication skills including reading, writing, speaking, and listening. In addition students must also have the ability to cooperate and work with others (Kauffman, 1992). Implementing writing exercises in agricultural classes enhances the learning process by incorporating critical thinking strategies, dialog between instructor and pupil, and engagement in thought

provoking exercises (Cobia, 1986). While lectures are essential for the dissemination of facts, they are less effective in assisting students with overall analysis, synthesis, or integration of course material (Verner and Dickinson, 1976) and therefore utilization of non-lecture based alternative teaching methods could enhance the overall learning process. Writing in college animal science courses is an important means to teach students the language of the discipline and assists students in learning the designated material outside of class lecture (Aaron, 1996).

Material taught in class can be emphasized with a writing assignment and in doing so; educators who encourage writing in their classes will improve the thinking and writing skills of their students (Haug, 1996). Students should be responsible for segments of their own learning in a college environment. Therefore, if less of their energies are centered upon simple information recall and more on integration of their own learning experiences with the lecture material, their educational experience may be enhanced (Kauffman et al., 1971).

A study completed by the National Assessment of Educational Progress in which high school seniors participated in writing tasks to measure the three purposes for writing: narrative, informative, or persuasive. In this study, only 25% of participants from across the country demonstrated competency at writing (Salahu-Din et al., 2007). With many of these students entering higher education, there is a need for colleges and universities to teach writing skills as part of the overall curriculum. Therefore, the objective of this classroom assignment was to incorporate the concepts of Blooms Taxonomy into the teaching method of class in order to better assist undergraduate students in their understanding of core concepts in animal science courses by transforming scholarly research into a popular press format suitable for publication in a popular press magazine.

## Methods

The overall premise of the discussed project is that student engagement in reviewing scientific literature and using this information to write a popular press article will increase their writing skills and their understanding of animal science while at the same time enhancing higher order learning. It was also important as part of this project to introduce students to the peer-review process in an attempt to

<sup>1</sup>207 Karls Hall, 901 S. National Ave.

increase their editing, writing, and team building skills. In order to accomplish the above, students were allowed to select a topic of their choice (within the scholarly goals of the particular class), write, edit classmates work, and be a part of the publishing process in an attempt to engage them in higher order thinking. An example of the project outline is provided in Table 1.

**Formation of the Peer Writing Cluster**

Junior and senior level students enrolled in AGS 311 Feeds and Feeding starting spring of 2007 and later students taking AGS 301 Farm Animal Physiology starting spring 2010 participated in the writing exercise. On the first day of class, all students were introduced to the methodology of the project and were asked to bring popular press magazines to the next class meeting to facilitate the discussion of the differences between popular press and scholarly publications. Examples of scholarly and popular press articles were provided and differences between the two as related to scholarly writing, citation methods, audience, and format were explained. Suitable topic areas were discussed and possible topics provided. Topics provided in the syllabi were broad so that students could get ideas, but not a specific question to explore. Students were assigned to writing clusters based upon their topic interest of choice (i.e. beef cattle nutrition, sheep and goat health, etc.). Peer writing clusters comprised a minimum of three and a maximum of five students.

**Working within a Peer Writing Cluster**

The project was divided into three main phases. In the first phase, students worked within their individual writing clusters to develop their individual papers. Within these writing clusters, students were encouraged to discuss their topics and assist one another to determine a subject most applicable to that particular writing clusters subject area. Communication within the writing cluster was accomplished via the internet and through direct contact in class. Students were required to prepare an outline of the material they wished to research and email it to their writing

cluster as well as the course instructor. Each student in a writing cluster was required to evaluate and edit each outline in their writing cluster. Edited outlines were emailed back to the original author and to the instructor for grading purposes.

Upon outline approval, first drafts were completed and distributed to the writing cluster. Students within each writing cluster were then required to provide detailed edits of each cluster member's paper. The instructor also edited, graded, and returned first drafts to the authors. While some students simply "Ok'ed" papers, others took careful consideration and made excellent editorial suggestions.

Students completed final drafts and sent them to their instructor and writing cluster for final review. Students were required to evaluate and rank their writing cluster papers and email the instructor those evaluations and rankings based upon the paper they felt was most likely to get published. Individual rankings were kept confidential. Low score was determined and the author of the best writing cluster paper received 20 points of extra credit. Responsibility of selecting the most publishable paper within each cluster was relegated to the students.

**Table 1. Example Project Outline and Timeline used in AGS 311 and AGS 301**

Item	Delivery Date	Method	Points
Topic selection	Jan 13th	Discussion in class	0
Assign to writing cluster based on topic selection	Jan 20th	Please exchange email addresses, phone numbers etc to aid in cluster communication.	0
First draft due	Feb 3rd	Email to writing cluster & teaching assistant	40
Edits of papers due	Feb 10th	All edits from writing cluster and teaching assistant will be handed back by this time	5 points per paper reviewed up to 15 points
Final draft due	March 3rd	Email writing cluster and instructor	100
Final draft returned after grading	March 15 <sup>th</sup>		5 points when you send me ranking of cluster papers – Due: March 13 <sup>th</sup> . Winner of each writing cluster gets 20 points of extra credit
Writing cluster reads and ranks all cluster winning papers	March 17th		5 points when you send me your ranking of papers
Winner is announced	March 22		Winner gets 20 points, and writing cluster gets 20 points extra credit
Winner and instructor work towards getting paper ready for publication			Upon acceptance for publication, entire class receives 20 extra credit points.



### Selection of the Best Paper

The second phase of the project took place when the winning writing cluster papers were submitted to the class as a whole to review and be edited by the class. Students emailed edits of each paper to the instructor and then ranked the papers (most likely to get published to least likely to get published). Rankings were sent to the instructor and kept confidential. The author of the paper with the lowest rank then received an additional 20 bonus points and the writing cluster from which this paper came also received 20 extra credit points for their part in editing and selecting the paper.

The final phase occurred when the selected paper went through a final class review. The author of the final paper made necessary edits as determined by their classmates and then sent the paper to the instructor for final edits. After the paper was complete, it was sent to the chosen magazine for consideration for publication. The class as a whole had a stake in this process because if the editors agreed to publish the paper, the whole class would receive a 20 point bonus which meant that the original author received a total of 60 points, members of the original writing cluster received 40, and the class as a whole received a maximum of 20 bonus points. A complete list of points awarded as part of this project is presented in Table 1.

### Results and Discussion

In each year this project has been completed, the top papers have been published in a popular press magazine though not necessarily in the first choice of the author. The authorship of the paper was as follows: individual student author, instructor, 20XX Class. As a side project in 2007, the second place author was approached and the second place paper was revised and published in a popular press magazine. This was done outside of class and the students did not receive any additional class credit for the paper. However, it was encouraging that the student took pride in getting their work published and took the extra effort to make it happen. For a list of all

published papers since this project began, please see Table 2.

### Challenges and Benefits

As part of the Missouri State University William H. Darr School of Agriculture commitment to distance education, both AGS 311 and AGS 301 are taught via live interactive television to up to five off-campus locations. One challenge of incorporating this project involves the communication between on and off-campus students who are in the same writing cluster. However, assignments are completed via email so issues around classroom location are negated. Distance students have performed as well as on-campus students.

Another challenge is helping students work in a cooperative and collaborative way. Students are given oral guidance when the project is first discussed and time is allowed at the beginning of each class so students can establish lines of communication within their group. Further guidance is provided by the instructor if students have problems with their writing cluster or if members of the writing cluster fail to engage in productive communication. Unfortunately, not all students are equally motivated and some will not be engaged in this assignment as others.

Since 2007, 113 students have completed this project. Grades both with and without this writing cluster assignment were compared. Overall, 87% of the students increased their grade by a numerical percentage and 40% of those students increased their grade by at least one letter grade. Only 1.7% of the students lowered their letter grade as a result of this project. Since some students differ in test taking abilities and tests can over assess student knowledge and under assess student know-how (Wiggins, 1984), this project allows students to earn points not associated with test taking. Over the years, the writing cluster assignment has accounted for 13% to 19% of the student's final grade, not including bonus points. Differences in percentages are partially due to moderate changes in points for the project as it was

changed and improved upon over time. Additional point differences are due to points accumulated per number of quizzes, exam points, homework, etc.

### Areas of Learning within the Project

#### Autonomy

Educators in agriculture hypothesize that students learn best when their learning experiences are hands-on/minds-on (Parr and Edwards, 2004). The writing cluster project

**Table 2. Title of Student Paper and Publication Source for Student Papers Published as a Result of the Engagement of Undergraduate Students in the Publication Process**

Title of paper	Date	Publication Source	Class
Beef up your bottom line by combining fat supplements.	August, 2007	The Oklahoma Cowman <a href="http://www.okcattlemen.org/">http://www.okcattlemen.org/</a>	AGS 311
Supplementing Your Weanlings: An evaluation of the nutrient requirements and the potential deficiencies of your weanling colts.	September, 2008	Ozarks Farm & Neighbor. <a href="http://www.ozarksfn.com/">http://www.ozarksfn.com/</a>	AGS 311
Urinary Calculi in the herd – causes and prevention of urinary calculi in sheep and goats.	September, 2009	Ozarks Farm & Neighbor. <a href="http://www.ozarksfn.com/">http://www.ozarksfn.com/</a>	AGS 311
Forage Analysis – Hay mistakes could cost you – understanding a forage analysis report	December, 2009	Ozarks Farm & Neighbor. <a href="http://www.ozarksfn.com/">http://www.ozarksfn.com/</a>	AGS 311
Testicular Temperature.	June, 2010	Ozark Farm and Neighbor <a href="http://www.ozarksfn.com/">http://www.ozarksfn.com/</a>	AGS 301

allows students to determine their own research path for the project which puts the responsibility on them to select a topic they want to learn about. Inquiry based educational exercises can “turn-on” the minds of students if instructors allow them some control of their assignment while providing guidelines and advice on an as-needed-basis. By providing students the opportunity to select both the popular press journal they would most like to get published in and by allowing them to select their subject material, it was hoped that autonomy of the project would help compel students towards success.

*Teamwork*

The importance of working with others has been demonstrated as a necessary component of the college experience when preparing agriculture students for employment in the agricultural sector (Bekkum, 1993; Carter, 2005). When students are comfortable with their peers and with the instructor, they are more likely to challenge themselves and their creative side regarding their writing style (Cobia, 1986). By requiring students to depend upon their writing cluster and their classmates for assistance and for possible grade advancement, students were exposed to the challenges of working in groups.

James Watson, the co-discoverer of the double-helix DNA molecule stated, “Nothing new that is really interesting comes without collaboration” (Johnson et al., 1998). Cooperative and collaborative learning occur as a result of students working together in unstructured groups. Cooperative efforts are the result of the interaction of the individuals to encourage and help each other's efforts whereas collaborative learning occurs when students work together in unstructured groups to create their own learning opportunity (Johnson et al., 1998). The discussed writing assignment provides students both the opportunity to learn in a cooperative manner i.e. students must assist those in their writing cluster to have the best chance at obtaining bonus points and the opportunity to work in a collaborative effort as they work in an unstructured group to obtain similar educational goals.

*Communication Skills*

Agriculture students need a variety of skills for success after graduation including skills associated with technical agriculture and skills related to communication, data collection, and time management. As reviewed by Ball and Garton (2005) problem solving, critical thinking, and higher order thinking skills are critical for students to acquire. As we move into a “knowledge-based” economy, we must prepare our students with the skills necessary for acquiring more information (Thurow, 2000) and as new ideas shape the field of agriculture, the need to communicate will cause businesses to seek individuals who contain both the basics in agriculture and who are also creative and

can effectively communicate ideas to a non-agrarian society. Production methods in agriculture will constantly evolve as new basic and applied science is generated and it is critical that agricultural students have the skills necessary to read and comprehend basic science, interpret it, and reproduce the knowledge via applied terms. By the nature of the project discussed above, where students had to locate, read, and comprehend research articles and then had to transform them into layman's terms, coupled with communicating with their writing cluster mates, student were engaged in a variety of communication skills and engaged in higher-order thinking.

*Writing skills*

Students often feel that writing assignments are only for the benefit of the teacher and have little relevance for the student (Aaron, 1996). In order to try to overcome this negative perception, student papers were graded on a first draft and final draft basis. The first draft was graded to show the students their major weakness areas and to assist the student in the development of proper writing skills. Another aspect of turning in a first draft was to ensure that students were progressing on their paper at a reasonable pace. The final paper was graded more rigorously for content, format, creativity, and grammatical and spelling errors (Table 3).

Businesses desire strong writing skills by both their applicants and their current employees. Students need to develop strong writing skills in their own disciplines' style and format to enhance their opportunities in the job market. Writing can be an indicator to companies as to the potential of a job applicant and a major skill desired by American businesses is writing accuracy and understanding of subject material (National Commission on Writing, 2004). Teachers in the agriculture fields should incorporate writing assignments into their classes and emphasize correct grammar, sentence structure, thought progression, and critical thinking. The written assignments in the classes discussed above gave students a chance to practice not only their written skills, but also learn the proper ways of editing others written work.

<b>Items Graded</b>	<b>Percentage of total points</b>
Content	50
Punctuation/Spelling/Sentence Structure	30
Citations & format of citations	10
Length	10

*Formulating a Research Problem*

Some students just beginning their junior and senior level courses may not have enough information to begin to ask thought provoking questions, or if they do, their questions may be either written too broad or too narrow and more guidance may be needed in the form of detailed instruction or one-on-one meetings with the instructor or teaching assis-

tant. Students who generate their own questions related to a specific topic have increased overall comprehension and retention of the specific material (Davey and McBride, 1986).

By incorporating real world writing assignments such as editorials, position papers, non-technical notes, scientific papers, etc. into agricultural science courses, students can be taught that the most important part of research is often the formulation of the question and the only way to properly formulate a proper question is in thoroughly understanding previous published research. Broad topics for student papers are provided by the instructor as students may not have the necessary background information to develop a topic, much less a question. Topics; however, provide the student a starting point and help lead them in a direction they choose to pursue.

### *Critical thinking*

There are two prominent learning theories in agricultural classes – authentic and experiential learning (Knobloch, 2003). Activities which promote solving problems, thinking critically, formulating knowledge, and applying skills in a “real-world” context are most often used to augment authentic learning activities. Conversely, experiential learning occurs via real-world experiences and supports educational principals of practice and student inquiry by applying knowledge and solving problems in real-life settings (Knobloch, 2003). In the discussed writing project, students are encouraged to select topics which have meaning to them and they are interested in learning more about. Often times, instructor editing is focused not just on the grammatical aspects of the paper, but also in making the paper readable by a non-academic audience. While students have practice writing research papers geared towards college instructors, they often lack experience writing for a non-academic “real life” audience.

Learning in a classroom is typically different from the way we learn in life which may cause students to disengage from the formal learning process. Meaningful experiences in which students are actively engaged tend to enhance the learning process (Reardon and Derner, 2004). What needs to be stressed in agriculture is that while lectures are important in presenting key facts related to a specific topic, a key element of overall academic learning and understanding is the ability to locate, select, evaluate, synthesize, and cite outside sources of information (Burton and Chadwick, 2000). However, some educators may feel that the responsibility for teaching the process of interpretation of literature used for writing rests with the English program of the University, and not in the more technically geared fields such as agriculture which may leave students with a diminished ability to locate sources, interpret their meaning, and write appropriately in agriculture (Howard et al., 2006). Also, if the instructor does not emphasize the importance of these skills by requiring

outside reading, comprehension, and writing, perhaps the students will not understand the importance and relevance of these skills. In order to address this possible issue, the significance of the paper is emphasized (not just with points but also with the prestige of being published and having that publication on their resume) and time is spent in class helping students develop their questions and in finding research papers geared towards their question.

### *Lifelong learning*

As reviewed by Carter (2005), lifelong learning is three dimensional and encompasses a mindset wherein individuals are willing to learn when placed in an environment that encourages learning and teaches skills which allow “self-directed” learning. Teachers should incorporate self-learning opportunities into their agricultural classes to encourage a pattern of lifelong learning by using teaching methods that require students to reflect, interact, and work independently and interdependently (Carter, 2005). Furthermore, teachers should help students find and properly interpret and use information while also challenging the techniques used to provide student feedback and reinforcement (Carter, 2005). One of the goals of the current project is to attempt to provide students with learning skills necessary to continue their education outside the classroom.

### *Motivation*

Motivation can be defined as “the degree of desire to learn, to study, to participate, and to cooperate in the overall teaching-learning process” (Campbell, 1977; p. 889). Along these lines of thought, a “student is not a student until someone or something turns him or her on” and one cannot force a student to be motivated to perform to the best of their ability “they can only be inspired to do it” (Campbell, 1977; p. 889). For a student to learn at their maximum potential, they must be in a relaxed environment where they are encouraged to take risks and where they feel psychologically safe, an environment which is positive yet challenging, respectful yet engaging (Reardon and Derner, 2004). Students in the current writing project work with their peers on formulating their question, their research, and their papers. One of the goals the instructor has set forth is that the writing assignment is done in a relaxed, yet challenging manner, by using a peer support model. In the current project, motivation is stimulated both via grades and by the possibility of their paper being selected amongst their peers for publication.

## **Summary**

Students of agriculture must be versed not only in the basics of their particular field, but must also be effective communicators. If students come into agricultural departments with a lack of skills in any of the areas within the field of communication, it is

imperative that instructors in the agricultural sciences (animal science, agronomy, soils, education, communication, etc.) convey not only the necessary skills themselves, but the reason behind why they should obtain those skills in the first place. Agricultural teachers must not only be well versed in their area of expertise but must strive to motivate students into wanting to become better communicators within the field of agriculture. Incorporating “out-side the box” writing assignments coupled with positive reinforcement with the peer support model and through intrinsic (opportunity to get published) and extrinsic (grades) motivation may be key element towards this goal.

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# Field Trip to Racetrack Enhances Classroom Experience<sup>1</sup>

**Teresa L. Slough<sup>2</sup> and Jennifer M. Bormann<sup>3</sup>**  
**Kansas State University**  
**Manhattan, KS**



## Abstract

Students enrolled in ASI 695 Equine Exercise Physiology at Kansas State University have participated in a field trip to a racetrack in three separate years. In 2007, students travelled to the Woodlands in Kansas City, KS, and in 2009 and 2010 students visited Remington Park in Oklahoma City, OK. Each trip involved watching morning workouts, visiting with local horse trainers, watching races, visiting with track veterinarians, meeting with the track manager, and touring the jockeys' room. In the fall of 2010, all past participants were asked to complete a survey regarding their perceptions of the experience. Twenty-four students completed the survey. One hundred percent of students indicated that they that they learned a lot, their knowledge of the racing industry was expanded, and they enjoyed the field trip. Of all categories included on the survey, students indicated that their chosen career paths were least impacted by the field trip. In order to impact career decisions, it may be more beneficial to offer such experiences to younger students, rather than the juniors and seniors enrolled in the course. This is one way to implement experiential learning into an exercise physiology course and enhance student comprehension of concepts taught in the classroom.

## Introduction

The demographics of agricultural students in colleges and universities have changed over the past 20 to 25 years, with more students coming from non-rural backgrounds (Dyer et al., 1996; Mollett and Leslie, 1986; Scofield, 1995). Colleges also are experiencing growth in the number of students primarily interested in companion animals and horses (McNamara, 2009; Moore et al., 2008). Because many of these students lack practical and applied knowledge of animal husbandry and management, it becomes even more critical that college curricula include experiential learning opportunities. While previous equine experience does not impact students' performance in introductory equine classes (Pratt-Phillips and Schmitt, 2010), it will be necessary for these students to gain hands-on experience and technical skills prior to becoming equine professionals.

Experiential learning opportunities enhance traditional classroom instruction (Cantor, 1995).

College-wide experiential learning programs aid students in gaining technical skills, being able to apply coursework to practical situations, and in developing research skills (SWP). Study tours have been utilized in agricultural sciences to enhance students' exposure to related industries (Ockerman, 1974; Posler and Mugler, 1980), including the equine industry (Anderson, 2009). Such experiential learning experiences have been reported to provide students with insights they are unable to gain through traditional classroom modalities (Robbins and Orr, 2004).

Equine Exercise Physiology (ASI 695) is offered at Kansas State University and consists of twice weekly lectures and a laboratory once per week. In the first year the course was offered (2007), there were 27 students enrolled. Typically new equine classes in the department enjoy large enrollment in the first semester as students are eager to try new classes and to earn credit hours toward their equine certificates, but after the initial offering enrollment generally levels off to numbers that are more sustainable on an annual basis. This course is no exception, with enrollment since 2008 remaining fairly consistent with 10-13 students each semester. Students learn about the physiological systems involved in the exercising equine athlete during lecture, and then they have the opportunity to evaluate physiologic responses to exercise during laboratory experiments. They do not, however, have the opportunity to see academic principles put into practice in a commercial setting. To accomplish this, a racetrack tour was implemented into the course curriculum. Survey data was then collected to gauge how students felt about the experience, what they felt they learned, and how the trip might be improved for future classes.

## Materials and Methods

### Pre-Trip Preparation

Throughout the semester students learn about the systems involved in exercise and conditioning programs as they apply to racehorses. These classroom discussions aid in preparing students for the racetrack experience, thus it is more beneficial to take the trip later in the semester, as was done in 2009 and 2010. In the week preceding the field trip, students take part in an in-class debate where they discuss current topics related to the racing industry.

<sup>1</sup>Contribution no. 11-251-J from the Kansas Agricultural Experiment Station.

<sup>2</sup>Assistant Professor, Department of Animal Sciences & Industry, 129 Weber Hall

<sup>3</sup>Assistant Professor, Department of Animal Sciences & Industry, 131 Weber Hall

## Field Trip

By debating such issues, students are better prepared to carry on knowledgeable conversations with track personnel, and they tend to ask more relevant questions while at the track.

## Field Trip

Most students enrolled in the class are from Kansas or neighboring states. The horse racing industry in Kansas is limited, with only two minor racetracks currently operating in the state. Most of the students have very little, if any, exposure to horse racing beyond watching it on television. Thus the objectives of the field trip were threefold:

1. Give students a better understanding of horse racing as an industry.
2. Provide a medium whereby students can see how the concepts they learn about in the classroom are applied in a real-world situation.
3. Educate students about the breadth of personnel involved in the racing industry, thus exposing them to a variety of career opportunities.

Field trip attendance is highly encouraged, but it is not required. Students prepare a report following the trip that counts as a laboratory assignment toward their final grade in the course. The lowest laboratory score for each student is dropped at the end of the semester, so if students have scheduling conflicts with the field trip, they can choose not to attend. In that case, the field trip assignment will be used as their “drop score” at the end of the semester.

A racetrack tour was first offered in the fall of 2007. The class went to The Woodlands in Kansas City, KS. Students met with a trainer for morning workouts where they learned about the mental and physical conditioning of race horses. The trainer then took students back to his barn to visit with the class about the nutrition and health care provided to his horses. Then a state-employed veterinarian visited with the class about lameness exams and tools used to evaluate a horse's gait. The track manager gave students a tour of the facility and students ate lunch at the track. They then went to the test barn to learn about drug testing procedures. Students were also allowed to go into the jockeys' room, where they were permitted to hold racing saddles and learn about handicapping and the weights carried during a race. The class was allowed to sit at the start gate for the Quarter Horse races and then watched Thoroughbred races from the finish line. Because Quarter Horses race for short distances, horses leave the start gate at a full sprint and students were able to sense the power generated as the horses departed, and they could watch the entire race from their vantage point at the gate.

The Woodlands was closed in 2008, so no field trip was offered. When The Woodlands did not reopen the following year, a field trip was planned to Remington Park in Oklahoma City, OK. Students enrolled in 2008 were invited to attend the field trip in 2009. In total, two students from the 2008 class and eight

students from 2009 participated, along with a graduate teaching assistant. Remington Park offered many of the same experiences that students enjoyed at the Woodlands: watching morning workouts, meeting with trainers in the stable area, visiting with track veterinarians, touring the jockeys' room, visiting with the track general manager, touring the facilities, and watching live races. Remington Park provided a complimentary meal to each student and welcomed the class over the public address system. One of the day's races was named for the class, and students were included in one of the photographs of a winning horse that day.

In 2010 the class again went to Remington Park. Because the race schedule had changed, this time the field trip was an overnight excursion. As such, the field trip also included a brief stop at Lazy E Ranch in Guthrie, OK, to learn about how racehorse prospects are prepared for yearling sales. The overnight format also enabled students to spend some time at the American Quarter Horse Association World Championship Show which was also being held in Oklahoma City at the time.

Each year the Kansas State University Department of Animal Sciences & Industry has provided van transportation to and from the racetrack. Remington Park provided complimentary meals in 2009 and 2010, but in 2007 and 2009 any other personal travel expenses were paid individually by the students. In 2010 funding was obtained through the Kansas State University Office of the Provost's Academic Excellence Fund to cover all expenses associated with the field trip, including hotel and meal expenses.

## Survey

In the fall of 2010, a survey was electronically distributed to all students previously enrolled in ASI 695 Equine Exercise Physiology for which current contact information was available. The Kansas State University Institutional Review Board (IRB) determined that this survey was exempt from IRB review. A disclosure statement was included on the survey and students were informed that they could opt-out if they so desired, and the identity of respondents were kept anonymous. The survey used a Likert-type scale (1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, 5 = strongly agree) and questions were designed to assess three different areas: 1) learning objectives 2) the value of differing components of the racetrack experience (for example, meeting with a track veterinarian, watching morning workouts, etc.) and 3) general benefits and perceptions. As well, students were asked to rank various aspects of the field trip from most to least educational (1 = most educational, 8 = least educational) and from most to least enjoyable (1 = most enjoyable, 8 = least enjoyable).

Of those who took the course prior to 2010, 12 of the 37 students (32.43%) that received the survey completed it. According to student responses, nine

**Table 1. Student Responses Regarding Learning Objectives During Racetrack Field Trip (n = 24)<sup>y</sup>**

	Mean <sup>z</sup>	Standard Deviation	Minimum	Maximum
My knowledge about the horse racing industry was expanded	4.76	0.44	4.00	5.00
I felt like I learned a lot on the field trip	4.71	0.46	4.00	5.00
The field trip provided additional knowledge, beyond what had been gained in the classroom	4.62	0.59	3.00	5.00
I learned a lot about the rules and regulations regarding horse racing	4.48	0.60	3.00	5.00
My knowledge about the physiology of the equine athlete and its relationship to athletic performance was enhanced	4.48	0.68	3.00	5.00
I learned a lot about the welfare considerations surrounding horse racing	4.43	0.60	3.00	5.00
The field trip helped me understand the concepts discussed in the classroom	4.43	0.75	3.00	5.00
I learned a lot about the management of a race track	4.43	0.75	2.00	5.00
My knowledge about equine-related careers was expanded	4.33	0.73	3.00	5.00
I learned a lot about the physical conditioning of a race horse	4.29	0.90	2.00	5.00
I learned a lot about the mental training of a race horse	4.10	0.94	2.00	5.00
I learned a lot about drugs and their use in the racing industry	4.10	1.04	2.00	5.00
I learned a lot about the basic management and care of horses	3.81	1.12	2.00	5.00

<sup>y</sup>Survey responses listed in descending order of mean score

<sup>z</sup>Scale used: 1=strongly disagree; 2=disagree; 3=neither agree nor disagree; 4=agree; 5=strongly agree

**Table 2. Student Responses Regarding Value of Different Components of Racetrack Field Trip (n = 24)<sup>y</sup>**

	Mean <sup>z</sup>	Standard Deviation	Minimum	Maximum
I learned a lot by visiting with the local horse trainers	4.57	0.60	3.00	5.00
Watching morning workouts was a valuable experience	4.33	0.73	3.00	5.00
I learned a lot by visiting the jockeys' room	4.29	0.72	3.00	5.00
Visiting with the track veterinarian was definitely worthwhile	4.29	1.10	1.00	5.00

<sup>y</sup>Survey responses listed in descending order of mean score

<sup>z</sup>Scale used: 1=strongly disagree; 2=disagree; 3=neither agree nor disagree; 4=agree; 5=strongly agree

who were enrolled in 2007, 0 who were enrolled in 2008, and three who were enrolled in 2009 completed the survey. In 2010, 12 of the 13 students enrolled in the course attended the field trip and all initiated the survey. One student, however, chose to answer only the first two questions. Six respondents had taken the trip to The Woodlands, three had not attended a field trip, and 16 had visited Remington Park. Two students began the survey but did not complete it.

### Statistical Analysis

Means and standard deviations were calculated for responses to all survey questions. A General Linear Model was used to determine differences in student responses between those attending prior to 2010 and those attending the field trip in 2010. A paired t-test was used to determine the differences between students' educational and enjoyment ranking for each item. All data were analyzed by SAS version 9.2 (SAS Institute, 2007).

## Results and Discussion

### Learning Objectives

There was unanimous agreement among the students that their knowledge about the horse racing industry was expanded and they felt like they learned a lot by participating in the field trip, with 100% of respondents agreeing or strongly agreeing with these statements on the survey instrument (Table 1). Students felt as though they gained additional knowledge beyond what they learned in the classroom. They had an increased understanding of the rules regulating the horse racing industry. They had an increased understanding of how the physiological systems impact athletic performance. They learned more about welfare issues related to the racing industry, and they better understood the concepts taught during class, and that their knowledge of equine-related careers was expanded, with none of the respondents disagreeing (ranking 1 or 2) with any of these statements. These results are similar to those reported by Anderson (2009), who found that students reported a greatly expanded appreciation for all aspects of the horse industry following a horse industry study tour.

## Field Trip

The lowest mean scores were obtained; indicating students felt they learned the least, on statements regarding the mental preparation of race horses, drug usage in the racing industry, and basic management and care of horses. Because students were primarily juniors and seniors that had previously taken a number of equine-management courses and some owned horses themselves, the students had a reasonably strong understanding of equine management practices prior to their participation in the field trip, so it was not surprising that they did not feel they increased their knowledge basis as dramatically in this category. The veterinarians that met with students during the first two years spent more time discussing drug testing than did the veterinarian in 2010, and there was variability from year to year regarding how much the mental health of the race horses was discussed. In general, the students' responses provided evidence that they felt as though they gained considerable knowledge and increased comprehension as a result of participating in the field trip.

### Field trip Components

When the individual components of the field trip were broken down, students felt they got the most value from visiting with local horse trainers (Table 2). The trainers who participated each year were willing to spend considerable time with the students, went into great detail about their training programs, and were willing to answer all of the students' questions.

None of the students disagreed with (ranked a 1 or 2) any of the statements regarding the educational value of differing activities, but the highest standard deviation (1.10) was noted when students ranked the value of meeting with a track veterinarian. In the first two years students met with a veterinarian employed by the state, and most verbal comments students made on the trip home regarded how much they enjoyed and learned from the track veterinarian.

Both state-employed veterinarians spent considerable time talking about pre-race examinations, drug testing, and other regulatory issues. On the third year, students met with a private veterinarian that worked at the track. He focused on topics such as joint injections, X-rays, and preventative medicine. This particular veterinarian was distracted by personal events and spent less time and effort in discussing his role on the track. In fact, of those participating prior to 2010, 100% of students agreed or strongly agreed that meeting with the veterinarian was worthwhile and a mean score of 4.8 was generated by these students. Of those participating in 2010, eight students agreed or strongly agreed with the same statement, but three students (27.27%) provided lower rankings, generating a mean score of 3.82, which was significantly different ( $P = 0.0378$ ). In fact, students attending prior to 2010 ranked this as their second most enjoyable experience at the track, while those attending in 2010 ranked it as the sixth most enjoyable experience ( $P < 0.0001$ ). In terms of educational value, students attending prior to 2010 ranked meeting with the veterinarian as the most educational, while those attending in 2010 ranked it the fifth most educational component of the trip ( $P < 0.0001$ ). The individual veterinarian chosen to meet with students appears to be very important, and those employed by the state may be seen as more interesting or relevant by the students.

Interestingly, when comparing the responses of students who attended the field trip in 2010 versus those participating prior to 2010, there was a significant difference in their perception of the value of the visit to the jockeys' room. In 2007 and 2009 jockeys were present and able to visit with students, and students gave this activity a mean rating of 3.80. In 2010, the Horseman's Liaison visited with students, and students ranked the activity significantly higher with a rating of 4.73 ( $P = 0.0011$ ). Although students attending in 2010 were not able to visit with jockeys,

**Table 3. Student Responses Regarding General Benefits and Perceptions of Racetrack Field Trip (n = 24)<sup>y</sup>**

	Mean <sup>z</sup>	Standard Deviation	Minimum	Maximum
I found the field trip to be an enjoyable experience	4.81	0.40	4.00	5.00
I learned about how the ideas discussed in the classroom can be applied to a real-world situation	4.62	0.67	3.00	5.00
The field trip allowed me to further develop connections and relationships with my classmates and/or instructor	4.57	0.75	3.00	5.00
The field trip helped me understand concepts discussed in my other classes	4.19	0.75	3.00	5.00
The field trip caused me to reconsider some of my pre-conceived ideas regarding the horse racing industry	4.00	0.95	2.00	5.00
The field trip stimulated an interest in horse racing that I did not previously have	3.95	1.02	2.00	5.00
The field trip influenced the way I will condition my own horses	3.24	1.04	1.00	5.00
The field trip influenced my career path	3.20	1.24	3.00	5.00

<sup>y</sup>Survey responses listed in descending order of mean score

<sup>z</sup>Scale used: 1=strongly disagree; 2=disagree; 3=neither agree nor disagree; 4=agree; 5=strongly agree



**Table 4. Student Rankings of Activities at Racetrack (n = 24)**

	Ranking Basis	Mean <sup>y</sup>	Standard Deviation	Minimum	Maximum	P-Value <sup>z</sup>
Morning workouts	Enjoyment	3.62	2.27	1.00	8.00	0.038
	Educational	4.52	1.83	1.00	8.00	
Visiting with horse trainers	Enjoyment	3.00	1.64	1.00	7.00	0.0013
	Educational	1.90	1.00	1.00	5.00	
Visiting with track veterinarian	Enjoyment	4.62	2.54	1.00	8.00	0.0009
	Educational	3.19	2.09	1.00	8.00	
Visiting the jockey's room	Enjoyment	4.19	1.60	1.00	7.00	0.76
	Educational	4.33	1.68	1.00	8.00	
Going to the saddling paddock	Enjoyment	4.43	1.91	1.00	7.00	0.023
	Educational	5.38	1.36	2.00	7.00	
Visiting with the track manager	Enjoyment	4.38	1.43	2.00	7.00	< 0.0001
	Educational	2.71	1.31	1.00	6.00	
Watching the races themselves	Enjoyment	3.86	2.35	1.00	7.00	< 0.0001
	Educational	6.33	1.11	4.00	8.00	

<sup>y</sup>Students ranked activities from most enjoyable or most educational (1) to least enjoyable or least educational (8). There was an "other" option, which, when included, allowed for a ranking of eight activities

<sup>z</sup>p < 0.05 indicates a difference in the students' rankings of the educational value vs. enjoyment obtained within a given activity using a paired t-test

they felt as though they learned more. This may simply reflect the public speaking ability of the Horseman's Liaison, while the jockeys tended to be more quiet and reserved.

In fact, there were several components that were ranked higher by students attending in 2010 versus in previous years. These statements all had a higher mean ranking in 2010: I learned a lot by visiting with the local horse trainers (P = 0.0439); I learned a lot about the rules and regulations regarding horse racing (P = 0.0414); I learned a lot by visiting the jockeys' room (P = 0.0011); my knowledge about equine-related careers was expanded (P = 0.0427); my knowledge about the horse racing industry was expanded (P = 0.0052); the field trip stimulated an interest in horse racing that I did not previously have (P = 0.0026); and the field trip allowed me to further develop connections and relationships with my classmates and/or instructor (P = 0.0029). These increased rankings could be attributed to a variety of factors. Perhaps because the trip was in recent memory for these students, their feeling and emotions were stronger than those answering survey questions up to three years following their respective field trips. As well, it is possible that with experience, the instructor of the course had done a better job of preparing students for the trip. Finally, adding the overnight component and the stop at Lazy E could have enhanced the students' experience in 2010.

### General Benefits

Aside from the course-related objectives addressed in Table 1, the students were also asked to rank a variety of statements regarding general benefits and perceptions related to the field trip (Table 3). All respondents enjoyed the experience, with 100% ranking this statement as a 4 or 5. Students felt that the field trip enhanced their ability

to understand the real-world application of concepts discussed in their exercise physiology class as well as other classes, and the experience enabled them to deepen their relationships with classmates and/or the instructor, as none of the students disagreed (ranked 1 or 2) with these statements. Interaction with other students and with the instructor has been shown by others to increase overall satisfaction in equine classes (Wood et al., 2010). While the field trip did not necessarily stimulate a great interest in the racing industry amongst all students, all indicated that it was a valuable experience.

The lowest rankings were in the area of whether the field trip influenced how the students will condition their own horses or their career paths. This would indicate that while the students felt they learned a lot, they did not necessarily feel that they would change their lives because of it. Only one student who participated in the field trip came from a racing background, but a few of the students competed in barrel racing. While the survey instrument did not link responses to individuals, it is probable that these were the students most likely to use the knowledge gained to condition their own horses. Many other students did not have horses of their own, and others were not necessarily concerned with conditioning their own horses to run. It was also apparent that the juniors and seniors enrolled in the course, who likely have already developed career plans, are not very likely to change their goals based on a field trip. Following a horse industry study tour, Anderson (2009) also reported a relatively low percentage of upperclassmen who reported that their chosen career path had been influenced by the experience. If career exposure is a major objective, this type of experience might be more useful if offered to students as freshmen or sophomores.

### Educational Value versus Enjoyment

There was considerable variability in the students' rankings of various activities in terms of educational value and perceived enjoyment, with all activities receiving a number 1 ranking in at least one category or the other (Table 4). There were significant ( $p < 0.05$ ) differences in student rankings of all but one activity when students were asked to shift their emphasis from most enjoyable to most educational. Students ranked watching morning workouts ( $p = 0.03$ ), going to the saddling paddock ( $p = 0.02$ ), and watching the races themselves ( $p < 0.0001$ ) higher on the enjoyment scale, as compared to their rankings on the educational scale. These tended to be activities where the students had less interaction with the professionals working at the track. Conversely, students ranked these activities higher on the educational scale than they did the enjoyment scale: visiting with horse trainers ( $p = 0.001$ ), visiting with the track veterinarian ( $p = 0.0009$ ) and visiting with the track manager ( $p < 0.0001$ ). It was quite apparent that students felt there was more educational value in listening to these professionals and in getting the opportunity to ask questions than there was in simply observing race day activities.

### Summary

Overall the students reported having a very positive experience on their field trip to the racetrack. Those participating in this activity experienced strong support and gracious hospitality from both racetracks and from the professional horsemen and women involved. Student responses to the survey indicated that the objectives for the field trip were met: give students a better understanding of the racing industry, develop a further comprehension in the students about how principles discussed in class can be applied to a real-world setting, and expose students to the breadth of career opportunities available related to the racing industry. Students' responses would indicate that this particular experience met the first two objectives readily. While students were exposed to a variety of equine professionals and witnessed the array of jobs offered at a racetrack, they indicated that the experience did not cause them to change their chosen career paths. If instructors want to impact students' career choices, this type of activity might be better suited to freshmen and sophomore students. Students also gained other benefits from the class, such as developing closer relationships with their classmates and/or instructor. One hundred percent of students indicated that they that they learned a lot, their knowledge of the racing industry was expanded, and they enjoyed the field trip.

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# Expansive Collaboration: A Model for Transformed Classrooms, Community-Based Research, and Service-Learning<sup>1</sup>

**Florence V. Dunkel<sup>2</sup>**  
**Montana State University**  
**Bozeman, MT**



**Ashley N. Shams<sup>3</sup> and Camille M. George<sup>4</sup>**  
**University of St. Thomas**  
**St. Paul, MN**

## Abstract

The Expansive Collaboration (EC) Model suggests methodologies promoting education for sustainable development. This EC Model, though not new, stresses: 1) communities be involved as vested partners; 2) collaborations include significantly different disciplines representing humanities, agriculture, art, business, engineering, health, communication; 3) tribal colleges or other non-Western (non-European derived) culture institutions link with non-native serving institutions; and 4) all stakeholders focus on a community-selected issue using the holistic process. The EC Model, designed to link institutions serving different cultures to focus together on a specific local or international community, developed over 10 experimentation years, with eight higher education institution partners, 130 students in overseas (Mali) components, and estimated 3,000 in U.S. classroom components. This model works in different educational and community settings with or without formal service-learning components. Authors present the Model's theoretical background and role in providing students in disciplines within and "beyond" agriculture with tools to implement sustainable development and use the holistic process. The Model operates under the premise that teaching environments, created when these diverse working teams form, deepen student interest and learning by promoting critical thinking, creative problem-solving, and enhance communication skills needed to solve nuanced issues. These transdisciplinary, multi-institutional approaches create synergy not possible with a simpler collective.

**Keywords:** transdisciplinary collaboration, agriculture-based service-learning, international service-learning, sustainable development, holistic, poverty, participatory, transformative education, diversity

## Introduction

Today's students in higher education are mainly in the "Millennium Generation" (Millennials) or are adult learners. Adults are the fastest-growing segment of today's undergraduates (NCES, 2009). Adult students are twenty-five years of age or older, responsible for themselves financially and educationally, often with competing sets of adult roles (Kasworm, 2003). These students are ready to learn, but are often place- and job-bound, but wanting specific education to advance in the job market (Holyoke and Larson, 2009). Adult students also want to leverage their own experience, solve specific problems, and apply new knowledge immediately (Knowles, 1970). The other main component of today's undergraduates is the Millennials (16 to 24-year olds). Millennials move strongly and confidently into society, sharing with their GI-Generation great-grandparents (born 1901-1924) a concerned engagement to right the world's wrongs (Strauss and Howe, 2000). These students come to classrooms with a social agenda and ask for practical skills and experiences to connect them immediately with responsible, environmentally-balanced living, professionally and personally. Socially responsible students want to know about issues of and failures of aid to material poor communities, ideas of sustainability, equality, holistic engagement, and transdisciplinary thinking.

The holistic process is useful in each of these areas in which students search for knowledge and skills. This process was first defined by Savory and Butterfield (1999) as a formal, deliberate method of determining one's life values, current resources, and sustainable future resources to achieve or maintain one's life values. The holistic process provides an effective methodology for both adult learners and Millennials to make the community connections they seek.

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<sup>2</sup>Associate Professor, Department of Plant Sciences and Plant Pathology; Tel: 406-451-9343; Email: ueyfd@montana.edu

<sup>3</sup>Assistant Professor, Department of Classical and Modern Languages; Email: anshams@stthomas.edu

<sup>4</sup>Associate Professor and Program Director, Department of Mechanical Engineering; Email: cmgeorge@stthomas.edu

## **Purpose**

This paper presents the Expansive Collaboration (EC) Model that creates a teaching/learning unit to engage students in service-learning, community-based research, or other format, and that fosters development of sustainable solutions from the bottom-up. No single academic discipline is sufficient to address a complex community issue. Thus, a partnership structure was formed to determine if the EC Model would more effectively solve community problems and facilitate student/faculty learning, leading to greater community satisfaction than a simpler model. “Expansive Collaborative” is herein defined as a highly interactive, multi-cultural, multi-institutional group of faculty and students that includes, in a transdisciplinary and systems approach, the academic areas of agriculture, the humanities, arts, sciences, and technology in a collective teaching-learning unit using the holistic process. The EC Model can be used to create courses, transform curricula, conduct action research, and develop service-learning experiences with any community.

This paper argues that, to effectively engage all students who want to learn how to be socially responsible, institutions should provide opportunities, both in the classroom and in social action groups, for faculty and students to form a teaching and learning unit using the holistic process as defined by Savory and Butterfield (1999). Savory and Butterfield advocate using these three basic steps. First, the community-of-focus defines, in one sentence, their most important values/goals; second, the community lists their current resources to maintain these values; and third, the community determines what sustainable future resources they will need to maintain these values. Faculty members engage long-term with a community. Students participate as visitors, listeners, contributors, and mentorees in this ongoing process that extends over multiple semesters or quarters.

The holistic process blends naturally with service-learning. The classic definition of service-learning, however, does not specifically include the holistic process. Service-learning pedagogy is a form of course-based, credit-bearing, civically engaged scholarship emphasizing “development of democratic, mutually beneficial, and respectful relationships between students and community members with whom they work” (Benson and Harkhavy, 2003) in which “...students a) participate in an organized service activity that meets identified community needs and b) reflect on the service activity in such a way as to gain further understanding of course content, a broader appreciation of the discipline, and an enhanced sense of civic responsibility” (Bringle and Hatcher, 1995, p.112). To meet student needs more effectively and community goals sustainably, the holistic process should be integrated into service-learning programs.

Reorienting service-learning educational processes toward developing and implementing sustainable solutions requires the holistic process, which in turn requires working at disciplinary interfaces, using inclusivity, valuing long-term relationships with the community-of-focus, and valuing all ways-of-knowing, technologically-oriented as well as traditional-based knowledge. In the EC Model, faculty engage and students participate in a transdisciplinary manner. “Transdisciplinarity involves going between, across, and beyond different disciplines” (UNESCO, 2010 p.1), simultaneously searching for balance. For example, when a group of agricultural scientists, business managers, and engineers discovered their community-of-focus was primarily interested in locally eradicating malaria (Sanambebe, Mali), or wide-spread community alcoholism (Renchinulmbe, Mongolia), or in maintaining their local population of crocodiles that have both economic and spiritual value (Borko, Mali), or in preserving their endangered indigenous language (Lame Deer, MT), they worked together with the community on the issue and did not dismiss issues as out of the purview of their disciplines.

## **Example of an Expansive Collaborative in Action**

The birth of the EC Model occurred as a result of this example. Agricultural scientists had been working with the village of Sanambebe, Mali since 1998. For six years, collaborative on-farm research had been conducted related to sustainable pre-harvest protection of green beans and tomatoes from insect vectors and soil-borne fungi, and long-term preservation of cowpeas postharvest. When finally asked in a series of holistic focus groups initiated by Millennials what their most important issues were, villagers said their concerns were not about pre-harvest and postharvest protection of crops. Their highest priority was to protect their children from malaria and hunger (later redefined by these villagers as kwashiorkor). Professors and students from Entomology, French Literature, Business Marketing, Horticulture, Neurobiology, Art Design, Molecular Biology, Media and Theater Arts, Nursing, Soil Science, Liberal Studies, and Organismal Biology in a Hispanic-serving institution (UC-Riverside), a tribal college (Chief Dull Knife Community College), a Malian agricultural college (Institut Polytechnique Rurale et Institut Formations Recherches Appliquee), and an 1862 Land Grant university (Montana State University) listened to villagers and began to develop answers to villagers' questions. Five years later, there have been no childhood deaths from malaria for two years and villagers are helping a neighbor village with their malaria issues. The most important thing that led to this success, Sanambelean villagers said, was that students and faculty took time to tell the stories of the insect vector and the protozoan that causes malaria (Table 1). Now,

a similar success story is emerging with “hunger,” which is actually not lack of food, but making better choices of food produced in the village to provide the appropriate balance of the essential amino acids for children to prevent kwashiorkor (Brewster et al., 1997). When this Expansive Collaborative involved students and faculty in the holistic process with the village, seemingly unsolvable-across-Africa issues became locally solvable.

Inspiration for the EC Model was the global, participatory, Integrated Pest Management (IPM) Collaborative Research Support Programs (CRSP) (De Datta, 2005; Norton et al., 2005). CRSPs, similar to the EC Model, were developed at land-grant institutions. Originating in the 1960's, CRSPs throughout their history focused on international research, not U.S. undergraduate curricula. First tests of the EC Model construction focused internationally on small-scale, subsistence farmers and linked IPM CRSP partners with U.S. curricular changes (Dunkel et al., 2007). The EC Model uses participatory approaches of IPM CRSP, but couples that approach with the holistic process and more expansive multi-institutional components as part of a credit-bearing curriculum in higher education. The EC Model makes use of existing structures to target “many students who graduate having accumulated whatever number of courses is required, but still [are] lacking a coherent body of knowledge or any inkling as to how one sort of information might relate to others. And all too often they graduate without knowing how to think logically, write clearly, or speak coherently” (Boyer, 1998).

The EC Model is also based on the development suggestions of Easterly (2006) which focuses on not having a plan, but letting the community develop their own plan in their own timeframe. Because the EC Model has members of the community-of-focus acting as on-site mentors, there is opportunity for guided interpretation of cultural dissonance. Usually this interpretation leads to a transformative effect in both faculty and students (Kiely, 2005; Mezirow, 2000). This transformation will strengthen the possibility that both faculty and students will address future agricultural and other systemic issues with these tools, leading to acceptance and adoption of sustainable solutions (Knickel et al., 2009). In this way, the EC Model creates an informal academic grouping without requiring a new academic department.

### **Examples of Service-Learning Projects Similar to Expansive Collaboratives**

The number of multi-disciplinary, service-learning projects implemented has grown in the past decade. The following are a few of the examples. The program initiated in 1995 at Purdue with only engineering students (EPICS: Engineering Projects in Community Service), now draws 10% of its student participants from liberal arts (Oakes et al., 2000).

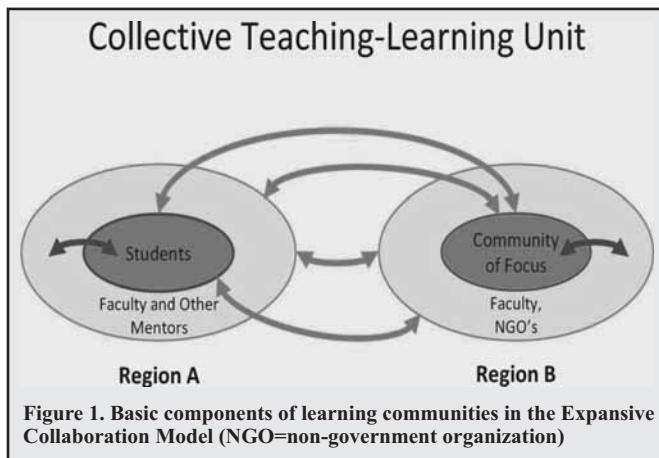
The University of Nebraska program brought students together from classes in Spanish, social work, communication, and engineering to work on a short-term project with one community agency (UNOmaha, 2008). The University of Pennsylvania undergraduates in 2003 launched a middle school community health center (Sayre Health Promotion and Disease Prevention Center) now serving as a teaching and learning focus for medical, dental, nursing, arts and sciences, social work, education, design, and business students (Harkavy, 2004). Linking a large, elite university and a smaller, minority-serving university in shared classes focused on the same community-of-focus has been effective (Marullo et al., 2009). To more deeply engage with the people of their state, the University of Georgia, the 1862 Land-Grant institution in Georgia includes a service-learning component in their courses across campus (Fischer, 2009). The result was a renewed link connecting towns with expertise across the university and the state-university system. Whether or not these examples were transdisciplinary which the holistic process requires as opposed to multidisciplinary which the holistic process moves beyond is not known. Whether or not these programs used the holistic process (Savory and Butterfield, 1999) with the community being the seekers of information rather than the interdisciplinary or multidisciplinary groups being the givers of information is not known. One example was found using the holistic process in higher education in combination with service learning at University of Texas-Austin (Richardson, 2007).

### **The Conceptual Model**

The EC Model (Figure 1) was initially designed in 2002 (Dunkel et al., 2007), revised in 2004 (Dunkel and Gamby, 2007; Dunkel and Montagne, 2006) and 2007 (Dunkel and Montagne, 2009). The EC Model provides a methodology to promote education for sustainable development. Its efficacy is currently under evaluation.

This model requires two main groupings of higher education institutions (in Region A and Region B) linked in what should be entered into as a long-term relationship (Figure 1). Two or more culturally distinct regions are needed in the model to set the stage for cognitive dissonance followed by perspective transformation. The importance of a long-term relationship cannot be over-emphasized. Most communities require a year or more simply to establish trust required for an effective working relationship. These essential two regions also become a way to appreciate diversity. Scientist/novelist, C.P. Snow (1959) in his well-known essay “A Second Look,” saw hope for a sustainable world only if societies reweave the “two cultures,” literary and scientific, back together. Students trained in sciences must be trained to understand social consequences of technological change. Simultaneously, humanities

students must have basic scientific/technological literacy to fully understand issues related to poverty, health, and agriculture. Solutions to real problems demand transdisciplinary approaches (Baker et al., 2009).



Regions A and B can have many configurations. Region A is focused on students, whereas the community-of-focus is the center of Region B, although local students and faculty can exist in Region B. In our first tests of the EC Model, Region A was a coalition of four 1862 Land-Grant universities, a Native American tribal community college (1994 Land Grant), a public non-land grant university, and a service-based, private, urban university (George et al., 2011; Shams and Smith-Cunnien, 2009; Smith-Cunnien et al., 2010). Region B was a similar set of teaching and research institutions, but in a material resource-poor country, Mali. The main community partners in the Expansive Collaborative in Region B were cooperatives, women's associations, and councils of Elders within communities. To help bridge gaps in understanding each other's cultures, Region B partners who served as site-mentors for both U.S. faculty and students were found to be invaluable. One mentor group was composed of mid-career professors, scientists, and an engineer who traveled between the two regions (Dunkel and Gamby, 2007). These mentors are residents of Mali (Region B) and speak indigenous languages of the subsistence farmers with whom the Region A participants work. Other long-term partners were the U.S. Peace Corps-Mali and non-government organizations (NGOs) such as Shee-Yeleen International, based both in Regions A and B.

Another configuration of Regions A and B tested was within a state (Region A) and a Native American nation (Region B) in the same state. A third configuration was formed as a network of secondary and elementary school classrooms in both Regions. They were linked via electronics to the institutions of higher education and to each other (Woolbaugh et al., 2006). Students, teachers, and faculty interacted via email, visits, collaborative research and service-learning, exchanges of cultural trunks with local artifacts, letter exchanges by students, and annual

video conferencing (the Global Science Fair) (Woolbaugh and Dunkel, 2008). A website (Virtual Center for Alleviating Rural Poverty while Valuing Traditional Ecological Knowledge, 2011) became a mechanism for sharing outputs. The EC Model creates bridges and can foster changes in institutions of higher education quickly (Table 1).

Why is it so crucial to configure the EC Model around at least two culturally different collections of institutions? Higher education faces an urgent need. First, students must “learn to understand, appreciate, and work cooperatively with those of different beliefs and values” (Chisholm, 2004; Foreword, p. x). Second, student learning should come from experiences as well as traditional academic sources of information. Third, higher education has a “...responsibility to deploy their resources to address... problems, issues and suffering in their own societies and those of the world” (Chisholm, 2004; Foreword, p.x). The EC Model evolved to specifically promulgate these changes.

**Basic Steps in Building and Using an Expansive Collaborative**

The EC Model is implemented using the following steps.

1. Foundation Step is to first create a coalition of professors in Regions A and B from different academic disciplines across different institutions of higher education. This phase usually involves seeking and receiving funding, and may take a year or more. Similar to the Collaborative Research Support Programs (CRSPs), the foundation step need only be taken every five to 10 years.

2. Colleagues in Region A link with their counterparts in Region B and together engage one or more communities in Region B in a holistic discussion.

3. Depending on the issues raised and the holistic goal generated by consensus in the community-of-focus, specific partners are recruited from the community and from institutions of higher education.

4. The structure of the learning environment is established. Courses are redesigned or created and approved by each institution's administration.

5. A series of culture-general and culture-specific teaching and learning sessions are conducted by faculty and students at their institution involving collaborators from other institutions electronically. Students explore Western and non-Western (non-European derived) cultures' theories of “development” with the following authors: Norberg-Hodge (1992), Ayittey (2005), Easterly (2006), Ba (1972), Straus (1977), Yunus (2003), Mortensen and Relin (2006), Mortensen (2009), Kidder (2003). Students sharpen participatory (Chambers et al., 1989) and holistic skills (Savory and Butterfield, 1999) and learn in-depth interview techniques (Halvorson et al., 2011). To prepare for the intensive listening process, students learn about community members,

community dynamics, and social structure through videos, in-depth interviews with previous visitors, and by engaging in role plays and follow-on evaluations. Mentored student reflections begin at this step and continue through step 8.

6. Students join with faculty and community mentors and engage the community in the participatory, holistic process to continue interactions begun in step two. Students and faculty listen within the community and also in the multi-institution,

**Table 1. Examples of Tangible Benefits to Student Learning (S), Transformative Effects (Mezirow 2000) (T), Faculty Development (F), and Positive Changes in the Community-of-focus (C) from using the Expansive Collaboration Model and (year) Benefit Began to Accrue after Initiation of Program in 2002**

Type of Institution	Specific Group within Institution	Benefit
<sup>a</sup> Tribal College (1994 Land-Grant) Region A	n.a.	<ul style="list-style-type: none"> <li>◆ first international program (T) (2003)</li> <li>◆ first service-learning course (S,T) (2003)</li> <li>◆ tribal history interest renewed (S,C) (2009)</li> <li>◆ teaching/learning dialogue initiated on Indigenous issues with Sanambele farmers/ Elders (S,C) (2009)</li> </ul>
<sup>b</sup> Service-Learning University Region A	College of Arts and Sciences School of Engineering School of Business School of Theology	<ul style="list-style-type: none"> <li>◆ added agricultural /natural resource issues into existing courses (S,T,F) (2005)</li> <li>◆ provided language-based service-learning opportunities in another material resource country (S,T) (2005)</li> <li>◆ received student/faculty awards in service-learning and international research (S,F) (2008)</li> </ul>
<sup>c</sup> 1862 Land-Grant Universities Region A	College of Agriculture College of Letters and Science College of Liberal Studies	<ul style="list-style-type: none"> <li>◆ added service-learning and the holistic process to courses (S,T,F) (2005)</li> <li>◆ added new courses (S) (2003)</li> <li>◆ received student, faculty, department awards in service-learning, research, international educational opportunities (S,F) (2009)</li> <li>◆ added intercultural competency measurements to undergrad tests (T) (2005)</li> </ul>
<sup>d</sup> Hispanic-Serving University Region A	College of Agriculture College of Humanities, Arts, and Social Sciences	<ul style="list-style-type: none"> <li>◆ added course on understanding poverty and cultural wealth (S,T) (2007)</li> </ul>
<sup>e</sup> Agricultural University and <sup>f</sup> National Agricultural Research Organization Region B	Agricultural Engineering Small Enterprise Economics Integrated Pest Management	<ul style="list-style-type: none"> <li>◆ added the holistic process to mentors'/instructors' skill set (S,T,F) (2007)</li> <li>◆ added appreciation for essential role of human geography in engineering (T,F) (2008)</li> <li>◆ received student, faculty, national awards in research/international activities (S,F) (2005)</li> </ul>
<sup>g</sup> Communities Region A	n.a.	<ul style="list-style-type: none"> <li>◆ communities participated in annual, public cultural events with local institutions of higher education (C) (2003)</li> <li>◆ grade school, secondary school student/faculty exchanges (S,T,F,C) (2005)</li> </ul>
<sup>h</sup> Communities Region B	Village Group 1  Village Group 2  Village Group 3	<ul style="list-style-type: none"> <li>◆ villagers eradicated locally malaria (no child deaths)(C) (2009)</li> <li>◆ village women established handicraft cooperative, national / international market, and physical center www.mmama.net (C) (2009)</li> <li>◆ grade school, secondary school student/faculty cooperative research/arts/cultural heritage development (S,F,C) (2005)</li> <li>◆ farmers learned, successfully used certified seed potato production methods (C) (2010)</li> <li>◆ women learned quality assessment, management techniques for value-added local, renewable natural products. (C) (2008)</li> <li>◆ women organized into a shea cooperative. (C) (2008)</li> </ul>

<sup>a</sup>Chief Dull Knife College, Lame Deer MT; <sup>b</sup>University of St. Thomas, St Paul MN; <sup>c</sup>Montana State University-Bozeman, Virginia Tech-Blacksburg, University of California-Davis; <sup>d</sup>University of California-Riverside; <sup>e</sup>Institut Polytechnique Rurale et Institut Formation Recherches Appliquee, Katibougou, Mali; <sup>f</sup>Institut d'Economie Rurale, Bamako, Mali; <sup>g</sup>Lame Deer, MT; St. Paul, MN; Belgrade, MT; Helena, MT; Choteau, MT; Bozeman, MT; <sup>h</sup>Sanambele, Mali, Borko, Mali, Dio and Zantiebougou, Mali.

## Expansive Collaboration

transdisciplinary groups, and join with the community in action(s) decided upon. This specific active listening process uses certain verbiage such as verification or rephrasing. Supportive expressions that convey attitudes of valuing, appreciating, and empowerment are used. Directive, judgemental, and negative statements are prohibited. Listening involves a series of focus group discussions and individual, in-depth interviews.

7. Substantial give and take occurs and the community is empowered to focus on their holistic goal. Community members, students, and faculty take further mutually-decided-on action(s).

8. At the end of the semester's or quarter's experience for each cohort of students, all Region A and B participants jointly assess outcomes and impacts.

Over variable time spans, but usually each year, the specific problem or issue, and, therefore, the goal may change. The on-going process, however, provides a real framework to build students' basic knowledge and skills. This multi-year conversation provides the foundation upon which students in a variety of service-learning, action research courses in partner institutions and the community-of-focus can see progress. Meaningful social change and in-depth learning occurs when faculty and students practice their enhanced participatory, holistic listening skills, and their teaching, research, reflection, critical thinking, problem-solving skills.

The careful foundation set in place, combined with give and take at every step in the cycle, builds and strengthens the inter-institutional framework and multi-academic-year memory. The EC Model combines pedagogies with andragogies, such as the holistic process, service-learning, and international study abroad, that educate future generations in the mindset and skills required for developing and implementing successful, sustainable practices. Students are involved in Steps 5-8. New students enter at Step 5 each semester/quarter. Step 8 is the time for in-depth assessment and preparing for a repeat of the process as faculty and community mentors may change.

### Application of the Model

Primary test sites for the EC Model were established in four village groupings in Mali, on the Northern Cheyenne Reservation in Montana, and in a nomadic herding community in Mongolia. One hundred and thirty students from four 1862 Land-grant Universities (including a Hispanic serving institution), one urban private university, one tribal college, and one public non-Land-grant university have participated with 35 U.S. and Malian faculty in tests of the EC Model in Mali. An estimated 3,000 students participated via on-campus action research courses since 2001.

## Benefits

The EC Model offers many benefits for students, faculty, institutions of higher education, and communities in both Regions A and B (Table 1).

**Intercultural Competency Benefits.** The EC Model emphasizes intercultural competency for students and faculty. Mentor-guided reflections with site mentors is a crucial part of the discovery process. Faculty became interested in their own level of intercultural development, particularly in moving from ethnocentric approaches (denial, defense, minimization), toward ethno-relative world views (acceptance, adaptation, and integration) (Bennett, 2004; Pusch, 2004). Faculty in Region A gained appreciation for simply listening and the usefulness of, at times, "being motionless" and accepting of a slower pace (Tonkin, 2004, p. 1). Western culture students and faculty learned to suppress their own "need-to-plan," to value other ways-of-knowing, and to appreciate non-Western cultures (cultures not of European origin) development processes such as those they discovered when studying Norberg-Hodge (1991).

**Pedagogical / Andragogical Benefits.** The EC Model enhances student learning. Students in one discipline must explain their parts of the project to other team members. Explaining the concepts and workings of a solution or approach to someone outside one's own field requires some knowledge of the other disciplines and using effective communication skills. Transmitting meaning constructed in individual contexts and through social negotiation, collaboration, and experience internalizes and deepens learning. For example, the holistic approach requires identifying all of the necessary and sufficient

### Key factors in forming an Expansive Collaborative:

1. Main form of interaction is the participatory, holistic process.
2. The Expansive Collaborative is a network of long-term relationships.
3. Communication by all members across the collaborative should be frequent.
4. Students are co-taught, co-advised between institutions, between countries, by villagers, tribal community members, by peers.
5. Faculty pay attention to intercultural development, guiding students and each other from ethnocentrism (believing their culture is the center of the universe), through minimization of differences toward ethno-relativism (appreciation of differences), particularly integrated ethno-relativism (in which one moves subconsciously from appropriate behavior in one culture to that of another) (Bennett, 2004; Pusch, 2004).
6. Villagers/community-of-focus decide topic and action.



sustainable resources to solve a problem or maintain a value. Local malaria eradication, kwashiorkor, alcoholism, unemployment, and other expressed community problems have no single disciplinary home and students soon discover this complex problem must be solved using a systems approach.

**The EC Model encourages creative problem-solving.** The EC Model emphasizes knowledge construction, not reproduction. Neither teacher nor textbook are center stage. Students ask and then learn how to find answers to their own questions. In this pedagogy, learning situations, environments, skills, content, and tasks are relevant, realistic, authentic, and represent the natural complexities of the real world. Learning in this way encourages creative problem-solving. Solutions offered by students must be appropriate and sustainable for community partners (George et al., 2011). To offer acceptable assistance, students must consider broader societal issues such as culture and gender roles in the community or specific physical constraints such as long-term, sustainable availability of critical resources, and effects of local climatic patterns.

The EC Model enhances communication skills. The EC Model requires transdisciplinary thought and action, i.e. communication along the interfaces between different disciplines. Students from different sized institutions with different ethnicities, religious backgrounds, and socio-economic status learn to collaborate. Collaborations between urban and rural institutions coalesce among students with different understandings of agricultural issues and students with very different sets of 'common knowledge.' Collaborations between institutions in different countries involves more than just some knowledge of each other's language, but also requires knowing and following customs and traditions of each other's societies for successful communication. Students must first listen to community partners, and then respond to community questions and requests, remembering continually that the community is in the "driver's seat." Students must be part of formal, but non-technical presentations to Elders, and informal interactions with community members. Later, students are required to give formal professional presentations.

The EC Model creates valuable relationships. In addition to students from a multitude of disciplines working together and learning from each other, the EC Model also encourages faculty to forge new professional relationships outside their individual academic departments. In so doing, they learn about organization of other academic fields which broadens their own content knowledge and deepens appreciation for others' knowledge.

After 11 years of developing and using the EC Model (2000-2011), there were many examples of these basic pedagogical and andragogical benefits. Individual examples are too numerous to list here.

Each student in the overseas component benefitted in different specific ways. These are a few of the benefits of the 130 students in the Mali component. Students discovered many aspects of cultural wealth, including traditional uses of local medicinal and pesticidal plants (Lehman et al., 2007), respect for elders (Chaikin et al., 2010), values of multi-generational family groups (Chaikin et al., 2010), the power of sharing, and peaceful conflict resolution (Jones, 2007). Students and faculty, learned that knowing community perceptions is essential before even suggesting interventions (Halvorson et al., 2011). The 3,000 students who did not travel to a Region B location accrued benefits by being exposed to unique learning experiences and becoming aware of their own intercultural development process. Most students who worked in Region B reported the experience dramatically changed their perspectives.

**Recruitment, Retention, and Persistence Benefits** accrue to institutions using the EC-Model because faculty have opportunities to build relationships with students outside the classroom. Studies indicate these experiences lead to greater student satisfaction, retention, and persistence (Gallini and Moely, 2003; Shumer, 1994; Astin and Sax, 1998). Word-of-mouth from current and previous satisfied students improves recruitment. Adult students and Millennials are more engaged and have their needs for connection to sustainable actions met. These factors can lead to improvement in student recruitment, retention, and persistence (Fox Koon et al., 2009).

**Community Benefits.** The EC Model can be used in the U.S. with migrant worker and Native American communities, in inner cities, and communities anywhere in the world. Outcomes have mutual benefits (Table 1). Community members are empowered, talents are discovered among community members, and new skills are developed. Most important, the community develops pride in their accomplishments, and develops a process to continually align their values with their resources, sustainably.

## Summary

Many global issues can be addressed by using the EC Model. Transdisciplinary, multi-institutional, multicultural platforms using the Savory-Butterfield holistic approach support bottom-up, sustainable development. Service-learning is even stronger when the holistic process is used and could become the best practice to create learning environments for adult students and Millennials. Pedagogical and andragogical skills of faculty improve, students are highly engaged, and teaching is inspiring once partnerships are in place. The EC Model is one way to realign higher education experiences with the needs of their adult students and the Millennials. The EC Model creates synergy not possible with a simpler model.

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# Urban High School Students' Perceptions about Agricultural Careers and General Agricultural Knowledge<sup>1</sup>

Lacee Brianne Frazee<sup>2</sup>  
American Museum of Agriculture  
Lubbock, TX



Tracy Rutherford<sup>3</sup>, Gary Wingenbach<sup>4</sup>, and Lawrence A. Wolfskill<sup>5</sup>  
Texas A&M University  
College Station, TX

## Abstract

The Big City, Big Country Road Show (BC2BC) was a recruitment workshop for traditionally underrepresented inner-city high school students with little or no agricultural background. The workshop synthesized agricultural communications with activities emphasizing leadership, photography, writing, video production, and Web design to broaden students' perspectives of career opportunities in agriculture. The purpose of this study was to measure the influence of workshop participation on students' perceptions of careers attainable with an agricultural sciences degree and their general agricultural knowledge levels. Significantly more students perceived attainable agricultural careers, such as public relations officer, loan officer, account representative, Web designer, photographer, government official, and landscaper, after participating in the workshops. As workshop participants learned about the connections between agricultural subjects and careers, their perspectives about agricultural careers were changed. Significant differences in perceived knowledge levels were found; students perceived they knew less about agricultural subjects than did their peers after participating in the BC2BC workshops. Participants' pre- and post-workshop tested knowledge of agricultural facts revealed no significant differences. Future research should include a variety of agricultural knowledge assessment methods, procedures, and settings to better understand the role of increasing one's knowledge of agricultural facts and its possible effects on career decision making processes.

## Introduction

Many children are not exposed to agriculture as a

way of life (Esters and Bowen, 2004). To sustain the agricultural workforce, colleges of agriculture must invest in recruiting students to agricultural majors (Scott and Lavergne, 2004). Recruitment efforts are necessary, specifically with minority students, so that the agricultural workforce reflects the diversity of the U.S. population.

Minority students identified career perceptions and social status as barriers to pursuing careers in agriculture, as well as a lack of information about career opportunities (Outley, 2008). Such perceptions may influence underrepresented groups' participation in agriculture, contributing to a workforce population disproportionate to that of the general public. Hispanic/Latinos and African-Americans together comprised 10.2% of the USDA's workforce (USDA, 2007), and less than 10% (9.76%) of those same groups were enrolled in an undergraduate four-year, agricultural or related sciences degree program in fall 2006 (Food and Agricultural Education Information System, 2007). Reports compiled by the U.S. Census Bureau predicted that the Latino population, currently the largest minority in the U.S., will triple by the year 2050 (Passel and Cohn, 2008), making Latinos a significant population from which future agriculture professionals can be recruited (Mullinix et al., 2006).

According to White et al. (1991), urban youth thought that careers in agriculture were only for those who had an agricultural background, worked outdoors, and participated in on-the-job training. Other studies (Conroy, 2000; Newsom-Stewart and Sutphin, 1997) suggested that students equated agriculture with science, but not with computers, engineering, and teaching. Conventional extracurricular activities, such as 4-H and FFA, have not contributed to minority recruitment initiatives, since they

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<sup>2</sup>Executive Director, 1501 Canyon Lake Drive, P.O. Box 505, Lubbock, TX 79408; Email: lacee\_brianne@yahoo.com

<sup>3</sup>Associated Professor, Department of Agricultural Leadership, Education, and Communications, 2116 TAMU, College Station, TX 77843-2116; Email: trutherford@tamu.edu

<sup>4</sup>Professor, Department of Agricultural Leadership, Education, and Communications, 2116 TAMU, College Station, TX 77843-2116; Email: g-wingenbach@tamu.edu

<sup>5</sup>Doctoral Candidate, Department of Agricultural Leadership, Education, and Communications, 2116 TAMU, College Station, TX 77843-2116; Email: wolfskill@shsu.edu

are rarely housed in urban high schools. As colleges of agriculture work to confront this disparity, scholars (Conroy, 2000; Outley, 2008; Talbert and Larke, 1995; Wildman and Torres, 2001) have recommended that recruitment efforts should focus on biotechnology, communications, ecology, media portrayal, and/or urban horticulture to expand minority students' perceptions of agriculture, as well as build career knowledge and self-confidence. Marcelin et al. (2004) discussed programs that both engage and enrich minority student populations, and emphasized the importance of "project-based learning, technology, and role models" (p. 522) to help students build skills and knowledge. Having a positive attitude toward agriculture as a result of a pre-college workshop increased the likelihood of enrolling in an agricultural college major (Wiley et al., 1997).

The Big City, Big Country Road Show (BC2BC) was a multi-year program designed to introduce and recruit underrepresented urban high school students to careers in agriculture through experiential learning. Two-week workshops held in Houston, San Antonio, Atlanta, Chicago, and El Paso, focused on media representations of agriculture. Based on real-world contexts, the activities were team-oriented problem solving situations. Student teams met with local media professionals and produced communications media to advance their understanding of connections between modern agriculture and communications, economics, education, entertainment, and health. What makes BC2BC innovative is its use of communication technologies and strategies to engage students' interests in agriculture, compared to traditional techniques such as exhibitions and demonstrations. Ultimately, the BC2BC program provides a unique recruitment opportunity through experiential learning to change student attitudes about career opportunities in agriculture.

In their study of positive youth development programs, Catalano et al. (2004) asserted that programs fostering self-determination, self-efficacy, belief in the future, and opportunities for pro-social involvement, provided the greatest opportunity for positive attitudinal shifts. Roberts' (2006) model for the experiential learning process, drawing from the work of Dewey, emphasized the role of context and importance of "intelligent" activity, where one postpones action until observation and judgment have taken place. In Roberts' model, the learner first focuses on the experience, then reflects on the experience to draw generalizations. Once generalizations are formed, they are used to guide the next set of experiences, refining and focusing the generalizations until knowledge is produced from active participation. Contextual factors Roberts considered were "the level, the duration, the intended outcome, and the setting" (p. 26). Esters and Bowen (2004) shared an emphasis on context, discussing the influence of environment on factors influencing enrollment in an urban agricultural education

program. Esters (2007) elaborated that once an environment provides opportunity for agricultural experience and career exploration, career choice satisfaction is likely.

This study evaluated the effect of workshop participation on underrepresented students' attitudes toward pursuing careers in agriculture and their levels of agricultural knowledge. Imperative to this study was the idea of attitudinal influences affecting choice, and how recruitment efforts, partially supported by contact with media professionals in experiential situations, best address those choices. Duncan and Broyles (2004) found that experiences gained in a hands-on program with professional involvement positively influenced students' choices toward agricultural majors.

## **Methods**

The purpose of this study was to determine if high school students' participation in a summer agricultural communications workshop affected their perceptions of agriculturally-related careers and/or their agricultural knowledge levels. The objectives were to:

1. Determine students' perceptions of careers attainable with an agricultural degree;
2. Determine if significant differences existed in students' pre- and post-workshop perceptions of agriculturally-related careers; and
3. Determine if significant differences existed between students' pre- and post-workshop knowledge about general agricultural facts.

Similar descriptions of the methods and demographics exist for the larger project (Wingenbach, et al., 2007), and are described fully herein. Descriptive survey research using Web-based survey data collection methods (Ladner, et al., 2002) were used to complete the study, after obtaining approval from the Texas A&M University Institutional Review Board.

The population of interest included all inner-city high school students (grades 9 to 12) who were considered part of the underrepresented populations in agriculture and who lived in San Antonio and Houston ( $N = 55,264$ ) during summer 2007; El Paso, Atlanta, and Chicago ( $N = 121,863$ ) during summer 2008; and San Antonio ( $N = 17,792$ ) during summer 2009. Project directors used a USDA definition (USDA-Grants-MSP FAQs, n.d.) of underrepresented populations, which included Hispanic and African American students. Selected schools in Houston, San Antonio, El Paso, Atlanta, and Chicago were selected for workshop sites because of their high enrollments of underrepresented populations (Houston = 59% Hispanic, 29% African American; San Antonio = 88% Hispanic, 9% African American; El Paso = 79% Hispanic, 5% African American; Atlanta = 4% Hispanic, 86% African American; and Chicago = 39% Hispanic, 47% African American).

Participants were recruited through promotional materials mailed to more than 500 high school

administrators, counselors, and teachers in Houston, San Antonio, El Paso, Atlanta, and Chicago. Two teachers from each city were selected to serve as workshop recruiters for their individual schools. Selected teachers taught core-curriculum classes in mathematics and science. By using core-curriculum teachers, the BC2BC project directors were able to contact students from a broad range of backgrounds and interests.

Students who were identified by teacher recruiters completed online applications, including demographic and personal information questions, for program participation. Not having demographic questions on the research instrument itself increased research participants' trust levels, as described by social exchange theory (Dillman, 2007). Each applicant received a unique code at the time of his/her online application. Codes were used to identify participants' pre- and post-responses to increase confidentiality. BC2BC administrators reviewed all student applications. Student selection criteria included grade level and interest in the BC2BC program. Not all students who applied for the summer workshops were selected to participate in the program.

The recruitment process produced an accessible population ( $N = 145$ ) in Houston, San Antonio, El Paso, Atlanta, and Chicago, from which a purposive sample ( $n = 94$ ) was derived. Of the 94 students selected to participate in the summer workshops, 30 did not complete all research elements in the BC2BC program, resulting in experimental mortality. Gall et al. (2007) defined experimental mortality as "losing research participants during an experiment because participants dropped out, missed pre- or post-testing, or were absent from one or more sessions" (p. 386). The final sample included 64 program completers for a response rate of 68%. Caution is warranted when attempting to generalize the results of this study to any other population of interest.

To achieve the research objectives, data were collected with researcher-developed questionnaires, adapted from Mitchell's (1993) instrument measuring Ohio State University minority students' knowledge, perceptions, and career aspirations related to agriculture. Texas A&M University and Texas Tech University faculty members participating in the BC2BC program evaluated the instrument for face and content validity.

Students' perceptions of agricultural careers and general agricultural knowledge were measured in individual sections. Students were asked to identify careers they perceived as attainable with an agricultural degree. Traditional (farmer, rancher, landscaper, etc.) and non-traditional (media personality, photographer, public relations officer, etc.) careers were included in the list of careers, which was adapted from Mitchell's (1993) instrument.

Students were asked to gauge their agricultural knowledge levels as (a) *I have less knowledge about*

*agricultural subjects than my friends*; (b) *I have the same knowledge about agricultural subjects as my friends*; or (c) *I have more knowledge about agricultural subjects than my friends*. Following the measurement of perceived agricultural knowledge, students were tested, through ten multiple-choice questions, to measure their actual knowledge about general agricultural facts. Questions were loosely based on the Ag-knowledge section of the USDA's Agriculture in the Classroom Web site (Agriculture in the Classroom, n.d.). Example questions included (a) *Ethanol, an alternative fuel, cannot be produced from which of the following agricultural products* (biomass, sorghum, soybeans, corn); (b) *Hydroponic farming methods do not include* (soil, nutrients, water, plants); (c) *What communication method currently reaches the largest number of people worldwide* (books, newspapers, radio, television); and (d) *Which state is the largest producer of dairy products* (California, Wisconsin, New York, Pennsylvania).

The instrument was administered twice. Pre-tests were administered via email to students prior to their completion of online instructional modules. Workshop participants were sent personalized emails with the study's purpose, a survey hyperlink, and each student's unique code for entering the online survey. Students completed the pre-test from one to two weeks before the face-to-face agricultural communications workshop. The post-test (identical to the pre-test) was administered in person after the workshop. Each student entered his/her unique code into an online survey. Time between response sets ranged from 14 to 28 days. Four participants were absent during the post-test and despite repeated follow-ups, did not complete the post-test; those participants' pre-test responses were excluded from analyses. Findings should be generalized only to the respondent group ( $n = 64$ ).

Data were analyzed using descriptive statistics. Paired sample t-tests, Wilcoxon non-parametric tests

**Table 1. Student Participants' Demographic Profiles ( $n = 64$ )**

Variable	Sub-group	<i>f</i>	%
Year	2007	27	42.2
	2008	24	37.5
	2009	13	20.3
Age	14	4	6.3
	15	22	34.4
	16	14	21.9
	17	23	35.9
	18	1	1.6
	Race	Hispanic	46
	Black	12	18.8
	White	5	7.8
	Asian	1	1.6
Gender	Female	42	65.6
	Male	22	34.4
Grade	9 <sup>th</sup>	17	26.6
	10 <sup>th</sup>	20	31.3
	11 <sup>th</sup>	26	40.6
	12 <sup>th</sup>	1	1.6

were used to determine if significant differences existed in the variables of interest. A significance level of  $\alpha = .05$  was established a priori.

### Results and Discussion

Workshop participants were inner-city high school students ( $n = 64$ ) from Houston, San Antonio, El Paso, Atlanta, and Chicago. Participants' ages ranged from 14 ( $n = 4$ ) to 18 ( $n = 1$ ) with an overall average of 15.92 ( $SD = 1.01$ ) years. The majority of participants were Hispanic ( $n = 46$ ), female ( $n = 42$ ), and most ( $n = 27$ ) participated in 2007 when they

were sophomores or juniors ( $n = 46$ ) at the time of their workshop (Table 1).

We were interested in knowing students' perceptions of careers attainable with an agricultural sciences degree and if significant differences existed between those perceptions in pre- and post-workshop settings (Table 2). The scores for the variables of interest were not normally distributed; therefore a Wilcoxon Signed Ranks Test (a non-parametric test of statistical significance) was used (Gall et al., 2007).

Significantly more students perceived viable careers that are attainable with an agricultural science degree, such as public relations officer, loan

**Table 2. Students' Perceptions of Careers Attainable with an Agricultural Degree ( $n = 64$ )**

Careers	Pre-workshop		Post-workshop		Diff.	Test Statistics <sup>z</sup>	
	<i>f</i>	%	<i>f</i>	%		<i>Z</i> <sup>y</sup>	<i>p</i>
Public Relations Officer	21	32.8	38	59.4	17	-3.71*	.00
Loan Officer	11	17.2	24	37.5	13	-3.15*	.00
Account Representative	21	32.8	34	53.1	13	-2.84*	.00
Web Designer	29	45.3	41	64.1	12	-2.68*	.01
Photographer	38	59.4	49	76.6	11	-2.29*	.02
Government Official	24	37.5	33	51.6	9	-2.06*	.04
Landscaper	36	56.3	44	68.8	8	-2.53*	.01
Engineer	33	51.6	41	64.1	8	-1.71	.09
Chemist	29	45.3	36	56.3	7	-1.70	.09
Media Personality	34	53.1	41	64.1	7	-1.70	.09
Zoo Director	36	56.3	42	65.6	6	-1.50	.13
Journalist	39	60.9	44	68.8	5	-1.29	.20
Teacher	35	54.7	38	59.4	3	-0.73	.47
Rancher	39	60.9	42	65.6	3	-0.90	.37
Farmer	39	60.9	40	62.5	1	-0.30	.76

Frequencies total more than 64 because students were allowed multiple responses.

<sup>z</sup> Wilcoxon Signed Ranks Test.

<sup>y</sup> Based on negative ranks.

\* $p < .05$ .

**Table 3. Frequencies and Significance Tests for Students' Perceived Knowledge about Agricultural Subjects ( $n = 64$ )**

Knowledge Levels	Sub-categories	Pre-workshop		Post-workshop		
		<i>f</i>	%	<i>f</i>	%	
Perceived knowledge about Agricultural Subjects <sup>z</sup>	Less knowledge than my peers	3	4.7	19	29.7	
	Same knowledge as my peers	29	45.3	10	15.6	
	More knowledge than my peers	32	50.0	30	46.9	
	Missing	—	—	5	7.8	
Test Statistics <sup>y</sup>	Ranks	Mean Rank		<i>Z</i>	<i>p</i>	
	Post-workshop Perceived-	Positive	16 <sup>x</sup>	10.59	-2.46 <sup>x</sup>	.01*
	Pre-workshop Perceived	Negative	19 <sup>w</sup>	24.24		
		Ties	24 <sup>v</sup>			
	Total	59				

<sup>z</sup> Respondents could only select one of three choices.

<sup>y</sup> Wilcoxon Signed Ranks Test.

<sup>x</sup> Post-perceived Knowledge > Pre-perceived Knowledge.

<sup>w</sup> Post-perceived Knowledge < Pre-perceived Knowledge.

<sup>v</sup> Post-perceived Knowledge = Pre-perceived Knowledge.

\* $p < .05$ .



**Table 4. Frequencies and Significance Tests for Students' Tested Knowledge of Agricultural Facts ( $n = 64$ )**

Knowledge Levels	Sub-categories	Pre-workshop		Post-workshop			
		<i>f</i>	%	<i>f</i>	%		
Tested Agricultural Facts <sup>z</sup>	Correctly answered = 50%	31	48.4	27	45.0		
	Correctly answered = 51%	33	51.6	33	51.6		
	Missing	—	—	4	6.3		
		Paired Differences					
Test Statistics <sup>y</sup>	<i>M</i> <sup>x</sup>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>t</i>	df	<i>p</i>
Pretested Knowledge	6.58	2.56	-0.50	1.06	-0.36	59	0.72
Post-tested Knowledge	6.63	2.61					

<sup>z</sup> Ten multiple-choice questions;

<sup>y</sup> Paired Samples *t*-Test.

<sup>x</sup> Test scores ranged from 1-10 correct in the pre- and post-test.

officer, account representative, Web designer, photographer, government official, and landscaper, after participating in the workshop (Table 2). Positive gains were indicated for other careers (engineer, chemist, media personality, zoo director, journalist, teacher, rancher, and farmer), but these gains were not statistically significant (Table 2).

We examined participants' perceived knowledge of agricultural subjects. Table 3 shows that in pre-test situations, a majority of students (50%) perceived they had "more knowledge" about agricultural subjects than did their peers. However, vastly more (25% increase) realized they had "less knowledge" about agricultural subjects than did their peers after students progressed from pre- to post-workshop settings (Table 3). Significant differences in perceived knowledge levels were found. Wilcoxon Signed Ranks Tests showed that significantly more students' "perceived" they knew less about agricultural subjects in post-workshop settings, than what they originally believed they knew about agricultural subjects prior to their workshop participation (Table 3).

Finally, we analyzed participants' tested knowledge of agricultural facts to find out if significant changes had occurred from their workshop participation. Participants' knowledge levels of agricultural facts were examined by the number of students who answered  $\leq 50\%$  of the test correctly, versus those who answered  $\geq 51\%$  correctly. The  $\leq 50\%$  group decreased slightly (3.4%) from 31 (48.4%) students in pre-workshop settings, to 27 (45%) students in post-workshops (Table 3). The number of students who correctly answered  $\geq 51\%$  remained constant (51.6%) from pre- to post-workshop test administrations. Four students missed the post-workshop knowledge test because of illness or program dropout. A comparison of participants' pre- and post-workshop tested knowledge of agricultural facts revealed no significant differences (Table 4), probably because their overall test average increased by only 0.05 points as a result of their participation in the workshops.

## Summary

The Big City, Big Country Road Show was a series of inner-city, high school student recruitment workshops designed to introduce communications-related agricultural careers to youth through unique learning experiences. Research has shown that colleges must actively recruit students to agriculture majors (Scott and Lavergne, 2004), and that underrepresented groups (specifically, Hispanic and African American), tend to view agricultural careers only for those with agricultural backgrounds, or for those who work outdoors, or who had on-the-job training (White et al., 1991). Through communications technology and communication events, the BC2BC workshops presented high school students with new perspectives about agricultural careers beyond traditional production-related views.

Through a comparison of pre- and post-workshop tests, we found that hands-on experience significantly affected students' identification of careers they could attain with an agricultural science degree. Workshop students' perceptions of information technology careers, such as Web designers and photographers, were statistically significantly different (significant differences were also evident for loan officers, public relations officers, account representatives, government officials, and landscapers), from pre- to post-test administration, highlighting information technology as a critical factor for career consideration.

Previous studies (Conroy, 2000; Newsom-Stewart and Sutphin, 1997) suggested that students equated agriculture with science, but not with computers, engineering, and teaching. "Agriculture undermines the use of technology" was one of the reasons for not choosing agriculture by the students as a career, but the BC2BC workshops' inclusion of technology factors improved students' perceptions of these specific careers. The workshops contributed significantly to changing attitudes; similar programs should incorporate information and communication technologies into future initiatives.

The BC2BC workshops were not designed to increase the students' knowledge of general agricultural subjects; rather, they presented students with the idea of communications-related careers available to agriculture science majors. The lack of significant differences in pre- and post-test scores for the agricultural knowledge test highlighted this fact. While the general agricultural knowledge test results are interesting, their applicability to other programs is dubious. Future research should include a variety of agricultural knowledge assessment methods, procedures, and settings to better understand the role of increasing one's knowledge of agricultural facts and its possible effects on career decision making processes.

The BC2BC workshops helped students understand more about their perceptions of agricultural knowledge. Pretesting showed that students viewed themselves as more knowledgeable than their peers about agricultural subjects. However, student's perceived they knew less about agricultural subjects than did their peers after participating in the BC2BC workshops. As workshop participants were exposed to and learned about the connections between agricultural subjects and careers, their perspectives about agricultural careers were changed.

Roberts (2006), Esters (2007), and Esters and Bowen (2004) discovered that context is important when teaching youth. Structuring recruitment events where students observe and absorb their peers' experiences and where they participate directly in their own events can have significant positive impacts on their perceptions of agricultural careers. There exists the expectation that such experiences will lead to increased numbers of inner-city students from underrepresented groups choosing to enter into agricultural science majors and careers. To achieve this goal, colleges of agriculture faculty members and students will have to continue working together to meet, teach, and recruit inner-city youth in their schools. The BC2BC student recruitment model can serve as the template for successfully achieving this goal.

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# Encouraging Critical Reflection through Action Research Projects in Agriculture and Natural Resources Teacher Preparation: A Case Study

Jennifer E. Rivera<sup>1</sup> and Shari L. Dann<sup>2</sup>  
Michigan State University  
East Lansing, MI



## Abstract

This case study summarizes curriculum revision to foster critical reflection among teacher candidates in an Agriscience and Natural Resources Education (ANRE) teacher preparation program at Michigan State University. Specifically, we analyze the usefulness, applicability, benefits, and drawbacks of student-designed action research projects during the internship (student teaching) year. We review the theoretical evolution of and frameworks for reflective teaching and teacher action research. Student assignments included deep reading and dialogue around problems of practice that could be studied using action research in the classroom, reflective journaling, design of the research projects, and poster presentation of findings and implications for teaching practice. This case study describes how we provided guidance to foster an inquiry-oriented professional learning environment to allow teacher candidates to explore problems of practice relevant to the settings of ANRE. Students initially demonstrated resistance to this approach, but then reported that they developed inquiry processes that they believed would be beneficial in their careers. We conclude with benefits and weaknesses of this approach, and recommendations for fostering reflective practice orientations among agriculture and natural resources undergraduates to address increasingly complex social problems.

## Introduction

Most of the U.S. Agriculture and Natural Resources Education (ANRE) teacher preparation programs are situated within a state Land Grant University; this common context provides the agricultural and natural resources content and teacher education curricula needed to address complex, contemporary, applied science problems. Changes in recent years have put agriculture and natural resources at the crossroads of local as well as global economic development (Committee on a Leadership Summit to Effect Change in Teaching and Learning and The National Research Council, 2009; Association for Career and Technical Education,

2008). More than ever, complex issues exist for agriculture, our natural resources, and sustainability; interdisciplinary and transdisciplinary approaches to problem-solving are being incorporated into curricula and new modes of inquiry in Land Grant universities (Baker et al., 2009). Many teacher candidates interested in teaching at the secondary level about society's important issues related to agriculture and natural resources face daunting challenges in addressing these issues in a core-content-driven and standardized-test-based context. Altogether, these changes present an increased need for developing habits and skills for critical reflection among teacher candidates. Today, ANRE programs at the secondary level require teachers who are critically reflective in order to prepare youth to be effective citizens for sustainable food and fiber production, natural resource management, and decision making that positively affects their communities.

*Reflective practitioner and teacher inquiry*—these terms are regularly used in secondary education teacher preparation institutions, and have been since the 1980s. By the 1990s, most colleges of education began to restructure teacher preparation programs to foster critically reflective practice on the part of undergraduates. In addition, in science education especially, a renewed focus emerged on pedagogies for developing inquiry capacities among both K-12 students and teacher candidates. Yet, at our institution, a conceptual gap had widened between other secondary teacher preparation programs (i.e. science education) and the Agriculture and Natural Resources Education (ANRE) teacher preparation program. The ANRE program, housed in the College of Agriculture and Natural Resources, had not adapted to this change in the wider field of education and teacher preparation.

We noticed this lack of adaptation during our first semester teaching the 800-level courses during ANRE students' internship year. Early in the fall semester of 2007, we noted the conceptual gap when we presented our course syllabi; the behavior of ANRE students demonstrated their aversion to the assignments tied to the College of Education's specific desired outcomes for this 5th year (graduate level)

<sup>1</sup>Assistant Professor

<sup>2</sup>Associate Professor

learning in areas such as reflective practice, inquiry-based learning, and teacher leadership. Students could not critically reflect upon—or inquire about—problems and opportunities of teaching practice.

Fostering critical reflection for all students is a process that takes years. We undertook this case study as part of a larger programmatic change for the ANRE teacher preparation program at our institution—moving from a traditional curriculum that mirrors Tyler's rational curriculum model (1949), to one that is progressive, developmental, and pedagogic in its basis (Ross, 2000).

We have three purposes in presenting this case study. First, we outline the integration of reflective practice as conceptualized in colleges of education with our College of Agriculture and Natural Resources (CANR) secondary teacher preparation program. Second, we report on the course design we initiated to focus on reflective inquiry processes and to engage student interns (student teachers) in action research projects to inform and strengthen agricultural and natural resources teaching practice through reflection. Finally, we summarize our work, discuss the benefits and weaknesses of our approach, and provide recommendations for agriculture and natural resource teacher preparation and for undergraduate learning in today's Land Grant systems.

## Theoretical and Conceptual Background on Reflective Practice in Teaching

### *Evolution of Reflective Teaching*

Critical reflection has been an educational practice dating back to the early 1900s. Dewey (1904) favored the idea of the reflective practitioner, where the student is thoughtful about his/her work rather than focusing rotely on methods that are good or bad. However in the mid-60s through the 1980s, Dewey's assumptions were challenged and Competency-Based Teacher Education (CBTE) and Process-Product Research began to drive most teacher preparation programs, especially vocational education programs (Richardson, 1990). Both CBTE and Process-Product Research assume that if the teacher candidate completes a certain set of courses and completes a student teaching experience, they will be ready to teach (Haberman and Stinnett, 1973). This linear, operationalized, rational behavioral paradigm assumes that there is a set of “correct” behaviors in teaching. Around the mid-70s, educational researchers began to challenge the CBTE and Process-Product Research models. Doyle (1977) found that CBTE and Process-Product Research ignored factors such as classroom climate, teachers, student attitude, and learning contexts in the processes of teacher preparation. He stressed that the CBTE paradigm was led by policy makers and administrators to standardize the education field (Doyle, 1988). Renowned thinker Donald Schön (1983a) also finds

fault with approaches such as CBTE, and considers such paradigms a “technical rationality” model of professionalism (1983b). Schön coined the term *knowledge-in-action*, which takes into consideration teacher experiences interacting with specific situations. Schön refined and extended this concept into *reflection-in-action*, a process by which professionals integrate diverse perspectives as they act (1983b).

In the mid-80s, reflective practice influenced teaching and teacher preparation programs, as noted in the theme for the 1986 American Education Research Association conference. However, teacher preparation for agricultural education continued to rely on competency-based learning models. This is still evidenced by the limited inclusion of critical reflection in research regarding agricultural education teacher preparation (e.g., Ewing, 2009), and its absence in the most recent overview of agricultural teacher preparation (Torres et al., 2010). Yet, according to the National Standards for Teacher Education developed by the American Association for Agricultural Education (AAAE), “All agricultural education faculty instruction encourages the development of reflection, higher order thinking, and professional disposition of teacher candidates” (AAAE, 2001; 4b). Furthermore, Career and Technical Education (CTE) including agricultural education, has been challenged to “change or die,” (Medrich, 2005) and strategy documents call for new focus on interdisciplinary critical thinking capacities to increase rigor and relevance of CTE for learners of the future (Brand, 2003).

In teacher programs during the 1980s-90s, Grimmitt et al. (1990) note that reflective practice had three major characteristics. The first was that reflection was seen as an instrumental mediator of action. This type of action assisted teachers to put into practice research findings. This view of reflection followed the belief that knowledge was driven by external authority using tested theories, expert advice and scholarly journal articles. However, the mode of knowledge was technical, rarely taking into consideration the contextual aspects of teacher, student, and classroom (Johnson, 2005). The second major characteristic was that reflection was a tool to deliberate among competing views of teaching. This view of reflection recognized that knowledge is deliberative and consequences develop from different actions. The third characteristic was that reflective practice was contingent on context. This notion took into consideration that teacher self-identity promotes teacher self-reflection. This ontological viewpoint was concerned with ways of being in the world, and it allowed the teacher to deconstruct and reconstruct experience in the process of making meaning. It is this third notion of reflective practice that has driven its inclusion in current teacher preparation programs.

Reflective teaching developed as a peer teaching technique to help teachers examine the process of teaching (Cruickshank, 1985). This programmatic

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model considered internal and external variables influencing student learning, and resulted in the increased use of videotape assignments in teacher preparation programs. Throughout the 1980s, programs began to develop inquiry activities to encourage student teachers to explore relationships between knowledge, theory, and practice. This was noted in assignments such as action research projects, case studies, and curriculum analysis. Reflective writing (journaling) also was a tool used to encourage students to critically analyze and provide reasoning for actions in the classroom.

Both reflection and criticality strengthen with practice; therefore, these areas of development are needed early in teacher preparation programs to allow them to become habits of mind and practice. Importantly, reflection is not a behavioral competency to be checked off a list of requirements in teacher preparation programs. Development of reflectivity takes time and multiple iterations, as well as much dialogue and deep thinking. Ultimately, as teacher educators, we strive to provide students with the language and capacities to evaluate their learning, and to observe and make sense of their situations, over and over throughout a career; we also strive to take learning a step deeper, by assisting teachers to make sense of problems of practice throughout a lifetime of teaching.

**Reflective Teaching at Michigan State University**

During the mid-80s, Michigan State University's College of Education received a grant from the Office of Educational Research and Improvement and the U.S. Department of Education to develop the Institute for Research on Teaching, now the Institute for Research on Teaching and Learning (IRTL). Work from the Institute, along with research conducted by the secondary teacher education faculty and the findings of the 1980 Holmes report, *Tomorrow's Schools*, were influential in the development of a three year teacher preparation program. The three years consist of two upper-level, undergraduate years on campus engaged in course work and small field studies, then a final yearlong student teaching internship (Table 1). Research has shown that the yearlong internship allows the needed time for student reflection as compared to the intense 10-14-week student-teaching assignment at the majority of universities (Carroll et al., 2007).

During their internship year, MSU ANRE teacher candidates are in a school placement where they instruct a focus class throughout the year. Interns have two periods of short-term "Guided Lead Teaching," during which they teach a small number of courses, not a full load (Table 1). In between these periods of Guided Lead Teaching, interns have a short period during which they teach only their focus class, allowing time for in-depth reflection outside of teaching responsibilities. Finally, the interns teach a full course load (including their focus class) during a 10-week period in the spring. This Lead Teaching period coincides with the regional FFA events, the Annual FFA Convention, and Career Development Events. Throughout the academic year, interns attend 20 on-campus class meetings to participate in reflective discourse with peers in a facilitated setting to deconstruct their experience and their associated assignments.

**Table 1. Model for the Intern Year- Teaching/Reflection Cycles in ANRE at MSU**

Timeframe (Semester 1)	Teaching/Reflection Roles of ANRE Interns
Weeks 1-3	<b>Focus Class</b> – Teach one class consistently throughout entire Internship Year
Weeks 4-8	<b>Guided Lead Teaching I</b> – Teach 2-3 classes (including Focus Class)
Weeks 9-10	<b>REFLECT</b> on Guided Lead Teaching I (teach Focus Class)
Weeks 11-15	<b>Guided Lead Teaching II</b> – Teach 3-4 classes (including Focus Class)
Weeks 16-19 (before and after holiday break)	<b>REFLECT</b> on Guided Lead Teaching II (teach Focus Class); Prepare for Lead Teaching
Timeframe (Semester 2)	Teaching/Reflection Roles of ANRE Interns
Weeks 20-29	<b>Lead Teaching</b> – Teach 4-5 classes (including Focus Class) FFA Annual Convention and Career Development Events
Weeks 30-31	<b>REFLECT</b> on Lead Teaching -- Transition to employment

Note. Adapted from the Secondary Intern-Mentor Teacher Handbook 2006-2007. Retrieved January 1, 2007 from <http://ed-web2.educ.msu.edu/team>

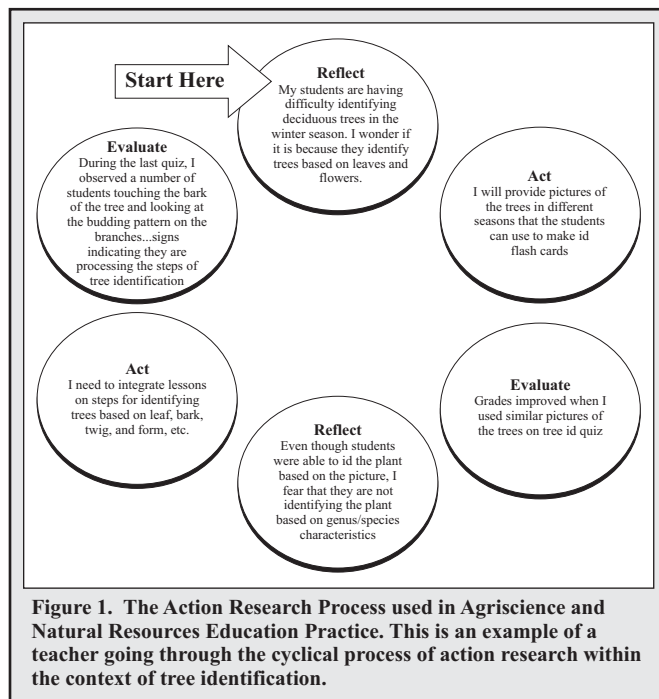
**Action Research in Teacher Preparation Programs**

Educational research consists of two main forms— traditional educational research and action research. Action research is aligned to reflective teaching and, if applied properly, to teacher education programs. Action research can help teachers connect theory and practice, may improve educational practice, will empower teachers, and may help teachers grow as professionals once in the classroom (Mertler, 2006). Johnson (2005) found that it was more difficult for teacher candidates to make every day decisions regarding the classroom than for practicing teachers. He noted that action research helps the teacher candidate identify aspects of the classroom climate that he/she would have never noticed before, which in turns speeds the process of assimilation into the classroom and helps the teacher to make better decisions. Another noted benefit of action research is that it allows the mentor, intern,

and faculty supervisor to work together on a common goal to improve teaching and learning in the classroom, through evidence-based reasoning.

Action research models in teacher preparation programs date back to Lewin (1952), who proposed a spiral process including planning, execution, and reconnaissance of teaching and learning. Creswell (2005) proposed a dynamic process focused on identifying a plan and problem, followed by implementing the plan, and then reflecting on the problem and plan of action. Mertler (2006) highlighted four processes in action research—planning, acting, developing, and reflecting. Hendricks (2006) highlighted action research as an ongoing process based on systematic inquiry and reflection (Figure 1). Taken together, similarities among these models of action research include the following:

1. All models feature cyclical versus linear processes of thinking, reflection, and change in practice;
2. All identify a problem or opportunity of practice;
3. All involve analyzing and interpreting data;
4. All involve reflection as a key component of the model.



## Methods

In our two courses for the ANR teacher interns, entitled *Reflection and Inquiry in Teacher Education I & II*, we re-designed the syllabi to include readings in critical reflection, teacher leadership, and educational action research (Table 2). Likewise, we incorporated activities to enhance critical thinking, dialogue, and personal reflection. We also required students to conduct an action research project at their placement schools during the second semester. These activities were developed to empower interns to:

- a. Make informed decisions about what teaching practice to change and what not to change;
- b. Link prior knowledge to new information;
- c. Learn from experiences (and failures);
- d. Ask questions and systematically find answers (Fueyo and Koorland, 1997).

We compiled observations from students' journals, field notes, samples of students' work, dialogue (both structured and unstructured) during class, and exit interviews to discern students' engagement with and reactions to the assignments that emphasized reflective practice. Pseudo-names were used when referring to the interns in our analysis to allow for anonymity. Direct quotes from student interns are used for illustrative purposes. We report on insights gained as we pursued this case study with a cohort of seven ANRE interns during the 2007-08 academic year at MSU.

Our project was deemed Exempt by our institution's Internal Review Board for Human Subjects (IRB #X08-378). This determination allowed our teacher education students to conduct action research projects in their placement schools and to use the de-identified qualitative and quantitative data to enhance teaching and learning processes.

## Description of Action Research Project Assignment

The primary objective of the assigned action research project was to encourage self-reflection in teaching and learning on the part of teacher candidates. The students were assigned to incorporate this project into on-going work at their internship placement sites, and to share their work with peers in our on-campus class sessions. Beginning in the fall semester of the students' internship year, we assigned readings in the area of teacher leadership and action research to begin introducing teacher research to the interns. (For additional information see Brookfield, 1995; Danielson, 2006; Ferrance, 2000; Fink, 2003; Knapp, 2001; Rourke, 2007.) During the spring semester, students read from Career and Technical Education (CTE) research journals and from agricultural education research and best-practice peer-reviewed journals. In addition, we read two popular books about reflective practice: Parker Palmer's *The Courage to Teach* (1998), and Frank McCourt's *Teacher Man* (2005). (See Table 2 for information regarding all course assignments as we revised our instructional model for teacher preparation in the internship year.)

At the start of spring semester, the students received a tutorial on the action research process. Our process closely followed Hendrick's model of Action Research (Fig. 1), since this model highlights the component of reflection and integrated reflective process. The action research project required that the students begin by writing journal entries about problems or opportunities of practice in their placement classroom and which they believed could be

**Table 2. Comparison of Former and New Model for ANRE Teacher Preparation Assignments during the Internship Year**

Former, CBTE (Competency-Based Teacher Education) assignments	New, revised reflective, action research and inquiry-based teacher education assignments
<b>Readings:</b>	
Textbook(s): Talbert, B.A., Vaughn, R., & Croom D.B. (2005) <i>Foundations of Agricultural Education</i> , Catlin, IL: Professional Educators Publishers, Inc.  Phipps, L.J. and Osborne, E.W. (1998). <i>Handbook on Agricultural Education in Public Schools</i> 5 <sup>th</sup> ed. Danville, IL: The Interstate Printers and Publishers.	-Peer-reviewed journal articles -Journal article critique and dialogue -Parker Palmer’s <i>The Courage to Teach</i> -Frank McCourt’s <i>Teacher Man</i>
<b>Project Assignments:</b>	
-Focus Binder -Written News Article -Bulletin Board -Required FFA Activities	-Focus Class syllabus and assessment -Action Research Project -Teaching Website -Collected Resources for lesson sequences
<b>Lesson Planning Format:</b>	
-Lesson outlines; unit outlines -Lessons correlated with Agriscience Education website, state standards and benchmarks	-Lesson plan with Big Ideas (thematic issues for instruction based on agriculture, natural resource and food systems issues in society), and Learning Progressions (based in constructivist research about science learning). -Correlations with Grade Level Content Standards
<b>Professional Products:</b>	
-Resume -Professional Teaching Portfolio	-Teaching Philosophy Statement (revised and revisited throughout the year) -Electronic Teaching Portfolio (including digital video vignettes of teaching practice, and on-line resume, samples of lesson plans) Teaching Website
<p><i>Note. For assignment details and assessment rubrics, contact the authors.</i></p>	

investigated in the time frame allotted. Students were to identify an educational concern—a problem or opportunity of practice within their classroom, with their FFA chapter, or with managing student Supervised Agricultural Experience (SAE) projects. Once they identified a problem, student interns were required to reflect daily in their journals about the problem and observations made, as well to record any data collected. We provided ongoing feedback to the students. Themes were noted within the journals and were used to foster dialogue in class. Once they identified a problem of practice, students dialogued in class and with fellow teachers to share why they thought it was a problem, why they were concerned about this problem, how the problem could be investigated, and what possible teaching changes could be made to address the problem.

The interns were to begin their project during the end of their first reflective period at the start of the second semester (just before starting the Lead Teaching period, as shown in Table 1). At that point in time, the students were to propose what they were planning on doing in their classrooms and what kinds of data they were going to collect. Projects were to last anywhere from one to four weeks, depending on the problem of practice being addressed and the data collection process.

Along with providing the students with resources for conducting action research projects and a template to follow to brainstorm potential projects, we also incorporated weekly reflections and time for

reflective dialogue. Students were encouraged to dialogue with other teachers, peers, and community members, about their problem of practice. These inputs were considered as students decided upon their action research methods, since they were not experts in the field that they were addressing. Course class time was given to students to discuss their action research with their peers to gain feedback. Dialogue was guided by the faculty instructors and included structured conversation.

By providing a structured format for students to journal about and discuss their action research projects, we were anticipating that we would gain some insight as to (1) what pre-service teachers view as problems of practice, (2) how they think and act when problems arise in the

classroom, (3) whether they act on prior observations and experiences when incorporating change in the classroom, and (4) whether they view educational reflection as a natural process or one that takes time to master.

Approximately three weeks into the student action research projects, we spent class time on how to evaluate the evidence being collected and how to use it to influence practice. We instructed the students to provide evidence that the conclusions that they came to were reasonably fair and valid. We also had them address how they would modify their concerns, ideas, and practice of teaching in light of their evaluations. The students then were assigned to assemble their action research work into professional poster presentations. We provided directions from the American Association for Agricultural Education website to the students and gave copious faculty input regarding their poster construction and professional writing.

Faculty members from the Department of Community, Agriculture, Recreation and Resource Studies (the department that houses the ANRE teacher preparation undergraduate program) were invited to the final poster symposium, where they interviewed students about their action research project and process and the implications of the project for future teaching practice. The faculty members were debriefed at the end of this symposium, and we recorded comments that were shared by the students and the faculty during and after the symposium.



## Case Study Results

### Benefits of Action Research in Agriscience and Natural Resources Teacher Education

Student-chosen action research projects were diverse, although there was some overlap in students' interests. Projects addressed the following themes:

- Teaching styles: traditional, lectured-based versus hands-on instruction
- Conjunction between test scores and teaching styles
- Student involvement in Supervised Agricultural Experiences
- Secondary student interest in Agriscience and Natural Resources
- Motivation through student-directed learning
- Internet resources and accessibility for new Agriscience and Natural Resources subjects
- The Immediate Feedback Assessment Technique in ANRE (Epstein and Epstein, 2010)

We observed a beneficial change in the interns from the first semester to the second semester in their level of inquiry and insight. The course discussions evolved from what the students referred to as “gripe sessions” during the first semester – where students shared surface-level thinking about the technical aspects of teaching. Discussions eventually (in the second semester) became a form of dialogue where students displayed higher orders of thinking and critical reflection regarding deep problems of practice and deliberated on multiple perspectives and approaches to teaching and learning (rather than focusing on “the one right technique”).

There was also a change in teaching styles by some of the interns based on their ability to conduct action research projects in their classroom. Some discovered traits about themselves that they would have never changed had they not done the project. For example, one intern instructing an agriculture and natural resources biology course realized through her research project that she was not afraid of using student-directed, active learning pedagogies, whereas prior to the project, she had typically used lecture and PowerPoint to keep students on task. In her journal observations and through her action research project, data indicated that the course was more engaging and retention of content learned was strengthened. Most interns emphasized positive changes for themselves, students, and classroom environments as an outcome of the action research project.

As noted in previous studies, we observed that action research provides student teaching interns a real-world process that students can translate into professional practice in their first employment. Regardless of whether they become teachers or if they choose a different career path, these undergraduates who are just bridging into introductory graduate-level learning, become empowered to *think* critically about problems and to self-reflect to help solve problems or determine proactive approaches to new

opportunities. Most of the student teaching interns who participated in the action research process shared that they will continue to use this inquiry approach in their future jobs. Some even said that they were doing another study to follow up on the data they collected for the assignment.

### Weaknesses of Action Research in ANRE Teacher Education

To allow student interns to have the time needed to complete an action research project, changes from past years' course syllabi had to be made. Extreme changes to courses can either be favored by the students or may cause student resistance. In the case of the action research projects for this study, at first, there was a heightened level of student resistance. The student interns did not understand the benefits of conducting research in their placement schools until close to the end of the assignment. In the early phases of this assignment, interns expressed that class time and extra readings on teacher reflection were wasteful and esoteric, and that the students would have rather been learning more practical “tips and techniques” specific to ANRE content and pedagogy. However, during exit interviews, the majority of the students expressed that the action research project gave them a new tool to take with them as they join the ANRE profession and that it provided an addition to their teaching resumes and portfolios.

To have the students conduct research during the beginning of the second semester proved to be problematic for some local ANRE programs. Interns felt overwhelmed by the added responsibilities assigned to them by their mentor teachers to prepare for the state FFA Convention and regional events (a leadership component of ANRE) and for Career Development Events (CDEs), which occurred from February to April with great intensity. Noted one student intern:

[Bob]: My school has a reputation for winning district and regional CDEs. I need to spend all my time preparing students for a contest that I don't know anything about, since I was not in FFA. This began to take over any school assignments or lesson planning that I was doing.

Even though the action research assignment was shared with the mentors to avoid scheduling conflicts, several mentor teachers also balked at the tasks, due to the intensity of ANRE programming during that window of time in spring semester. To address this challenge in the future, the action research process can be started earlier (during ANRE courses in the senior year), and the actual projects can be undertaken earlier in the internship year. Also, programming relationships between the ANRE faculty and mentor teachers need to be strengthened and clarified, with an intentional selection of mentor teachers open to action research as a means for

enhancing professional practice, in order to avoid undue stress for future student interns.

Some interns noted that the time of year for this project was bad because of the weather. Because of the large number of snow days that the state had during the beginning of the spring semester, there were an overwhelming number of school districts closed intermittently. This presented some problems as interns worked to frame their action research projects and to collect data. For example, one student noted:

[Lindsey]: I prepared my students for the test based on their learning styles and they really seemed to be getting the information. Then it snowed and school was cancelled for three days straight. When the students returned back to school and took their test, the grades were awful. I don't know if they just forgot the information for the test due to the number of days off or if studying based on learning styles did not work.

One of our major findings was the challenge of forming collaborative relationships with the schools regarding the importance of university academic assignments. Schools are a bureaucracy within which teachers must function, therefore limiting local autonomy on the part of mentor teachers and student interns. The highly-structured school day limited the student interns' ability to "stray away" from the standardized curriculum and the interns' and mentors' ability to have the time to reflect about teaching and learning. More work is needed to connect university activities with the priorities of the public school system, because currently time for reflection is not valued. The culture of reflection and inquiry needs be strengthened in schools, academia, and even society. In fact, the Holmes Group's report on *Tomorrow's Schools* (1990) comments:

Inquiry...should be a way for teachers, administrators, and professors to come together on equal footing. It should help forge a shared professional identity in schools and universities. And it should serve as a professional norm around which collaboration can take place, bringing together the many parties who are concerned for improving schools (p. 60).

One comment shared by a mentor teacher was that they were unaware of how to turn their activities into scholarly work, in turn making it difficult to help their interns with integrating the action research process into a typical school day. If the benefits can be seen by all involved during the internship year, there could be a more positive outcome of adding reflective practice to enhance student learning. Since most mentors were trained under "older," more technical/rational models of teacher preparation, it would be beneficial to instruct the mentor teachers about action research during one of their professional development meetings in order to foster a new climate of inquiry, reflection and learning among the acting teachers.

### **Discussion and Implications for the Future**

The faculty instructors, other faculty members in our Department and in the College of Education perceived positive benefits of the students' action research projects. Reflective practice was a new paradigm for ANRE at MSU, and one that was needed to help pre-service teachers *think* about educational practice. Thus, the overall problem of practice that served as the foundation for this case study was how to get students to *think critically about teaching and learning*. To be able to think critically, one has to be reflective in nature. At the start of the semester, students wanted recipes for solutions regarding any potential problem they would encounter in the school. They were frustrated with the lack of high school student engagement, yet the student teaching interns did not see themselves as a factor contributing to a lack of learning in the classroom.

This case study illustrates that the action research process can introduce new teachers to ways of becoming more reflective. The depth of critical reflection grew throughout the academic year and was displayed in student journals and classroom dialogue. Also, some of the mentor teachers shared that they saw the student teachers beginning to grow in how they processed issues in the classroom and took charge of situations, as compared to their early student teaching in which the interns always wanted directions and to be told what to do rather than ideas or suggestions upon which to reflect.

This growth was not noted in all students. Two of the students had difficulty expressing their observations and chose not to engage regularly in class discussions or daily journal writing. When asked why they chose to limit their participation, they expressed that it was a different type of learning with which they were not comfortable, and they felt it took too much time.

Even though there were observed weaknesses in incorporating action research into ANRE teacher preparation, we see this approach to developing reflective practice as an opportunity to strengthen ANRE in the future. In the future, researchers and teacher-preparation faculty could consider the following questions, based on our preliminary work:

1. Do student teaching interns continue to foster their inquiry-oriented approaches, once they are placed in "permanent employment" in their own classrooms?
2. As new teachers, do they feel empowered with decision-making capabilities and autonomy in their classrooms, as a result of their action research and reflective experiences?
3. Are they involved with other action research projects in their schools with fellow teachers? If so, what do the processes look like, and do ANRE teachers take a leadership role to get these established? If so, do these action research projects enhance evidence-based teaching and curriculum reform in secondary schools where ANRE teachers take such leadership?

Another lens for further investigation focuses on K-12 student learning – the ultimate aim of ANRE. More specifically, future research could investigate whether teacher education programs that emphasize reflective practice in turn influence youths' learning in relation to critical and complex issues regarding food, agricultural, and natural resource systems. Clearly, we can learn much from future studies of K-12 student learning and motivation within classrooms led by reflective agriculture, food and natural resource education practitioners. In addition, we have seen applications of this work in diverse teaching contexts within courses for non-formal education majors (e.g., Extension professionals), service courses, and elective or Study Abroad courses in our College of Agriculture and Natural Resources. The overarching opportunities to deepen undergraduate critical reflection are immense and largely unexplored, yet the need for reflectivity increases as our social issues become more complex.

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# Team-based Learning for Agricultural Ethics

Courtney Quinn<sup>1</sup>, Heath Harding<sup>2</sup>,  
and Gina Matkin<sup>2</sup>  
University of Nebraska-Lincoln  
Lincoln, NE



## Abstract

We implemented team-based learning in an agricultural ethics course in 2009 and 2010 at a land-grant institution. Team-based learning is a method of interactive instruction where students work in the same team throughout the semester on a variety of tasks such as quizzes, daily activities, and larger projects. Based on a multi-faceted student evaluation process we found team-based learning increased student engagement in the course and facilitated development of teamwork skills. Students reported five principle benefits of team-based learning; 1) respect for multiple perspectives, 2) personal accountability, 3) a willingness to share thoughts and opinions, 4) teamwork skills, and 5) interpersonal skill development. First, we discuss the theory and methodology of team-based learning and offer specifics on our experience. Second, quiz results and student journal excerpts illustrate benefits of team-based learning. We discuss the implications of our results and continuing plans for the course.

## Introduction

Today's students are future agricultural professionals whose decisions will affect human and environmental communities. Although it is essential for agricultural students to learn core knowledge, the complex environmental and social problems we face in the 21st century require students to grasp how the application of their knowledge will have ethical consequences. Mascia et al. (2003) noted that social sciences will play a crucial role in helping to stop and reverse human-caused environmental damage. Given agriculture is the largest and most widespread human interaction with the environment, agricultural professionals have a unique responsibility to address the ethical dimensions of their work (Zimdahl, 2000). Agricultural professionals will deal with such pressing issues as poverty, food sovereignty, and how to feed up to twelve billion people with increasingly stressed resources. Therefore, today's students need explicit education in agricultural ethics and opportunities to practice making ethical decisions on issues they will face as professionals.

Collaboration and cooperation will be necessary to tackle the complex problems of the future (Cortese, 2003). Future agricultural professionals will need the skills to make critical decisions within a team. Individuals will benefit from consulting with others

who have a stake in an outcome or a personal or professional opinion. In addition, employers are increasingly seeking workers who have human interaction and problem-solving skills (Fink, 2004). Employees are asked to work effectively in teams and evaluations are conducted at both the individual and team level. Employers report that interpersonal and teamwork skills are becoming increasingly important in agriculture (Graham, 2001). Given this, students need to learn how to work effectively and efficiently as a part of a team. Consequently, traditional lecture-based courses will not adequately equip students to understand and practice applying ethics to agricultural issues or to work as a team.

This article describes our experiences using team-based learning in an undergraduate agricultural and natural resource ethics course at a large land-grant institution. After providing an overview of research on team-based learning, we offer a description of the course. We utilized both quantitative and qualitative methods to evaluate the success of team-based learning in the course. We demonstrate the effectiveness of working in teams by comparing students' individual and team scores on exams. Qualitative methods were used to assess students' reflective journal entries regarding their team experiences.

## Team-Based Learning

Team-based learning (TBL) is an empirically grounded instructional strategy that utilizes small groups with the goal of promoting active and effective learning (Michaelsen, 2004). This method promotes active learning so classroom experiences are more interesting and worthwhile (Fink, 2004). However, team-based learning is more than asking student groups to complete a final group project or paper. Teams complete in-class activities and projects where they debate and make decisions on difficult problems. This structure distinguishes team-based learning from mere groups and brings distinct benefits to the classroom including a high level of individual commitment to the welfare of the team and a high level of trust among members of the team.

Effective use of teams has been reported in disciplines as varied as accounting (Lancaster and Strand, 2001), nursing and medicine (Clark et al., 2008; Dunaway, 2005), hospitality and tourism (Wolfe and Gould, 2001), economics (Cohn, 1999),

<sup>1</sup>PhD candidate, Agricultural Leadership, Education, and Communication, 300 Agricultural Hall; Tel: 402.480.2088; Email: courtney\_quinn@yahoo.com

<sup>2</sup>PhD

and microbial physiology (McInerney and Fink, 2003). A literature search on the terms “team-based learning and ethics,” “team based learning and agriculture” and “team based learning and environmental education” found no articles related to using team-based learning in an agricultural or an agricultural ethics course.

Michaelsen (2004) outlines four principles of team-based learning. First, attention should be given to creating the initial groups. The groups should be formed by the instructor to reduce barriers to cohesiveness (e.g. prior relationships that could cause factions in the group). Michaelsen recommends using any random method to assign groups. Second, individuals must be held accountable for their individual contributions to the team. Third, assignments must serve the dual purpose of increasing both learning and team development. Designing team assignments that demand interaction between team members is critical. “Group papers seldom provide any support for building group cohesiveness and almost universally result in social loafing, or at least what is perceived by others students as social loafing” (Michaelsen and Knight, 2004, p. 59). The team tasks must be structured so that they cannot be divided between team members for individual completion and put together at the end. Fourth, feedback should be both timely and frequent.

### **Course Overview**

The course we taught, Ethics in Agricultural and Natural Resources, was traditionally lecture-based. The course is designed for a junior-level knowledge and includes both agricultural majors and non-majors in other disciplines ranging from Biology to Hospitality, Restaurant, and Tourism Management. To increase participation, interest, content knowledge, and team skills, the instructors implemented team-based learning into the classroom in the fall of 2009 and used it again in 2010. Two instructors co-taught a class of 47 students in 2009 and one instructor taught 45 students in 2010.

The course consists of three units: 1) Deontology and natural resource issues, 2) Utilitarianism and agricultural issues, and 3) Virtue Ethics and climate change. Each unit included individual and team quizzes, daily in-class team activities that required individual pre-class preparation, and a larger team project.

### **Teams**

Michaelsen (2004) recommends creating teams in-class to make the process transparent. Birmingham and McCord (2004) point out that diversity in teams provides members with a broader range of resources and viewpoints. To maximize diversity, students were randomly put into teams of four or five students and remained in their teams for the entire semester. Michaelsen recommends using any random method to assign groups. “It is only when

students work together over time that they become cohesive enough to evolve into self-managed and truly effective learning teams” (Michaelsen, 2004, p. 30). It takes multiple interactions to establish a level of trust and understanding of the resources the team holds collectively to reach higher levels of functioning. As trust grows through stronger interpersonal relationships, communication becomes more effective.

### **Quizzes**

Quizzes occurred at the beginning of each unit to ensure students completed required readings on foundational ethical theories. The purpose of beginning with a quiz prior to discussion or lecture is to ensure students are held accountable for the required readings. Students cannot rely on class lectures to gain necessary knowledge.

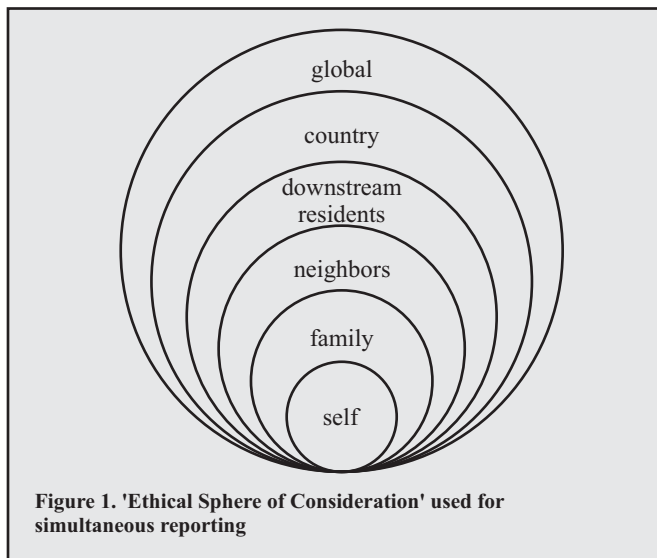
First students complete an individual multiple-choice quiz. While their individual quizzes are being graded in-class by instructors or a Teaching Assistant, teams complete the same quiz together. The team quiz utilizes self-scoring sheets so teams know their progress immediately. Each multiple-choice question has four scratch-off boxes. When a team has decided on their answer, they scratch off one box. A star inside the box indicates a correct answer. Absence of a box means the team should try another answer. Teams scratch off boxes until they find the star. This encourages teams to keep trying and discussing until the correct answer is found.

Team quizzes offer several benefits. For example, the process of reaching a team agreement demands discussion of each teammate's individual answer. In cases where individuals answer differently, each student must defend their reasoning and the team must reach a consensus. One student noted, “I really enjoyed doing the tests individually and then in groups because we could bring our learning together. It also led to discussions, which made the material sink in more.”

### **Daily Activities with Simultaneous Reporting**

The two or three class periods following a quiz focus on activities where teams apply their knowledge to specific agricultural or natural resources situations. Individuals complete pre-class readings and a pre-class assignment on the specific topic. In class, teams debate viewpoints and make an ethical decision on a case study or ethical question. For example, an in-class activity asked each team to decide the appropriate sphere to consider when making ethical agricultural decisions (self, family, immediate neighbors, downstream residents, etc.). After teams had ten minutes to debate and come to an agreement where our ethical sphere should reside, a team representative placed a dot onto a large drawing at the front of the room of expanding ethical spheres to indicate their team's decision (Figure 1). This requires all teams to give their answer simulta-

neously. Teams have to make a decision and stick to it. If all other teams choose “downstream residents” but one team chooses “family,” that unique team cannot change their answer because their answer has already been placed in front of the class. Each team member must be able to defend their choice and ask questions of other teams who may have chosen a different area of the sphere. Last, the instructors facilitated a large class discussion to explore various answers. Simultaneous reporting is beneficial because classroom energy plummets when students are required to listen to other teams' presentations on the same topic. We found students very involved and inquisitive when other teams made a decision different from their own.



### Team Projects

The final assessment for each unit was a large team project. Students were given in-class time to work on the project. The project was designed to require teams to increase team decision-making throughout the completion of the project. One plaguing problem with group work is that busy students cannot find a time outside of class to meet. This leads to the divide-and-conquer tactic that does little to contribute to student learning. By providing class time for project work, students were ensured time for teamwork while instructors were available as a resource. Although time on content is sacrificed, as instructors we feel this is a worthwhile trade-off as students utilize class for in-depth team discussions and produce superior thinking, team work, and products. Final projects included creating a professional poster regarding the ethical considerations of a current issue, writing and presenting a dialogue about an agricultural ethical issue, and a professional presentation representing a stakeholder at a climate change conference.

### Methods

The University of Nebraska-Lincoln Institutional

Review Board approved the study protocol and all participants provided written informed consent for the authors/instructors to use their journal entries and exam scores in the study. Students in two semesters of the course participated by writing reflection journals on team-based learning (N=92).

First, results of students' individual and team quiz scores were compared. Next, for qualitative analysis, we used open coding to investigate students' journal entries on their team experience. Students completed six online journal entries on various prompted topics throughout the semester. Towards the end of the semester, we asked them to write about their team experience. Students were asked to identify what they liked about team-based learning and what, if anything, they would change about the experience. We also asked them to reflect upon whether or not working in a team aided their classroom experience and their learning.

Although researchers have discussed benefits of team learning scholarly texts, we had no pre-developed themes in mind while reading student entries. Both instructors read each student's entry. Main statements were gleaned and written in the margins of the entry. Next, similar topics were grouped into categories to create themes. After themes were created, journals were re-read and remarks that illustrated each theme were tallied and representative comments were selected for inclusion.

### Results

Over two semesters, 92 students each took three quizzes, for a total of 276 quizzes. Student teams took the same quiz immediately following the individual quiz. In all but three instances, student teams outperformed even the highest scoring individual of the team. Student teams scored an average four points higher than individual students. The maximum increase of a team score above an individual's score was 11.75 points and in only one incident, a student's team scored two points worse than the individual. Table 1 shows an example of team individual and team scores for the three quizzes.

Scores alone cannot illustrate the benefits of team quizzes. Teams take the same quiz immediately after individuals, and as this is the second round of the quiz, we can assume that teams will score better. Although students often cite increased scores as the primary benefit of team quizzes, as instructors we see many positive aspects that deepen students' learning. The benefit comes in the discussions between team members. Students learn to justify and explain their individual choice if there are differences among team members, choices are negotiated, and teams must make a consensus decision before scratching off an answer.

The most important feedback on the benefits of team-based learning came from students' personal journals on their team learning experience. Five themes emerged detailing the principle benefits of

## Team-based

team-based learning as experienced by our students: 1) respect for multiple perspectives, 2) personal accountability, 3) a willingness to share thoughts and opinions in their team, 4) teamwork skill development, and 5) interpersonal skill development. Each theme is described below with examples from student journals. The responses were overwhelmingly positive, though students did express challenges they faced in their teams. Both positive comments and constructive criticisms are included to add validity to the results.

**Table 1. Sample Team Quiz Scores**

Student	Quiz 1 Individual	Quiz 1 Team	Difference	Quiz 2 Individual	Quiz 2 Team	Difference	Quiz 3 Individual	Quiz 3 Team	Difference
1	13.3	15.0	1.8	9.5	14.3	4.8	8.0	14.6	6.6
2	8.0	15.0	7.0	11.5	14.3	2.8	10.0	14.6	4.6
3	14.0	15.0	1.0	14.0	14.3	0.3	11.0	14.6	3.6
4	13.8	15.0	1.3	10.5	14.3	3.8	8.5	14.6	6.1
5	9.3	15.0	5.8	9.5	14.3	4.8	10.0	14.6	4.6

### Multiple Perspectives

The benefit of listening to, and working to understand, divergent perspectives was the most mentioned benefit of team-based learning (Table 2). When engaged in an ethical debate, people inevitably have different opinions. Through working in teams, students learned to value diverse opinions. "I was introduced to new ways of looking at things through my teammates." Students had to consider agricultural and natural resource issues from many stakeholder perspectives and through the lens of different ethical theories. Students also had to consider the viewpoints of their teammates. "Team-based learning forces people to see others' opinions."

Students made the connection between the challenge of working with different perspectives in their teams and the divergent perspectives stake-

holders have on solving environmental issues. "Some of the challenges were that working as a team; it was hard to come to one conclusion when everyone felt differently. This was a big challenge, but it was also beneficial in the end because this is what the work world is like." Because this course was based on student teams making decisions on ethical issues, each student had opportunities daily to express their opinion. Students had to practice dealing with multiple perspectives and not just their own opinion or the views of the instructor(s).

### Personal Accountability

Although instructors would like to believe every student gives their best effort in a class, which is not always the case. For various reasons, students fail to complete readings, study effectively for exams, and put forth less effort than expected. Team-based learning uses peer accountability to increase student involvement in the course since students may be comfortable letting themselves down. They may be comfortable not living up to instructor expectations. However, we have learned that is more difficult for many students to let team members down. Students reported studying harder, attending class more often, and taking their learning more seriously simply because of team-based learning. "When we would take tests, I would make sure that I had read the articles maybe a little more closely than I would have normally because I would not want my unpreparedness to affect the team as a whole." Students realize they are not learning only for themselves, but for their team as well. Students were more engaged and our classes had almost 100% attendance each day. "Not only are you trying to do a good job for yourself, there are three others that are depending on you as well which I believe brings out the best in someone." Team-based learning encourages active and consistent student attendance and participation. "My team motivated me to go to class prepared every day and to always strive to do my best work. The thought that others were depending on me motivated me more than any other class ever has."

**Table 2. Number of Theme Comments and Examples (N=92)**

Theme	Times mentioned	Example
Multiple perspectives	70	"No one thinks alike so it really opens you up to new ideas."
Personal accountability	23	"I have an obligation to my team to be there every class, it gives me initiative."
Sharing	50	"I'm the kind of person that doesn't like to speak in front of the class but it was easy for me to talk to members of my group."
Teamwork skills	24	"I have learned how to cooperate and work with people who have different ideas from me."
Interpersonal skills	22	This helped me learn when to speak up and when to just listen even if I don't agree.



### **Willingness to Share**

Every class contains outspoken students and those who do not feel comfortable contributing to class discussions. Shy students therefore miss an experience to deepen their understanding through active debate. Team-based learning provides a mechanism for all students to feel comfortable sharing their ideas and opinions. One purpose of keeping students in the same team for the entire semester is that it allows relationships to form between team members. Teams that develop trust have discussions that include all members. It is much easier for some students to talk to three other people than it is to express their opinion to 50 other people. “I’m the kind of person that doesn’t like to speak in front of the class but it was easy for me to talk to members of my group.” Especially in courses that require debate and thinking through difficult issues, team-based learning allows active participation by all students.

### **Teamwork**

Employers value teamwork skills. A recent study by the Association of American Colleges and Universities found that 71% of employers cited teamwork skills as a necessary outcome of higher education (AACU 2010). However, most group work requires students to meet outside of class. These groups usually do not work together throughout the semester or during class time. This leads to some students carrying the workload for the others. “Usually when working with teams before I was the ring leader and in some of the cases if it hadn’t been for me the team would have taken a failing grade.” Many students are initially skeptical when we tell them that teams can accomplish more than individuals can. Throughout the semester, students in our course experienced the positive results that a team can produce. “Having everyone do their part and bring different things to the table really made the projects and efforts better as a whole.”

Students reported learning teamwork skills they plan to transfer to their careers. “I’ve never considered myself a good team player until this class because this class showed me what an amazing experience you can have working through problems with other people.” Some groups did experience challenges. Instructors who utilize team-based learning expect team members to have difficulties. This is an important part of the learning experience. Although students find dealing with difficult team members very frustrating, it is essential they realize that classroom experience can transfer to their future workplace.

Dealing with conflict management becomes more important when utilizing team-based learning. Knowing when to intervene and when to let students work out problems on their own takes patience and practice. If team difficulties do not go beyond simple frustration at difference of opinion, personalities, or

work styles we do not intervene unless asked. We also remind students that effectively dealing with conflict will be an essential workplace skill and that the classroom is a safe place to practice such skills.

### **Interpersonal Skills**

Working closely with team members helps students develop interpersonal skills. In a large class, students can easily tune out discussions. With team-based learning, students have to listen to team members. “I also believe it made me a better listener and helped me value others opinions more.” Ethics poses difficult problems and many students have strong feelings. The strong emotions students feel can hinder their ability to think critically about an issue (Hofreiter et al., 2007), but listening to teammates helped students remain open to different opinions. “I feel that our group also dealt with disagreements very well. We listened to each other’s ideas and compromised.”

Daily activities ask teams to make a decision on an agricultural or natural resource issue. Students experienced the difficulty of reconciling differences of opinion. “The teams were challenging because it was hard to listen to the views of every team member when you disagree on something. This helped me learn when to speak up and when to just listen even if I don’t agree.” Because students remained in the same teams through the semester, strong bonds were formed. “We respected each person and developed relationships and also had residual trust that turned to resilient trust in the end.”

### **Discussion**

Team-based learning requires students and instructors to think about, and participate in, learning in a new way. Instructors using team-based learning structure their entire class around this method, which can be a departure from ‘the ordinary.’ Students have to be willing to step outside of their comfort zone and actively participate with their teams every class period. However, despite the learning curve for implementing and effectively using team-based learning, we could not recommend it more highly. Most of our students take the agricultural ethics class to fulfill a requirement. Yet many leave satisfied that they learned the content while gaining valuable life and professional skills, as well as a few new friends.

It is important to remember that great teams and teamwork does not ‘just happen.’ Carefully facilitating the team-based structure is essential for students to move beyond past negative experiences and embrace the benefits of working in a team. “I usually do not like doing team projects, but this class has made it easy to be able to work with each other. This is the best team learning class I have taken because of how close it has made our team by having us work together and learn from each other.”

## Team-based

Students expressed in their reflection journals that team-based learning prepares them for the difficult tasks they will face as future agriculture professionals. Farmers, crop scouts, extension agents, and agricultural teachers will all need the ability to work in teams and make difficult ethical decisions. Students who have had the opportunity to practice teamwork skills will be better equipped for the complex environmental and human problems of this century.

## Summary

Team based learning can be a benefit to any classroom, but especially to courses such as ethics where debate and sharing of ideas is essential to the process as well as the content. Students reported learning the content in more depth than if the class was lecture based. In addition, students learned valuable lessons in teamwork and interpersonal skills that will stay with them long after they have forgotten specifics of course content. We hope that our students learn to listen and respectfully converse with people who have a different opinion or come from a different background. Students in two classes of Ethics in Agriculture and Natural Resources reported five key benefits of team-based learning: respect for multiple perspectives, personal accountability, a willingness to share thoughts and opinions, teamwork skills, and interpersonal skill development. Each benefit was discussed above with examples from students. Increased quiz scores demonstrate the benefit of teamwork on students' grades. Given the positive responses from students' personal reflections and their increased exam scores, we feel that team-based learning facilitated classroom success.

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# Use and Effectiveness of Online Quizzes as a Study Aid for an Introduction to Animal Science Laboratory Course<sup>1</sup>

K.R. Stewart<sup>2</sup>, D.A. Dickey<sup>3</sup> and S.P. Morehead<sup>4</sup>  
North Carolina State University  
Raleigh, NC



## Abstract

To allow students to better understand laboratory material presented in an Introduction to Animal Science laboratory course, online study quizzes were created for students to review material prior to a laboratory examination. Quizzes were created on four topics that were covered on two separate examinations during the spring of 2010. The grade received on the two examinations and the numbers of quizzes attempted were recorded for each student. In the present study, 93.8% and 86.7% of the students attempted the online quizzes at least once for the first and second examination, respectively. Examination score was influenced by the number of quizzes attempted for the first ( $p < 0.0001$ ) and second examinations ( $p < 0.0003$ ) where students who did not use the online quizzes scored lower than the remainder of the students on the examinations. Ninety-five percent of students surveyed said they liked the online quizzes as study aids and 89% of students surveyed said they believed their grade in the course was improved by using the online quizzes. By being well received by students and helping to improve letter grades on examinations, the online quizzes appear to be a viable study aid for an animal science laboratory course and will continue to be offered to students in future semesters.

## Introduction

The majority of courses in Animal Science curricula are accompanied by laboratories. These laboratory exercises are designed to reinforce concepts introduced in lectures and to provide students interactive learning opportunities with live animals and animal specimens. It is these “hands-on” opportunities that are most often cited by students as the primary reason they decided to take the class or major in Animal Science. One of the challenges with laboratory courses is that during the laboratory, students are encouraged to participate in the interactive exercises which often makes note-taking difficult. As a result, after laboratory sessions have ended, student often feel that they do not have adequate resources in terms of notes and other opportunities to adequately prepare themselves for practical examinations. One possible solution is the use of online

quizzes. Online quizzes provide an avenue for the student to assess their personal learning and provide relevant and prompt feedback to help them direct their future study efforts.

Research on the effectiveness of online quizzes for enhancing student learning has focused almost exclusively on materials presented in lecture courses and has produced mixed results. Brothen and Wambach (2001) examined students enrolled in a developmental psychology course and found that students who spent study time taking online quizzes did not perform as well as their counterparts on examinations. In a follow-up study, Brothen and Wambach (2004) found improvements in examination grades when time limits were imposed on the online quizzes. Other studies have demonstrated that online quizzes significantly increased examination scores for undergraduate students (Derouza and Fleming, 2003; Grabe and Sigler, 2002). None of these studies involved a laboratory component, so the main objectives of this study were (A) to determine if online quizzes using digital images of animal specimens, equipment and anatomical pictures examined in laboratory courses would be utilized by students in an introductory Animal Science Laboratory course; and (B) to determine whether student use of online quizzes affected their performance on the laboratory practical examinations.

## Subjects and Methods

The spring 2010 Introduction to Animal Science Laboratory course consisted of 113 students divided into four laboratory sections of roughly 30 students per section. This one credit-hour course met weekly on either Mondays or Wednesdays for three hours. Course material was presented in an instructor-directed format by the faculty member responsible for the course with the assistance of six undergraduate teaching assistants (three for each laboratory section). The course consisted of 400 total points of which 200 came from two laboratory examinations and 200 from weekly activities or assignments associated with each laboratory.

Four topics were selected for the creation of online quizzes as study aids. Two of these topics were covered on the first laboratory practical and two were

<sup>1</sup>Prior to the beginning of the semester, all students signed a consent form agreeing to participate in the study.

<sup>2</sup>Corresponding Author, PhD., Lecturer of Animal Science: Telephone: 919-515-1176; Fax: 919-515-4463; Email: Kara\_Stewart@ncsu.edu

<sup>3</sup>David Dickey, Ph.D., Professor of Statistics

<sup>4</sup>Susannah Morehead, Undergraduate student

covered on the second laboratory practical. The first topic was digestive anatomy where students were expected to learn: anatomical parts of ruminant and non-ruminant digestive tracts from preserved specimens; various feedstuffs added to animals' diets to meet various nutritional needs; and how to determine an animals' food preference by examination of their teeth. The second topic was reproductive anatomy where students learned various anatomical parts of the male and female reproductive tracts from various species. The third topic was equipment used in management of domestic livestock. Students were expected to learn the name, use and species for each piece of equipment. Finally, the fourth topic was breeds and general livestock anatomy where students were expected to be able to identify selected breeds of various livestock species as well as the correct gross anatomy for sheep, cattle, swine, and horses.

At the beginning of each laboratory, students took a "pre-quiz." This quiz consisted of ten to twelve questions and was administered before students observed actual specimens. Each question required students to identify specific items on or answer questions about digital images. This quiz was designed to gauge what knowledge students had prior to the laboratory. A pre-quiz was not administered for identification of breeds of livestock, because there was not a single laboratory session in which all the breeds from the different species were discussed. Instead, this information was covered over five separate laboratories. In an attempt to adjust for this, students were provided this material weekly via laboratory handouts provided on the course web site. Following the pre-quiz, the laboratory session which normally lasted three hours was conducted during which students had the opportunity to observe live animals or specimens. The online quiz was made available to students at the conclusion of the laboratory class. The format of these questions was identical to those of the pre-quiz and also used digital images of animals or animal specimens.

Online quizzes were provided through the course management system, Blackboard™. A database of more than 100 questions was created for each study topic. Fifteen multiple choice questions were randomly chosen from this database every time a student attempted an online quiz. Each quiz attempt for every student was recorded by Blackboard™ and the instructor recorded scores for all students from two 100 point laboratory practical examinations. The questions on these examinations were fill-in-the-blank identification questions with no word bank provided to the students.

At the conclusion of the course, students were given a survey to determine if they enjoyed using the online quizzes and if they believed the quizzes were a useful learning aid.

Statistical analyses were performed using Statistical Analysis Software version 9.0 (SAS; Cary, NC). The number (i.e. frequency) of attempts for each of the four online quizzes for each student was

considered to be the independent variable and was placed into one of five categories; 0 quiz attempts; 1-5 quiz attempts; 6-10 quiz attempts; 11-15 quiz attempts; 16-20 quiz attempts; or greater than 20 quiz attempts. An arcsin transformation was performed on all percentage data prior to analysis. Two separate analyses were conducted. First, the effect of frequency of online quizzes on practical examination scores was evaluated using analysis of variance procedures for general linear models. The model included the main effect of frequency of use of the online quizzes and the pre-quiz scores for each student as covariates. When the main effect was significant Student-Newman-Keuls Multiple Range Test (SNK) was used to determine differences among number of quizzes attempted. For the second analysis, grades on the two examinations were converted to a letter grade where: A=90-100%; B=80-90%; C=70-80%; D=60-70%; and F= less than 60%. The data were subjected to a logistical regression analysis for ordinal response data. This procedure uses a proportional odds model to provide an odds ratio which is the multiplicative increase in the odds of improving from one letter grade to the next. These odds ratios were then used to calculate the probabilities of a student improving their actual grade by attempting more online quizzes. For example, a student that earned a 'D' on an exam could look at their odds ratio to determine what their odds are for getting a 'C' on the exam if they had increased their use of online quizzes. However, most students would probably like to know what the probability is that they could improve their grade, not just of getting a 'C' but an 'A', 'B' or 'C'. Therefore, probability tables were created to predict the probabilities of earning a certain letter grade or better for each of the quiz categories.

## Results and Discussion

During the semester, two students withdrew from the course after the first examination and two students did not show up to take the second examination, therefore, their information was excluded from the analysis for the second examination. One student did not take either of the two examinations despite never officially withdrawing from the course and was excluded from all analysis. Therefore, 112 and 108 students' data were analyzed for the first and second examination, respectively.

A study in 2006 by Johnson examined the frequency of use of optional online quizzes as well as the enhancement of examination grades with increased use of these quizzes. Overall, 66% of the students used the quizzes at least once during the semester. However, the number of quiz submissions averaged only 3.7 and 2.7 out of the possible 14 for the true-false and short answer quizzes, respectively. Other studies have also shown low participation rates when online quizzes were provided as study aids (Brothen and Wabmach, 2001, Swan, 2004, Muchovej, 2009). Although the quizzes were not widely utilized, a significant increase

in examination scores was found with a greater use of the online quizzes. This suggests that the online quizzes were convenient and provided a prompt source of feedback. However, the low number of quiz submissions indicated that only the most highly motivated students utilized the online quizzes as a learning tool. Therefore, it may be difficult to determine whether improvements in examination scores are correlated with increased use of online learning tools or motivation of the student for learning. Results of the present study were not consistent with these findings. In contrast, 94.6% and 90.7% attempted the online quizzes at least once for the first and second examination, respectively. Prior to the first laboratory examination, 23 students (20.5%) attempted the online quizzes greater than 20 times. For the second examination, 19 students (17.5%) had greater than 20 quiz attempts. The range in number of quiz attempts by an individual student was zero attempts to 89 attempts, with an average of 13 attempts. A small number of students attempted the online quizzes as early as the same day as the material was presented which has been shown previously to be positively correlated with examination score (Hadsell, 2009). However, the majority of the students did not attempt the online quizzes until the week of the examination (this was not examined in the statistical model in this study). Overall the online quizzes were well received by the students. Over 95% of students surveyed said they liked the online quizzes as study aids for the examinations and 89% of students surveyed said they believed their grade in the course was improved by using the online quizzes. These results indicate that a vast majority of the students in the course utilized the online quizzes as study aids for the laboratory examinations.

Examination score was influenced by the number of quizzes attempted for the first ( $p < 0.0001$ ) and second examinations ( $p < 0.0003$ ). For both, students that did not attempt the online quizzes had significantly lower examination scores compared to all other students that had attempted the quizzes at least one time. For the first examination, scores were  $75.2\% \pm 2.6$  for students that only attempted the quizzes 1-5 times compared to  $89.7\% \pm 1.8$  for the students that attempted the quizzes greater than 20 times. For the second examination, scores were  $80.1\% \pm 4.0$  for students that only attempted the quizzes 1-5 times compared to  $92.6\% \pm 1.2$  for the students that

attempted the quizzes greater than 20 times. No differences were seen in letter grade between the students that attempted the quizzes 6-20 times for examination one or two.

As expected, the data vary slightly between the first and second examination. This could be explained by the material covered on each examination. The material covered in the first examination (i.e. digestive and reproductive anatomy) is typically more difficult for students to gain an understanding of compared to the second examination (i.e. equipment used for management and breeds of domestic livestock). This was evident by a lower mean on the first examination compared to the second examination (81.3% and 83.7%, respectively). Therefore, the increase in the probability of achieving a better letter grade is more obvious with the second examination compared to the first. Eighty students improved their examination score on the second examination compared to the first examination. Of these 80, 35 also increased their use of the online quizzes resulting in an average increase in percentage on the examination of 12.7% (Table 1). This means that 45 students improved their examination score without increasing their use of the online quizzes. This group of students only had an average of an 8% increase in examination score. Even though overall use of the online quizzes was decreased for the second examination, it appears as though the students that did use the quizzes may have had a higher percentage increase in examination score on the second examination contributing to the increased class average on the second examination.

The estimated probabilities of getting a certain letter grade or better for each category of frequency of

**Table 1. Summary of Use of Online Quizzes and Subsequent Changes in Examination Scores**

	Number of Students	Total Students
<b>Used Online Quizzes</b>		
Exam 1	106	112
Exam 2	98	108
Maintained or improved exam 2 grade compared to exam 1	80	108
<b>Average number of quiz attempts</b>		
Exam 1	12.9	--
Exam 2	11.6	--
<b>Increased use of quizzes</b>	35	80
Average % change in grade	12.7 $\pm$ 8.6 <sup>†</sup>	35
Increased use up a category*	25	35
Did not increase use of quizzes	45	80
Average % change in grade	8.1 $\pm$ 5.5 <sup>†</sup>	45
<b>No improvement in exam 2 grade</b>	28	108
<b>Average number of quiz attempts</b>		108
Exam 1	16.0	--
Exam 2	8.14	--
<b>Increased use of quizzes</b>	8	8
Increased use up a category*	4	8

\* Use of quizzes categories: 0; 1-5; 6-10; 11-15; 16-20; >20. Moving up a category indicates the student increased their use beyond their original categorization.

<sup>†</sup> Data presented as average percentage  $\pm$  standard deviation.

attempts of the online quizzes are presented in Figure 2 and Figure 3 for the first and second examinations, respectively. For example, a student may ask what the probability is that they would get a 'B' or better (A or B) on the first examination if they do not utilize the online quizzes. Looking at Figure 2, the probability would be 0.53 (53%) that a student would earn an A or B when not attempting the online quizzes. The probability that this student would earn an A or B on the examination increases to 0.83 (83%) if they take the online quizzes more than 20 times. Using Figure 2, the estimated probabilities of earning other letter grades or better can be predicted. Interestingly, students attempting the quizzes 1-5 times had a numerically lower probability of earning a respective letter grade. This is most likely due to sampling error because the number of students in the '0' category was very small. It also does not appear as though increasing the number of online quiz attempts from 10 to 20 greatly increases examination grade since the curve appears to plateau. Overall, increasing online quiz attempts enhanced the probability of earning a higher letter grade on the first examination.

Similar results can be seen for the second examination where increasing the number of online quiz attempts from 0 to 15 improved the probability of earning a higher examination grade (Figure 3). Using the same student example from the first examination, there is a 51% probability that a student would get a B or better on the examination if they did not attempt the online quizzes and greater than 90% probability with 20 or more attempts. These data show a decrease in the probabilities of students improving their grades when attempting the online quizzes 16-20 times. This, again, is probably due to random variation or sampling error and no improvements in letter grade are seen when taking the quizzes 15-20 times.

Even though the probability of increasing letter grade increases with additional attempts at the online quizzes, one could speculate that there would be a saturation point at which additional quiz attempts would not provide any additional gain on the outcome for the student. In the present study, the category of greater than 20 attempts had wide variation in the number of quizzes attempted by students. For example, the student that attempted the practice quiz 89 times may have achieved the same letter grade on the examination if they attempted the quizzes fewer times. This particular student may have also experienced repetition in quiz questions. In 89 attempts, the student would have answered 1335 quiz questions. Being that there are only roughly 100 questions in the database, this student theoretically saw each question

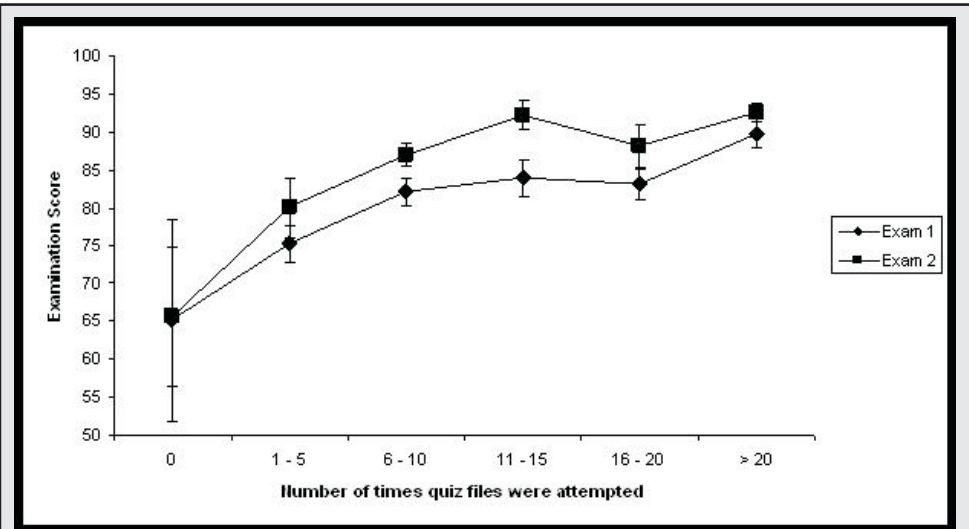


Figure 1. Scores on the first and second examinations for students in each category of use of online quizzes. Data is presented as the mean percentage with standard error bars. All percentage data was arcsin transformed prior to statistical analysis. a,b,c First examination scores without common letter differ by  $p < 0.05$ . x,y Second examination scores without common letter differ by  $p < 0.05$ .

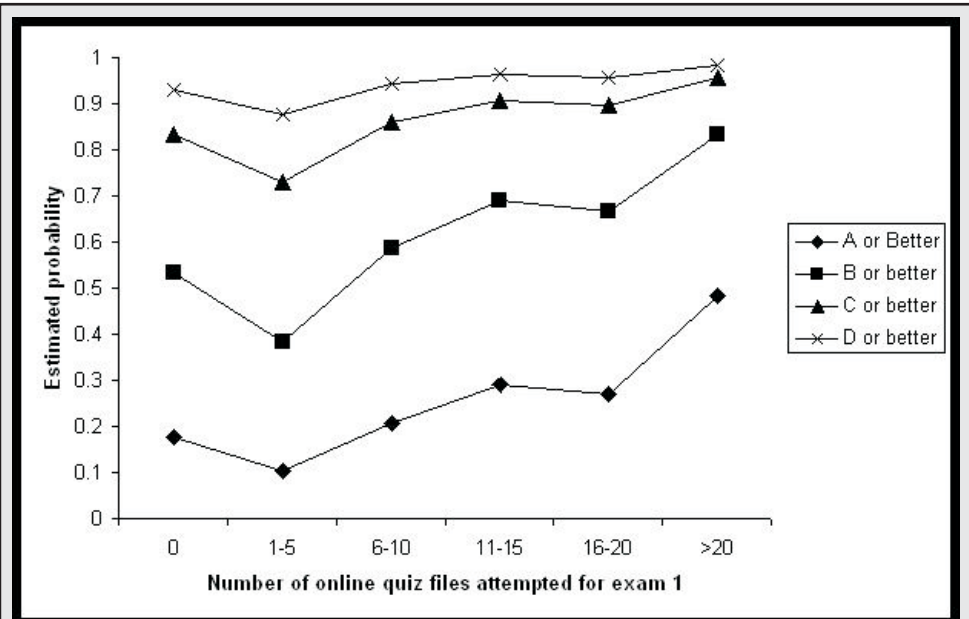
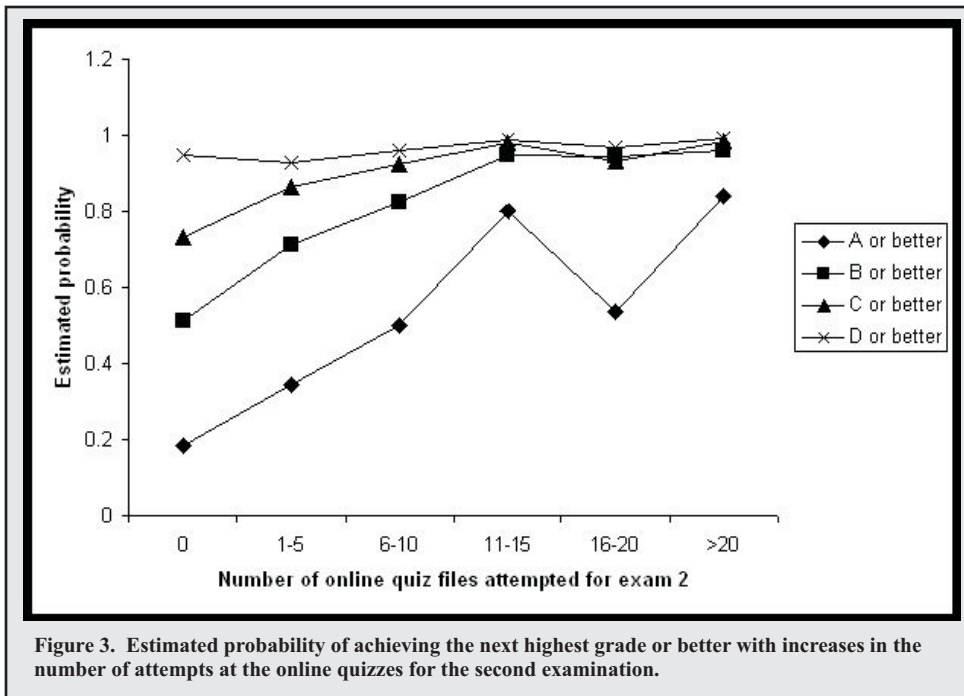


Figure 2. Estimated probability of achieving the next highest grade or better with increases in the number of attempts at the online quizzes for the first examination.



13 times. This saturation point could be different for different courses and different course materials. Looking at Figure 1, it appears as though this saturation point may be reached with 11-15 online quiz attempts for examination two. Examination one appears to have an additional increase with greater than 20 attempts. This variation could be due to the difficulty of the material covered on this examination.

## Summary

Online quizzes were offered to students in and introductory Animal Science Laboratory course for use as study aids for the two laboratory examinations. Material covered on these four online quizzes represented four main topics of the course, with each exam covering two topics each. The students' use of the online quizzes and examination grades were monitored during the semester. Data collected was then used to predict probabilities of improving letter grades on examinations with increased use of the online quizzes. The probability of improving letter grades on both examinations increased with the increasing frequency of quiz attempts. The data suggest that differences in examination topics may influence the improvements in examination letter grade with increased use. For the first examination, no statistically significant improvements in letter grade were seen when increasing the quiz attempts from the category of 1-5 attempts to greater than 20 attempts. Similar results were seen in the second examination scores except that there was additional improvement in letter grade when more than 20 attempts were made at the online quizzes.

Overall, greater than 85% of all students used the online quizzes for both examinations. The

students liked the quizzes and thought that they helped improve their overall grade in the course. These study aids will continue to be available to students enrolled in the course in future semesters.

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## Maintaining Professional Momentum In Your Teaching

L. H. Newcomb

### Dimensions of Professionals Who Maintain Momentum

What are the dimensions of individuals who maintain professional momentum in their teaching? The thesis of this paper is that such professionals are up to date with the science they profess. Not only do these professionals generate new knowledge, but they also use the new knowledge generated by others. They maintain authority in their role. When they speak, advise, instruct, and report, people listen because something worth listening to is being said. Individuals who maintain momentum in their teaching have great credibility. They also maintain a high level of energy and commitment.

Another vital sign of professors who maintain their momentum is that they care for their role, whether it be research, teaching, or extension. Likewise they continue to care for their clients and gain much from the helping relationship that they have with their clients.

These professionals are not in a "rut" in any of their endeavors. They maintain a fresh perspective and a continuing commitment. They are not satisfied to go about their professional life as they always have and merely maintain the status quo. They reach outward and onward.

This energy and activity is not reserved just for clients and specific job assignments, but also gladly encompasses contributions of service to the university and the profession in general.

In summary, such professors are capable of delivering, and they do deliver. They do not become stagnant and give out.

### The Current Environment

"Professional stagnation among American faculty is in danger of replacing faculty mobility" (*Change Magazine*, p. 217). John S. Roll (1980), President of the University of Maryland, says, "Most educational leaders agree that during the 1980's there will be fiscal austerity, emphasis on cost effectiveness, and attempts at higher productivity in academe. If American economic growth slows, high quality, labor-intensive organizations whose product is excellence - from great restaurants and symphony orchestras to research laboratories and universities - are expected to be among the hardest hit . . . moreover, with enrollments in higher education entering a period of stabilization and possible decline, the opportunities for new appointments and promotions will be limited." He then asks, ". . . how do colleges and universities continue to increase their quality and productivity

in a decade of increasing fiscal constraints when overall enrollments are no longer increasing?" (p. 4)

A rapidly occurring phenomenon in such an environment is the tendency of faculty to experience "burnout." This condition is receiving increasing attention in the literature. Burnout has been variously defined as "complete exhaustion" (Henrickson, 1979, p. 37), "a response to circuit overload; it is the result of unchecked stress caused by the institution's impersonal and unyielding demands and by the immediate environment in which . . . (professing) is done." (Henrickson, 1979, p. 37). It is, "The feeling of being locked into a job routine." (Reed, 1979, p. 67).

Kahn (1978) suggests that one of our biggest problems is overload. He says we do not object to what we are asked to do — we feel the requests are very appropriate —, but we feel we cannot meet all the current demands. Kahn feels there are two dimensions to overload. There is qualitative overload, when we feel the request is too difficult; and quantitative overload, when too much is asked.

When examining faculty morale at The University of Texas in Arlington, Hunter et al. (1980) found that faculty felt they were overworked, and faced ambiguous roles and evaluative criteria. They also considered their job stability and mobility uncertain and felt there was a low level of collegiality.

To the extent that professionals face an environment with any of the above components they will probably find it difficult to maintain their professional momentum and will need to work seriously at self renewal.

### Symptoms of a Need for Self Renewal

It is impossible to provide a complete list of symptoms of a need for self renewal. However, the presence of any of the following conditions could indicate the need for an individual seriously to pursue self renewing strategies.

For some individuals the need for renewal begins with a general feeling of uneasiness. As Hendrickson (1979) points out, "the joy of . . . (professing) begins to slip away." (p. 37). She also indicates that self concept drops and one begins to question the meaning of that which he does.

Another indication of problems, especially in the case of burnout, is "a gradual loss of caring about people they work with" (Maslach, 1978, p. 56). When professors begin to resent being bothered by their students, advisees, or other clients, they are headed for real trouble. Professors cannot allow themselves to write off the very people they are trained to serve.

Newcomb is a professor of agricultural education at The Ohio State University, Columbus 43210.



In other instances the people who are affected feel overworked. They sometimes feel that they are not able to complete any of the responsibilities as well as they feel they can. There is a loss of zest. People often begin to dread going to the office. Others find themselves counting the days until Friday or the end of the term, and still others begin to realize that they are anxiously awaiting retirement.

Still others become so repetitive in their work that they become bored with much of what they do. Whatever the symptoms, when they are present they indicate the need for self renewal.

### The Nature of Self Renewal

Perhaps no one has addressed the issue of stagnation and the need for renewal better than John Gardner (Gardner, 1964). Gardner reminds people that in order for there to be renewal there must often be growth and decay as well. He says, "in the ever-renewing society that matures is a system or framework within which continuous innovation, renewal and rebirth can occur" (Gardner, 1964, p. 5 and 6). Furthermore, "renewal is not just innovation and change. It is also the process of bringing results of change into line with our purposes" (Gardner, 1964, p. 7). Nevertheless, "as we mature we progressively narrow the scope and variety of our lives . . . We become caught in a web of fixed relationships. We develop set ways of doing things" (Gardner, 1964, p. 10). Obviously this leads to "doing it the way we always have" even when those ways are no longer defensible.

Gardner (1964) points out that no one is sure why some people are more capable of self-renewal than others, but he does suggest some characteristics of people who are capable of self renewal. Such people continue to develop their potential and to discover themselves, have a dialogue between themselves and their environment, and systematically explore the full range of their potentialities.

However, while all of this admonition to be a self-renewing person is fine and good, we must also remember that "it is not only the most difficult thing to know oneself, but also the most inconvenient one, too" (Gardner, 1964, p. 15).

Change and self renewal are in fact very difficult. John Gardner contends that most of the obstacles to self renewal are in the mind of the person rather than in the environment. Most people, professors included, tend to have many self-defense mechanisms built up, and they use these defenses almost without thought. The very nature of being defensive is quite an obstacle to change and renewal.

Another big obstacle to change and renewal is vested interest. People like to protect what they have created; who they are; where they are. This kind of mind set is natural and good in many cases; however, it also gets in the way of considering innovation or even the possibility of the need for change.

Based on what is known about the way people learn, it can be concluded that change generally does not occur unless the person who "needs to change" has a personal felt need to change. Until individuals personally feel uncomfortable with their current state of affairs there is likely to be no real effort to change, thus to renew themselves. Therefore, either the individual or those around the individual need to create a situation wherein the individual becomes uncomfortable with what is (when appropriate) and begins to seek new ways of functioning. How can such conditions be created?

Consider using some of the following techniques which can help faculty members realistically assess where they are and have the feedback necessary to decide whether or not they are in need of change or renewal.

1. **Video-taping your performance.** The most potent activity or technique to foster a felt need is to have your class(es) video-tape recorded. The hardware is readily available at almost every institution of higher education. Once your class is video-taped, arrange for a private viewing. When a faculty member sits for an hour and watches his/her own teaching performance, he/she cannot help but make important self-discoveries. As the faculty members view their teaching they need to assume the posture of a student in the class and have the following question foremost in mind, "How would I like to be in this class and how well would I be able to learn in such a situation?" You can "tell a professor" they have problems, but until the faculty member decides for himself/herself that there are problems, then little can be accomplished. Through this process of self-examination the impetus for self-renewal and change can be realized.

2. **Audio-taping your performance.** If one cannot have his/her teaching performance video-taped, then at least have the class audio-taped. This can be done very discreetly. Reviewing one's performance need not consume precious time in that you can listen to your class presentation as you drive home from work. Here again, if you diagnose "things" with which you are not pleased, the first step toward renewal has taken place. You have a frame of reference against which to focus your attention and a "new goal" toward which to strive.

3. **Reviewing student notebooks.** Another activity which can promote self renewal in teaching is to occasionally collect a random sample of students' notes from a class. Professors are amazed at how the students have things confused. However, once you reflect on the class sessions in question you will probably discover the source of the problem. Once again, this is a point from which to depart.

Once a professor has a personal felt need to change, to seek renewal, then he/she is ready to try strategies designed to promote renewal.

### Alternative Strategies for Maintaining Professional Momentum

Clearly strategies for self renewal must include self-help, peer support at the work place, and enrichment of

one's personal life. The idea of renewal has to involve the total person and cannot be confined to a narrow concept of professional improvement. Consider the following strategies for renewal.

**1. Try Something New and Daring.** The literature from education, higher education, social work, nursing, personnel, and psychology all agree that an overall strategy has to be to try to stop doing "it" the same way. One writer (Reed, 1979) suggests that the mind, like automobile tires, needs to be rotated.

Whatever your major responsibility, if you seek renewal, then experiment. Develop new research interests and methodology, new curriculum and teaching approaches, and new contacts.

**2. Create a Support System at Work.** Kahn (1978) feels professionals need social support on the job. He says he "mean(s) the expression of positive affect - liking, respecting, admiration. (He) would also include expression of affirmation, letting our colleagues and those we supervise know that we recognize and appreciate the strenuous situations with which they are working." (p. 63). We in the agricultural sciences must renew our pride in collegiality and close knit professional support of one another.

**3. Hold Retreats with Colleagues.** Get away from the university in an atmosphere conducive to reflecting, examining, and sharing. Recreate together; dream together; and share the responsibility of being a loving critic. Give one another ideas and assistance as well. Suggest new ideas and follow through with personal assistance.

**4. Return to Industry.** A stint in the industry we serve is a good change of pace. It reacquaints use with reality and offers fresh perspectives while at the same time reaffirming existing accuracies.

**5. Analyze the Mix of What Makes Up Your Job.** When you have completed your analysis, work with those to whom you report to alter that mix. For example, move to a new instructional level. If you are primarily conducting research, build in a good proportion of resident instruction for a term or change roles with an extension specialist. Others may want to add more advising or research or service. The idea is to try a new focus for a while. It revives, and that is essential to all professionals.

**6. Work for Greater Movement Among and Between Colleges.** Faculty mobility is fast becoming a thing of the past. Many faculty used to move to another university to keep themselves stimulated. With this option fading, Toll (1980) feels it will be necessary for universities to work seriously at providing the flexibility to allow exchanges of scholars. We may need to exchange positions for a term with people in other colleges in our university or with faculty from community and technical colleges. The insights gained and new ideas shared can be extremely helpful to all cooperating units.

**7. Research Your Teaching.** According to Mathis (1980), attempts to study and improve college teaching

seem to be viewed as involving great risks for those who are the objects. All academic disciplines cloak themselves in their own mysteries about the manner in which they are best taught. To examine these mysteries and make them public is to expose the act of teaching to scrutiny which strips away myths and identifies illusions. (p. 17) Most professors, after a while, feel rather definite about their approaches to teaching. Such tentative hypotheses need to be empirically verified. The very quest for truth should renew.

**8. Decompress Between Work and Home.** While it is easy enough to say one should not take work home, learning to practice it requires a sustained effort. It needs to become a learned habit. Maslach (1978) reports that "burnout rates soar when separation between work life and home life falls apart." (p. 56).

**9. Use Mental Health Days.** For most conservative agriculture professors, suggesting using sick leave to recharge or renew sounds unthinkable. However, it makes little sense to wait until one is hospitalized for exhaustion or has become ineffective as a professor to decide to take sick leave.

**10. Exercise, Relax, and Pursue New Avocations.** At first blush you'll probably think you don't have time for any of this. That is a sure sign you need it. The time it takes for moderate exercise, a short but well planned rest, or to study an avocation, returns attractive dividends in the form of renewed productivity.

#### Summary

The ball on the issue of self renewal is always in the reader's court. No one can do it for you. You have to feel the need to do it yourself and then invest the time, energy, and risk needed to make it happen. There is always an alternative. You can "die on the vine" before you are ripe.

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## Time Management Time Cards

I teach landscape architecture at Texas Tech University. One of the issues that students seem to have trouble with is time management. We've all struggled, I'm sure, with how to convince students to manage their time and avoid the last minute, "pull an all nighter," throw something together just before the deadline scenario. Never mind allowing time for a final review, edits, run test prints or even remember to click the spell check button. Providing interim or preliminary deadlines often times results in two all-nighters. Providing check lists, time lines or other tools seem ineffective to a generation who many would say grew up with their parents (usually the mother) acting as a scheduling secretary. Especially frustrating is backing off and given them more time to produce a quality product, only to see them once again, wait until the last minute.

Time management skills are something that is an important part of all our respective professions and we would love to be able to fit it into our curriculum. I found a tool that, with little instruction or training, seemed to have some impact on a group of students in my third year site design class. The class is a 4 credit design studio that includes two one hour lectures and two three hour design studios per week. Typically, design projects last from two to as many as six weeks. It is their first design class in our five-year professional degree program and it is at this point that we stress professionalism as a part of the studio experience. We also keep attendance for both lecture and studio as a matter of departmental policy. Consequently, I came up with the idea of using a time card. I developed a form the size of a half a sheet of paper, so two could be printed on normal letter-size stock. It listed the project name, a place for the students to write in their name, and a place to note the number of hours they worked on the project (usually the length of the studio).

Most importantly, and what took up most of the space was a box titled "Today's Goals:" with lines to list three to four goals or milestones for the day. When I came to their desk to help them with their project, I asked to see the time card and what they had written for that day. At the end of the studio, they dropped their time card in a box to receive credit for attending the studio that day. In all honesty, I rarely compiled the attendance but I kept the time cards just in case I might need to challenge a student's attendance record. Additionally, I stressed that almost all professional consulting offices have some sort of time reporting system since their clients are billed on an hourly basis. So it was not a menial task like punching a time clock at McDonalds. More importantly, it

made time management a part of each and every studio. Whether or not they accomplished their goals for that studio (I did not check) at least they thought about the need to accomplish something that day and to make progress toward the end product. And no, they could not leave early if they reached their goals before the end of studio.

It is paper intensive system, but it seemed to help. You may be able to adapt it to a science lab, an agricultural mechanics shop, or any situation where students are working on a long term project. Good luck, and let me know how it works for you should you decide to try it or a variation on the idea.

Submitted by:  
Charles H Klein  
Assistant Professor  
Texas Tech University  
Landscape Architecture  
charles.klein@ttu.edu

## Using Prezi in the Classroom

Prezi is an online Adobe Flash-based presentation program. It differs from traditional presentation programs like Microsoft PowerPoint and Apple Keynote in that it is not based on slides. Instead, Prezi presentations exist on a canvas. The presentation is navigated by zooming in and out of different points on the canvas, as needed by the presenter.

There is potential for Prezi use in classrooms to be expanded, but as it is with any new technology, adoption will occur with a few before the majority is typically willing to adopt (Rogers, 2003). Gary Moore spoke of having the courage to try new things in his Blue Ribbon address at the NACTA Conference in Edmonton. The authors of this article have all used Prezi as an instructional tool and are offering advice to instructors who may be interested in mustering up the courage to try Prezi. First, the pros and cons of Prezi will be discussed. Then, suggested guidelines will be presented.

### Pros

Prezi allows the creation of linear and nonlinear presentations. Designers have the option of creating a path that creates a linear presentation or can click on different objects in the presentation for a nonlinear presentation. By changing the sizes and positions of objects, designers can visually illustrate the relationship between concepts in the presentation to aid in student understanding of the pieces as well as the whole. Prezi also offers the ability for students to collaborate in class when using the program online.

## Teaching Tips

Up to eight people can edit the Prezi at the same time. For those in larger classes, this could be accomplished by dividing students into groups. This allows for a construction and presentation of students' knowledge, which could appeal to different learning styles. Prezi is made more accessible for students and instructors through its free online format. Students can view the Prezi during and after class by using an online link.

## Cons

Many of the negative points of Prezi stem from poor planning and understanding of how to use it effectively and differently than traditional slide-based software. For example, overzealousness in using the zooming features can create visual discomfort for viewers. Another possible downside of the program is designing it essentially as a PowerPoint without applying any of the added design benefits; this could result in a resemblance to an over-animated slideshow. Also, text-heavy presentations are not best displayed in Prezi. While you can print a PDF of a Prezi, because of the non-linear nature of most Prezi presentations these PDFs do not make good handouts or notes to provide to students. Because Prezi is still being developed and is free, occasionally designers may encounter glitches; however, they are few and far between.

## Suggested Guidelines

**Get creative.** Prezi removes many of the restrictions that traditional presentation programs foster. How ideas are displayed and what visual components are included in the presentation are largely up to the presenter. As such, it is necessary to understand how the information can be displayed to optimize learning of the content. Be prepared to think outside the constraints of slideshows.

**Customize.** While there are presets available, there is also the ability to customize the presentation. For most people, customization means changing the colors of different elements, changing font faces, and the ability to add in a logo. For those with knowledge of Web coding (CSS), there is the ability to write code to further customize the presentation.

**Illustrate relationships.** By being able to alter the location and size of different elements in Prezi, relationships are more easily displayed than they would be in traditional slideshows. Because non-linear relationships are more common than linear relationships, Prezi has an advantage over other programs.

**Use movement correctly.** The ability to move about the canvas is Prezi's strength and weakness. While the approach can create interest and facilitate learning, it can also be used excessively or ineffectively. Think about movement when you are implementing. Think about how it can best be used to facilitate understanding of the material.

**Involve students.** Students have the ability to be collaborators in Prezi. This process can get students more engaged in actively constructing knowledge. Another means of getting students involved is to allow them to navigate the Prezi on their own. Because there is the option to deviate from the path on Prezi, students can navigate the Prezi to look at information in a manner that best suits their learning needs.

**Avoid text-heavy presentations.** Prezi is a visual medium. While text can be displayed, Prezi is not the most conducive environment for displaying lengthy text.

**Use it purposefully.** Prezi should not be used simply because for its novelty factor. While this will initially garner student interest, novelty will wear off and student interest will fade. The authors of this paper have noticed this in their classrooms. Prezi has specific abilities. By using Prezi with these abilities in mind, instructors can be better able to garner student engagement.

## Conclusions

The decision to use Prezi is the decision of the instructor. Be mindful of its capabilities and its limitations before implementing it into courses. It has a place in education, but it will not become the dominant presentation medium. For more information or to view tutorials, please visit [www.prezi.com](http://www.prezi.com).

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Submitted by:  
Quisto Settle  
University of Florida  
Gainesville, FL 32611

Katie M. Abrams  
University of Illinois  
Urbana, IL 61801

Lauri M. Baker  
Kansas State University  
Manhattan, KS 66506

## Adding Value to Graduate Education: The Comprehensive Examination

Virtually all graduate study requirements for M.S. or Ph.D. degrees include a written comprehensive and an oral exam, the latter most often a presentation of thesis or dissertation results. The written exam takes many forms, but the goals are to test the candidate for technical competence and affirm that the prior program course work has been effective in bringing the candidate to an acceptable level of understanding of the discipline in which she or he has

been immersed. Although long accepted as a useful hurdle on the path to a degree, for some exceptional students who have already demonstrated competence in multiple ways, especially at the Ph.D. level, this has become an unnecessary chore for both students and supervisory committee members. All would rather devote quality time to something valuable for the student, rather than just busy work to re-validate what everyone already knows about the candidate. We have tested a new method of examination in a few situations, one that is focused on the student's ability to explain science to a lay audience.

*Learning objectives* are to 1) encourage the student to reflect on the broad importance of the courses and research project and how this can impact society, and 2) practice writing for a general audience about the topics of courses or research. With current skepticism about science and our research in many quarters, it is increasingly important to find effective ways to communicate with the public.

*Methods* include the framing of comprehensive exam questions that lend themselves to interpretation, clear articulation, and application to society's perceived challenges – quite a different challenge than writing for a journal. A recent comprehensive exam at University of Nebraska for a PhD student in practical applications of his research on use of diverse cover crop mixtures in sustainable farming systems included these five questions:

1. Select one important topic in soil microbiology relevant to organic agriculture and write an essay for a popular publication
2. What is a standard error? Explain this calculation and concept to a general audience outside of academia
3. Your research on mixtures of cover crops has potentially wide impacts on design of future farming systems; describe this practice to a general audience
4. Write an essay for the general public discussing the environmental benefits and drawbacks of agricultural intensification compared to organic agriculture
5. You have just been appointed to a farming systems and organic agriculture position at a major Land Grant University; using the advertised position description, prepare a draft of your first Hatch project

There were no further guidelines, nor time constraints put on the student to answer these questions, but rather he was urged to do as well as possible with the idea of submitting one or more of them for publication in a general interest journal in agriculture, natural sciences, or related area.

*Observed impacts* of this type of comprehensive exam were both immediate and striking. The student said up front in a meeting with the committee that this assignment “raised the stakes” of the exercise, since he understood that some of the results would actually be published, and not just languish in the file

of his supervisory committee. It was also said to be a new way of looking at science, and a challenge to write in a way and with language that was comprehensible to a lay audience. In fact, by the time of the oral exam over the questions, one had already been submitted and accepted for publication in *PrairieFire Newspaper*, a publication from Lincoln, Nebraska that circulates across the Great Plains (Wortman and Francis, 2011)..

Another PhD student in Agricultural Leadership, Education and Communications was afforded the same opportunity as an alternative to the traditional comprehensive examination. She had two articles accepted and published in this same regional publication, in the June and July 2011 issues (Quinn and Francis, 2011a, 2011b). These follow on a theme of two previous student articles in *PrairieFire*, one last August on the history of organic certification, and one early this year on the importance of introducing local and organic foods into schools.

Supervisory committee members for these students were equally pleased with the results. Since they already had the grad students in class and knew their technical capabilities, it was good to present a new type of challenge rather than revisit topics where the candidate's legitimacy had already been established. We do recognize that this approach is not necessarily for all students, and that the comprehensive written exam is an important way to assess technical knowledge. But for some students we feel that this is an innovative approach to broadening the capacities of a young professional to reach the general public.

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Submitted by:

John Lindquist, Sam Wortman, and Charles Francis,  
University of Nebraska-Lincoln

### A Teaching Module on Ozone as an Air Pollutant and its Effects on Plants

Since many universities and colleges offer limited environmental courses designed to educate students about air pollution during the summer (the height of the “bad” air quality season in the US) and because there are no known programs that teach air pollution effects on vegetation in an interactive manner, we developed a teaching module using ozone as the

## Teaching Tips

example air pollutant (and its effects on plants). This module is available for download on the web and can be inserted into preexisting courses, serve as a foundation for mini-courses, or sections of it used as individual lectures or exercises. Within the module is a unique exercise where students compare time-lapse photographs, illustrating the onset of ozone injury on plants recorded during a summer, with the ozone data collected during symptom development. This allows the students to relate the severity of the ozone-induced symptoms with the ambient ozone levels.

### **Ground Level Ozone as an Air Pollutant**

Ground level or tropospheric ozone is a major air pollutant in many industrial areas around the world affecting the human health, environment, and the economies of many countries. Ozone is one of the criteria pollutants designated by the Clean Air Act of 1970 to be monitored across the US to determine the safety of the air for human and ecosystem health. The ozone season, when the highest ozone levels occur and cause the greatest amount of concern to human health and vegetation injury, is typically mid-April through late October in much of the US. Human health problems associated with ozone pollution include coughing, congestion, chest pain, and throat irritation; and ozone can worsen respiratory diseases such as asthma, bronchitis, and emphysema. Elevated levels of ozone often experienced during the ozone season can cause damage to trees, agricultural crops, and other vegetation. Symptoms of plant injury due to ozone include leaf stipple, chlorotic mottle, tip burn, late season leaf yellowing, premature defoliation, and decreased crop yields.

### **Development of the Ozone Damage on Plants Exercise**

Since plant damage from ozone in the landscape occurs during the summer when most agricultural and environmental courses are not being taught, we developed an exercise (entitled Environmental Crime Scene Investigation) using time-lapse photographs of the onset and development of ozone-induced injury on plants. We also supplied the recorded ozone levels during the time when the photographs were taken. This allowed the students during their regular semester courses to establish relationships between leaf injury and ambient ozone levels.

Photographs of ozone-induced leaf injury were taken for five ozone-sensitive forest and agricultural species located at the Air Quality Learning and Demonstration Center (located on the Penn State campus) during a recent ozone season. The plant species photographed (common milkweed, black cherry, yellow poplar, Chambourcin grapes, and tobacco) had been previously shown to be sensitive to summer ambient levels of ozone in central Pennsylvania. A Pennsylvania Department of Environmental Protection air quality monitoring station, located at the Learning Center, collected

weather data (temperature, wind speed and direction, solar radiation, relative humidity, precipitation, soil moisture, and visibility) on a daily basis and monitored air pollution concentrations for nitrogen dioxide (NO<sub>2</sub>), nitrogen oxides (NO<sub>x</sub>), carbon dioxide (CO<sub>2</sub>), carbon monoxide (CO), particulate matter (PM<sub>10</sub> and PM<sub>2.5</sub>), and ozone (O<sub>3</sub>). The air pollution data are collected as mandated by the Clean Air Acts and are reviewed the by US Environmental Protection Agency.

After analyzing the photographs for onset and development of visible ozone injury on the leaves (Figure 1), the air pollution data (Figure 2) were examined to determine if high levels of ozone pollution were present immediately prior to the dates when symptoms occurred, or if the injury was related to low chronic concentration over an extended period of time. Since other environmental factors can have an effect on how much or when symptoms occur, select weather data were also evaluated.

### **The Development of the Ozone Teaching Module**

A larger more comprehensive ozone teaching module that incorporated the in class activity was then developed. The purpose of the module was to educate students regarding ground level ozone pollution. The length of the ozone module is approximately three hours; however it includes several individual portions that could be taught as smaller segments. The contents of the module include an overview; two power point presentations, both containing 38 slides; a homework assignment; an in-class activity; a quiz to test the students before and after completing the module; and an answer key for both the in class activity and quiz.

The first power point presentation in this module provides an overview of ground-level ozone, how the pollutant is formed and transported, and the importance of ozone to human and environmental health. The second power point presentation focuses on how ozone pollution affects vegetation. Both power point presentations contain several photographs, charts, animations, graphs and activities as to keep the students engaged and cater to all learning type techniques. For the benefit of the educators who use the module, important information and suggestions to assist in presenting the information are written in the notes section under each slide in the power point presentations.

The next section of the module is the in class exercise that was developed utilizing the photographs and real-time weather and air pollution data. The purpose of this activity is to allow the students to use the knowledge that they gained during the power point presentations to better understand the environmental impacts of ozone pollution. By the end of this exercise the students should be able to determine the connection between the plant injury and ozone levels when shown photographs and weather and air

pollution data. The format of the module exercise is a word document so new sets of photographs and weather data can be easily inserted to maintain the module updated with current information.

### Testing the Module

After the module was developed, it was presented to students (n=16) in the Agricultural and Extension Education (AEE) 313 course at Penn State University. The students in this course were pre-service student teachers about to begin their student teaching term. A 15 question, multiple-choice quiz was used to determine the individuals' knowledge on the subject matter prior to being presented the information in the teaching module. Following the quiz, the class was presented with the first power point presentation, followed by a short break, the second power point presentation, and then the in-class activity, during which the students were allowed to work in groups. At the completion of the activity, answers were discussed as a class and any last-minute questions were answered. To test the effectiveness of the module and for statistical purposes, the students were given a post-module quiz that was identical to the pre-module quiz. A paired t-test was conducted on pre- and post-module quiz results to determine the effectiveness of the teaching module.

The results of the paired t-test indicated that the confidence interval {95% CI for mean difference: (-7.60444, -5.27056)} for the mean difference between the two quizzes did not include zero, which suggests a difference between them. The small p-value (p=0.000) further suggests that the data are inconsistent with the Null Hypothesis (The mean difference between the two quizzes will be equal to zero), which means that there is a difference between the mean values for the two quizzes. Specifically, participants did better on the post-quiz (mean = 13.06) than on the pre-quiz (mean = 6.63). Thirteen out of the 16 participants received over 80% on the post-quiz, whereas none of the sixteen participants received over 80% on the pre-quiz.

Several of the AEE 313 students who were presented with the module, expressed interest in using it during their student teaching term and feedback was received from three of these individuals. One student teacher used the module in a plant science class containing 23 students. Feedback from this teacher was "...the students did enjoy it and found the information surprising and interesting...they really thought it was neat that they could check the ozone level in their area and see surrounding areas". The second teacher who provided feedback was using the module in his/her greenhouse class, consisting of 28 students. Unfortunately, due to the structure of the class the student teacher was not able to present the module all at one time but instead in 15-minute increments. Therefore, this individual could not provide much detail on the students' reaction to the module. The third individual who

provided feedback taught the module during a plant physiology portion of their class, which contained eight students. This student teacher said about the module, "...it not only tied everything I taught in the unit together, it allowed students to learn about the effect of ozone on these plant processes. The students really enjoyed the links to the internet and all the graphics". However, this teacher also mentioned that the students didn't do very well on the quiz, which she found confusing, considering the students interest in the subject matter. Although some feedback was negative, the majority was positive and provided further evidence that the ozone module can be successfully incorporated into high school curricula.

### Availability of Teaching Module onto the Internet

The module is available for download at various public websites including the Pennsylvania Department of Environmental Protection ([http://www.portal.state.pa.us/portal/server.pt/community/curriculum\\_class\\_activities/13906](http://www.portal.state.pa.us/portal/server.pt/community/curriculum_class_activities/13906)) and Penn State University ([http://www.personal.psu.edu/drd10/Ozone\\_Learning\\_module/Ozone\\_Pollution\\_Teaching\\_Module.html](http://www.personal.psu.edu/drd10/Ozone_Learning_module/Ozone_Pollution_Teaching_Module.html)). It is envisioned that the module could also be used as an outreach tool for public and private institutions.

Submitted by:

Sabrina Chrzanowski Haydt, Donald D. Davis, Tracy Hoover, and Dennis R. Decoteau (drd10@psu.edu), Penn State University

### Visioning Future Scenarios

Practical agronomists and other applied specialists in agriculture become experts in their narrow disciplines through academic courses and research for advanced degrees. Fulfilling this role as experts, they often follow careers in research, education, public sector extension, or private advising where they are expected to provide appropriate advice to farmers based on their experience and training. Although this "expert-client" relationship is an established norm and comfort zone for both parties, it may not help them explore the range of potential solutions that could emerge from a more holistic, systems-oriented strategy that leads to future visions and scenarios (Barker, J., 2001; Parker, M., 1991).

*Learning objectives* in agroecology courses are to: 1) examine multiple alternatives or "scenarios" that could be adopted by farmers to solve their production challenges, 2) evaluate the potential influence of any change in practices on total crop, animal, or crop/animal system performance, and 3) assess a priori the possible and likely production, economic, environmental, and social impacts of such changes. Our experience has led to development and refinement of visioning sessions as a robust method for reaching their objectives.

## Teaching Tips

*Methods* we have used over several years have included virtually driving through or taking a balloon ride across the landscape, drawing rich pictures to illustrate major farming system components and connections, and discussing future goals and aspirations with clients who will be the ones to implement any effective change. Often we ask students to observe, to visualize, to imagine, and especially to suspend judgment as they think about what an ideal system could be, especially unencumbered by current constraints.

*Observed learning outcomes* have been accumulated over the past decade of conducting visioning exercises in a number of educational venues. Evaluation of the visioning process puts this into context as one important step toward describing future scenarios. Students imagining a future desirable situation on the farm that will meet the farmer's and family's goals try to think beyond the current systems and constraints to consider what is possible in the future.

We have found that students who view the farm from a small distance are better able to focus on the entire operation, and not on the specific weeds, nutrient deficiencies, and fungus diseases on the leaves of the crop that often get in the way of observing the larger picture. From a position looking down on the farm, it is possible to see where the various crops and animal enterprises are located, and how major interactions may be possible because of the physical juxtaposition of the elements. From above, it is also possible to see how this farm fits into the surrounding rural landscape and how its key elements impact the farm. Also in this slightly detached mode, they can better envision possible changes or scenarios for the future that could help the client better meet his or her goals.

We do urge students to suspend judgment in their visioning, and not to jump to obvious solutions or recommendations, since these too often seem to represent their own disciplines or some pre-formed ideas about what should be. Observing from a small distance it is possible to envision new elements, innovative connections, and potential emergent properties from a reorganized or more diversified system.

Finally, we insist that the student teams come up with a series of potential future scenarios to present to the clients, rather than specific recommendations. In this way, there are multiple and creative ideas presented, and the clients can pick and choose the elements that they consider most useful to help them meet their goals. As a part of the evaluation, student groups try to calculate or at least imagine the impacts that any change in one component or addition of an enterprise will have on whole system performance – in production, economics, environmental, and social dimensions – and not only in the short term. Sustainability is a long-term concept, and we need to imagine and project the impacts of changes in systems into at least the medium-term future.

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Submitted by:

Geir Lieblein, Tor Arvid Breland, Suzanne Morse, and Charles Francis University of Nebraska-Lincoln



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kbarrick@ufl.edu

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