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Ph: 208.957.7001, Fax: 208.436.1384
Email: NACTAeditor@pmt.org

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Rick Parker, Editor
nactaeditor@pmt.org

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Using Self-Reported Data Collection and Analysis to Facilitate Student Learning: A Case Study[1]

Joshua P. Berning[2]
University of Georgia
Athens, GA

Abstract

This activity was used to help teach microeconomic concepts and empirical analysis. As part of an undergraduate course in agricultural economics, students recorded their own fruit and vegetable consumption over a 7-week period. Students also used the aggregated class data to perform econometric analysis and test their own hypothesis regarding fruit and vegetable consumption. Based on student survey responses, this approach appeared to help students with key learning objectives, although they did not necessarily like collecting the data.

Introduction

Motivation for developing DCA approach

There are numerous opportunities facing undergraduate students of agricultural economics. First, they have to have at least some cursory interest in learning economics, both theory and applications. As many are drawn to agricultural economics programs for their practical focus on agricultural, food, natural resources or the environment, interest in theory can be a difficult barrier for some. Assuming that the student can deal with some amount of theory, their next potential challenge is to learn how to apply the theory to the practical foci of agricultural economics. That is, they have to conceptually understand how markets work and practically how economics are used to evaluate actual markets.

For the instructor of agricultural economics, this creates numerous difficulties and opportunities, which at a minimum, keep the profession interesting. To make this process more challenging, students don't always come from backgrounds that equip them to understand agricultural markets. That is, even though they know about agricultural products, they are not always knowledgeable about agricultural and food supply chains. Even those with food industry experience often have distaste for food industry careers since their prior experience has been in low-level jobs such as fast-food cooks or servers (Litzenberg 2010). As such, students may not even be knowledgeable about food-related industries.

Finally, students are balancing other aspects of their life, perhaps to a greater degree than previous generations. As such students are pulled in many directions outside of the classroom. Consequently, it is important to find innovative and interesting ways to engage students of agricultural economics in the classroom.

In the spring of 2013, the author was assigned to teach an undergraduate course in agricultural and resource economics at a land-grant research university. While the primary focus of the class was teaching intermediate microeconomics, the author was also charged with exposing the students to some empirical analysis. The departmental motivation was to prepare the students for more applied work in higher level courses and to increase undergraduate interest in agricultural economics. As both intermediate microeconomics and empirical analysis generally command and deserve their own courses, this presented a special challenge. To try and engage the students and prepare them to be budding agricultural economists, the author implemented an experiential learning activity for the class. The activity is referred to as the DCA approach (data collection and analysis) for convenience.

Methods

The DCA approach

In the first week of class, students completed a demographic survey via an Excel spreadsheet on the University Blackboard system (Blackboard, Inc). There were 52 questions including age, GPA, and the location of their residence that all students completed (Table 1). In addition, questions were asked regarding their food shopping and cooking habits and their nutritional

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[2]Assistant Professor, Department of Agricultural and Applied Economics; Ph: 706-542-0768; Email: jberning@uga.edu

Table 1. Demographic survey questions

No.	Question
1-4	Name; Student ID; Age; Gender
5-7	Hometown; Home state; Permanent address zip code
8	Academic year in school (1 = frosh, 2 = soph, 3 = jr, 4 = sr, 5 = grad, 6 = other)
9	What is your approximate GPA? (0-2.0; 2.0-2.5; 2.5-3.0; 3.0-3.5; 3.5-4.0)
10	Approximately how many people in this class have you interacted with socially outside of class before? (0-5; 6-10; 11-15; 16-20; 20+)
11	Are you required to live on campus? (1= Yes, 0=No)
12	Do you live on campus? (1= Yes, 0=No)
13	If so, what is the name of the residence hall you live in?
14	How many times do you go home in a semester?
15	Do you have a refrigerator for your own use? (1= Yes, 0=No)
16	Do you share a refrigerator with others? (1= Yes, 0=No)
17	Do you own a functioning television? (1= Yes, 0= No)
18	Do you have a functioning car with you? (1= Yes, 0= No)
19	Do you have access to someone else's vehicle on campus? (1= Yes, 0= No)
20	Which statement best describes how often you ride the bus on campus? (…regularly on weekends and weekdays; …regularly during the week (M-F); …regularly on the weekends; …infrequently; …never)
21	Are you a part of fraternity or sorority? (1= Yes, 0= No)
22	Are you a part of the ROTC or a similar organization? (1= Yes, 0= No)
23	Are you a part of an organized school sports team including club teams? (1= Yes, 0= No)
24	How many hours per week do you work at a job on campus? (0; 1-10; 11-20; 20+)
25	How many hours per week do you work at a job off campus? (0; 1-10; 11-20; 20+)
26	If you work off campus, where is your job located (Enter the zip code)
27	Do you have a school meal plan? (No meal plan; Plan A; Plan B; Plan C; Plan D; Not sure which meal plan I have)
28	How often do you use a credit card to pay for food per week? (1-2 times; 3-5 times; 5+ times; I have a credit card, but I don't use it to pay for food; I don't have a credit card)
29	What is the largest area that you would consider local food to be from? (The town you live in; The county you live in; The state you live in; The multi-state region you live in; The United States; Larger than the United States)
30	Aside from the University campus, how many places CAN YOU buy groceries from while a student here?
31	Aside from the University campus, how many places DO YOU buy groceries from while a student here? (Groceries are defined to be food products that you purchase to consume at home, rather than on premise)
32	What types of places do you buy groceries from? (Grocery stores (example); Superstores (example); Warehouse club (example); Convenience store (example); COOP; Farmers' Market; Community Supported Agriculture (CSA); Other (Please describe))
33	Are you a vegetarian?
34	Are you a vegan?
35	Do you have any food allergies or food restrictions?
36	As of today, do you have any plans to take a vacation during spring break this semester?
37	When choosing to attend the University, how important was the University's meal plan? (0-not very; 1-a little; 2-a lot; 3- extremely important)
38	When choosing to attend the University, how important was the non-University food options? (1-not very; 2-a little; 3-a lot; 4- extremely important)
39	How important is overall nutrition to you? (1-not very; 2-a little; 3-a lot ; 4- extremely important)
40	How important is nutrition to you when you shop for groceries? (0- I don't do this activity; 1-not very; 2-a little; 3-a lot; 4- extremely important)
41	How important is nutrition to you when you prepare your own food? (0- I don't do this activity; 1-not very; 2-a little; 3-a lot; 4- extremely important)
42	How important is nutrition to you when you purchase prepared food? (0- I don't do this activity; 1-not very; 2-a little; 3-a lot; 4- extremely important)
43	How important is taste to you when you shop for groceries? (0- I don't do this activity; 1-not very; 2-a little; 3-a lot; 4- extremely important)
44	How important is taste to you when you prepare your own food? (0- I don't do this activity; 1-not very; 2-a little; 3-a lot; 4- extremely important)
45	How important is taste to you when you purchase prepared food? (0- I don't do this activity; 1-not very; 2-a little; 3-a lot; 4- extremely important)
46	How important is it to you to choose a diet with plenty of fruits and vegetables? (1-not very; 2-a little; 3-a lot; 4- extremely important)
47	How important is it to you to consume organic fruits and vegetables? (1-not very; 2-a little; 3-a lot; 4- extremely important)
48	How important is it to you to consume other organic foods (not including fruits and vegetables)? (1-not very; 2-a little; 3-a lot; 4- extremely important)
49	Rank how familiar you are with each of the following programs (1-not very; 2-a little ; 3-a lot ; 4- extremely important): Fruit and Veggies More Matters The Dietary Guidelines for Americans The MyPlate program A Healthier You
50	Rank how familiar you are with each of the following websites (1-not very ; 2-a little ; 3-a lot ; 4- extremely important): Sparkpeople.com Livestrong.com Oobafit.com Fitday.com University Dining Services Mobile App
51	Do you use any mobile applications to help manage your diet? (1= Yes, 0= No)
52	Do you use any online applications to help manage your diet? (1= Yes, 0= No)
53	If you live off campus, what town do you live in?
54	What is your off-campus residence zip code?
55	Do you live with family off-campus? (1= Yes, 0= No)
56	Do you live with non-family members off-campus? (1= Yes, 0= No)
57	Including yourself, how many people do you live with off-campus? (If none, put 0)
58	How many of the people that you live with off-campus are college students? (If none, put 0)

preferences (i.e. questions 39 – 48, Table 1). Students that lived off campus were asked to complete six additional questions (questions 53 – 58). The students were asked to complete the survey by the second week of the semester. Several reminders were sent to the class and over 93 percent of the class completed the survey on-time. The others completed the survey before the midterm break (n = 53).

At the beginning of the second week, students were asked to record their fruit and vegetable (FV) consumption from Monday through Wednesday using an electronic diary and submit this information via Blackboard by Thursday night. In addition, students were asked to describe where they obtained their groceries, how often they ate out, how often they exercised and whether they were ill that week (Table 2). Prior to completing the survey, students were instructed on how to measure a serving size using a standard measure provided by Produce for Better Health Foundation (taken from http://www.fruitsandveggiesmorematters.org/archives/16223). The exact serving measures are described in Table 3. This information was also provided on each survey for reference. Again, reminders were sent to the students and completion rates were over 90 percent each week.

The weekly food diaries were completed for seven weeks and finished before spring break. During the fourth week, the instructor introduced an experimental treatment. Specifically, half of the class was randomly selected and provided an informational pamphlet via email regarding ways to increase their FV consumption. No other instructions or comments were included.

Students that completed all of their surveys on-time (or within a two-day period) received points towards their project for data collection and were allowed to drop their lowest test grade during the semester. At the end of the 7 weeks, personal identifiers were removed and the demographic data and weekly diaries were combined to create a panel data set.

In the first section of the course, the instructor discussed consumer demand during lectures. To facilitate this topic, the instructor solicited student input regarding factors that affect their own FV demand, both quantity and quality. Students were able to easily discuss price and income effects as well as tastes and preferences. In addition, they discussed less traditional topics such as food access and food marketing. Through discussion, the class also discussed behavioral factors that might impact FV consumption. For example, commitment to a spring break trip may help to ensure students have a better diet and exercise more to stay in shape. Being part of a social group or club team may create peer pressure to stay in better shape. The class also discussed various policy issues related to FV consumption.

For the final section of the course, students were required to: 1. Develop a theoretical hypothesis based on demand theory regarding specific factors that might affect class FV demand; 2. Test their hypothesis using basic regression framework; and 3. Write up their analysis in a short report. During this section, the instructor discussed empirical methods and often referred back to the initial discussion in the first section. In addition, the instructor used the class data set to provide examples of analytical methods in class.

Evaluation of the DCA approach

Within the context of agricultural economics, there is a long history of developing experiential learning techniques. Wilson and Nelson (2009) cite an extensive list of examples. While Wilson and Nelson are proponents of what they call active learning, the authors argue that a weakness of active learning in a theory based curricula, such as economics, is the lack of theoretical orientation. By heavily or solely focusing on the activity implemented for the learning process, there is clearly a concern that students may miss the more important conceptual aspect of the learning process. That is, they can miss the intellectual forest for the trees. To that point, it is useful to consider why the DCA approach might be a relevant exercise for an agricultural economics class.

Table 2. Weekly Food Diary Questions

	Questions
1	Over the past 7 days, approximately how many bags of groceries did someone else provide to you? (Check one box only). 0 bags <1 bag 1-2 bags 2+ bags
2	From Monday to Wednesday, how many times did you eat at each of the dining facilities on campus? Location A Location B etc.
3	From Monday to Wednesday, how many times did you eat at a restaurant off campus?
4	From Monday to Wednesday, how many times did you buy grocery items on campus?
5	From Monday to Wednesday, how many times did you buy grocery items off campus?
6	From Monday to Wednesday, how many hours did you spend doing any kind of exercise? This includes cardio vascular exercise, lifting weights, playing sports, etc.
7	From Monday to Wednesday, how many days did you feel physically ill such as from a cold or fever?
8	From Monday to Wednesday, how many servings of fresh fruit did you eat (see definition of a swerving below)?
9	From Monday to Wednesday, how many servings of dried fruit did you eat (see definition of a serving below)?
10	From Monday to Wednesday, how many servings of fruit or vegetable juice did you drink (see definition of a serving below)?
11	From Monday to Wednesday, how many servings of vegetables did you eat (see definition of a serving below)?

Table 3. Fruit and vegetable measurement instructions

Consider 1 cup as the size of a baseball

We define one serving of fresh fruit/vegetables as:
One medium piece of fruit (1 medium apple or orange)
1/2 cup cut-up raw or cooked fruit/vegetable
1/2 cup cooked dry peas, beans, lentils
1 cup leafy greens
1/4 cup dried fruit or vegetables

We define one serving of dried fruit/vegetables as:
1/4 cup cut-up dried fruit/vegetable

We define one serving of fruit/vegetable juice as:
4 oz (1/2 cup) of 100% juice

For more information, go to:
http://www.fruitsandveggiesmorematters.org/archives/16223

Experiential learning is generally described as a process where a person engages in some activity, reflects on the activity in a critical manner and attempts to derive insights from the reflective analysis (Pfeiffer and Jones, 1981). Such learning by doing process in a classroom setting relies on the students: 1. actively engaging the activity presented to them; 2. learning from the engagement; and 3. applying it later. Each of these is discussed in turn.

Activity and Learning

The DCA approach was intended to serve several purposes. First, it was intended to encourage the students to be more observant of the market environment where they acquired and purchased food. Prior to earning their own self-sustaining wage, students may pay less attention to certain aspects of food marketing, such as price, variety or quality since they are often on meal plans or have food provided to them by family. Interestingly, college students often live in a dense food marketing environment where they are given a multitude of choices in confined areas. Further, they are presented with a large number of informational and promotional marketing materials. As such, there was ample opportunity to learn through observation.

The second purpose of the DCA approach was to encourage the students to conceptualize the market forces that may impact their decision making process. The instructor directed some of this thought process as well through discussion and lecture throughout the semester. The intention was that by collecting their own data on their consumption behavior, students also would begin to consider why they consumed what they did.

Another objective of the data collection process was to help students better understand data in general. While students have access to publicly available secondary data sets, (e.g. Census data or Labor data) it may not be clear to them what process is generating the data. That is, even after gathering secondary data, students don't always know what is being measured. Such confusion is not likely because secondary data sources are so abstract. Rather, undergraduate students often don't take the time to consider these data outside the formal structure of the classroom. By collecting their own data, students' basic understanding of the data should increase as well as their time and ability to focus on analysis of the data. As noted by Spencer and van Eynde (1986, p. 291), "*Teaching through experiential learning obviously is easiest in subject areas where students have at least some degree of familiarity with the subject.*" Because they were part of the data collection procedure, students might grasp more of the learning concept.

Finally, the experimental treatment implemented during the semester was intended to help students understand how external factors might affect the data they were collecting. In particular, as some students were given additional information about nutrition, this might change their consumption behaviors. Ideally, this would help to understand data better in general.

Application

After the students spent almost two months collecting and, potentially, thinking about the data, they had to apply what they had learned by testing their own hypotheses. Clearly this can be done with other secondary data sets as well. After collecting their own data, however, the students might be more inquisitive and creative regarding the formulation of hypotheses. If the students spent any time considering the data they were collecting, they may be better equipped to ask relevant and interesting questions. Further, by testing their own hypotheses with their own data, the students would reflect about their own learning and knowledge. As intended with experiential learning, the students might ultimately carry this experience with them beyond the classroom.

Kolb's Theory of Experiential Learning

Kolb's theory of experiential learning, summarized by Spencer and van Eynde (1986) also provides a relevant framework for evaluating the DCA approach as well. According to Kolb, experiential learning is a four-step process. In the first step, learners are involved in a structured activity designed to generate data related to the class learning objective. At this point, the learner reserves judgment and focuses on the task at hand. Clearly, the DCA approach meets the first requirement. Whether or not students "reserved judgment" is questionable. In particular, as students collected data, they may begin to consider the factors that influence the data collection procedure. As previously mentioned, the instructor encouraged this to some extent during lecture.

In Kolb's second step learners reflect on what happened during the experience stage and attempt to explain outcomes of their participation. This took place after data collection in several ways. First, the instructor used the data to motivate analytical methods during subsequent lectures. Second, the class project required them to consider what they could examine or explain with the data they generated.

As a result of the reflections, in the third step the learners make generalizations about what they learned. In particular, this involves developing more abstract thought and incorporating theory. To this end, the formal hypothesis the students created required they not only make generalizations and incorporate some economic theory, but also think more abstractly about the data.

In the final step, the principles and findings are to be used beyond the immediate learning experience. This often involves testing implications of the concepts that were learned in new situations or applying the principles. The analytical methods employed in class (mean comparisons, creating charts and graphs, least squares regression) tested the students' theories directly. Further, the students had to extrapolate from their results to demonstrate their understanding of their findings and provide a write-up of their thought process.

Based on the criteria put forth by Kolb, the DCA approach has the structure and favorable attributes of experiential learning and the potential to help improve

and enhance the student learning process. Still, there are tradeoffs to every classroom activity that each instructor must evaluate.

Costs and Benefits

A natural way for agricultural economists to evaluate the merit of some decision is to consider the costs and benefits. While the costs and benefits of the DCA approach were not explicitly measured, they can be considered qualitatively.

As an instructor, there is the very real opportunity cost of time required to develop and administer any new activity. Due to software and technology, the DCA approach is manageable and has near zero marginal cost. The start-up costs can be significant, however, depending on the nature of the data being collected. Prior to providing the survey instrument to the class, the instructor had the questions vetted by several grad students, a post doc and a fellow assistant professor. This greatly improved the quality of the survey, but also stole others' time. There is also a significant procedural learning curve that has to be overcome. Fortunately, subsequent versions of this activity benefit from any initial investments. Still, for an assistant professor these investments must be balanced with looming tenure requirements.

There are also other intangible costs to be considered as well. As pointed out by Wilson and Nelson (2009), there is the potential loss of reputation associated with experiments that don't work as planned. In the case of the DCA approach, there were minor difficulties that could have easily translated into lower class learning outcomes or class satisfaction. Overall, little difficulties can add up and make a course seem unorganized or unstructured. This can ultimately impact class ratings and enrollment. Unfortunately, the instructor did not have a comparable control group to compare with.

The costs to the students are another important consideration that any instructor should consider. For one, certain students may have a difficult time with an experiential learning activity. Several authors find experiential learning can lead to reduced achievement among students with certain personalities or learning styles (Dickie, 2006; Emerson and Taylor, 2004; Hawtrey, 2007). In addition, the DCA approach requires external effort, which certain students are hesitant to provide. This also requires persistent follow up by the instructor or teaching assistant. While students can be compensated with completion grades, they may resent the deviation from the traditional lecture-exam framework. Students often develop pre-conceived notions about what a college classroom environment should be like. Deviation from such expectations could lead to anxiety or discomfort for certain students. Effort may be needed to help students transition to new learning activities.

At the same time, Hawtrey (2007) suggests that students are not satisfied with a pure lecture classroom environment in economics. Clearly, certain student types will flourish in experiential learning environments and become more excited about such classroom environments. As such, there may be a positive payoff for students who are willing to invest in this learning activity. Further, by diversifying the type of assessments used for grading by incorporating something like the DCA approach, students have more opportunities for success. This can benefit students who do not perform well on tests.

Importantly, there are many benefits for the instructor as well. As noted by Hawtrey (2007), an important benefit of experiential learning is that it explicitly shifts responsibility for learning from the instructor to the student. In turn, this should encourage better, lifelong learning. Implementing experiential learning activities can also make teaching more enjoyable and provide inspiration and a sense of focus for instructors. If effectively executed, they can lead to better student evaluations and a higher classroom reputation as well. As the DCA approach was designed to mirror the instructor's research agenda, this provided greater opportunity to discuss familiar topics in class. Beyond the classroom, this informed the instructor's research opportunities as well. In fact, the aggregate student data provides a small sample data set to investigate research questions outside of the classroom. This extension of the DCA approach does require institutional review, however, which is an additional time investment.

Student evaluation of process

The instructor was not able to identify a comparison group to evaluate whether the DCA approach improved student scores. Instead, an anonymous survey was provided at the end of class to solicit students' perceptions of the DCA approach (Table 4). After going over each question, the survey was administered and collected by a teaching assistant. There were 44 of 52 students that attended class and responded to the 5-question survey. Questions 1, 3 and 4 were scored with a Likert scale response system: 1. Not interesting, 2. A little interesting, 3. Interesting and 4. Very Interesting. Questions 2 and 5 were scored with questions: 1. Not at all, 2. A little, 3. A good amount, 4. A lot.

The class demographic characteristics are provided in Table 5 to provide an overview of the survey participants. The students were 20 years of age on average and predominantly juniors. This shows a slightly older class, which could influence both participation and sat-

Table 4. Class Survey

Please rate your level of interest with the data analysis section (circle one)			
Not interesting	A little interesting	Interesting	Very Interesting
To what extent did collecting data for the class project help you with your analysis for the class project? (circle one)			
Not at all	A little	A good amount	A lot
Please rate your level of interest with the data collection process (circle one)			
Not interesting	A little interesting	Interesting	Very Interesting
Please rate your level of interest with the data analysis (circle one)			
Not interesting	A little interesting	Interesting	Very Interesting
To what extent has the data analysis section helped your understanding of microeconomics? (circle one)			
Not at all	A little	A good amount	A lot

isfaction with the DCA approach. That is, juniors often have a better idea about how to handle academic processes and deal with their class workload. The class was largely male and the class GPA was distributed from 2.0 to 4.0. This represents a good dispersion of academic achievement, but may underrepresent females, which is common in both agricultural economics and economics. About 25 percent of the students had to live on campus and about 20 percent were in a fraternity or sorority. About 20 percent were involved with ROTC or an organized school team. The majority of students did not work, although a few worked more than 20 hours per week. Overall, the students were active in other activities outside of the classroom.

The results of the student evaluation survey are provided in Table 6. The average value of responses for each question is greater than the midpoint (2.5), which suggests that students had favorable perceptions of the project with respect to the five questions in Table 6. Further, the standard deviation for all responses was less than a full step indicating little variability in student perceptions.

Table 5. Class Characteristics

Variable	
Age (mean)	20.44
Gender (0 = male; 1 = female)	32.7%
Academic year in school 1 = frosh, 2 = soph, 3 = jr, 4 = sr, 5 = grad, 6 = other)	3.12
Approximate GPA	
0 - 2.0	0
2.0 - 2.5	4
2.5 - 3.0	26
3.0 - 3.5	18
3.5 - 4.0	3
Required to live on campus	13
Part of fraternity or sorority	10
Part of the ROTC or a similar organization	2
Part of an organized school sports team including club teams	9
Hours per week at a job on campus?	
0	38
1 - 10	5
11 - 20	5
20+	4
Hours per week at a job off campus?	
0	41
1 - 10	4
11 - 20	5
20+	2

Table 6. Class Survey Results

	Q1 *Interest w/ analysis section*	*Q2* *Helped w/ project*	*Q3* *Interest w/ data collection*	*Q4* *Interest w/ data analysis*	*Q5* *Helped w/ microeconomics*
Average	2.95	2.91	2.64	3.10	2.82
St. Dev	0.65	0.77	0.89	0.59	0.66
Max	4	4	4	4	4
Min	1	1	1	2	1
Count of 1's	1	1	5	0	1
Count of 4's	7	10	7	10	5
Correlation					
Q1	1.000				
Q2	0.085	1.000			
Q3	**0.334**	**0.356**	1.000		
Q4	**0.381**	0.047	0.073	1.000	
Q5	0.309	0.013	0.282	0.261	1.000

Scoring for Q1, Q3 and Q4:
1. Not Interesting, 2. A Little Interesting, 3. Interesting and 4. Very Interesting
Scoring for Q2 and Q5:
1. Not At All, 2. A Little, 3. A Good Amount, 4. A lot.

The average scores for the data analysis section of class (Q1) and for how data collection helped with the data analysis project (Q2) are relatively high. So even though students might have disliked collecting the data, it may have helped them with the data analysis learning objectives. Further, there were many more high scores (Q1 = 7, Q2 = 10) than low scores (Q1 and Q2 = 1).

Students seemed to have a strong interest in the DCA approach (Q4), although the data collection itself was rated the lowest (Q3), which is not overly surprising given the extra work it required (even though they received points for doing so). This may be consistent with Dickie (2006) who found that economic experiments increase learning whereas grade incentives to participate do not. The lowest response for Q4 was A little interesting; there were no ratings of Not interesting for Q4; and Q4 had the largest share of very interesting ratings. All of this suggests that the DCA approach was appealing to most of the students.

A little concerning is that Q5 had the lowest number of high scores (5) and its mean score was the second lowest (2.82). This could indicate that students had a difficult time relating the data analysis to microeconomics, which could be due to the instruction or because combining microeconomics and analytics in one undergraduate class is too challenging or abstract for undergraduates. An alternative explanation could be the heterogeneous make-up of the class. The class contained upper-level economics majors as well as second-year agricultural economics majors. The former group had already been exposed to many of the microeconomic concepts and analytics discussed in class. The latter group was seeing this material for the first time. As such, the level at which the topics were taught may have been too low for some and too high for others.

The correlation of the questions suggests that scores for Q1 and Q3, Q4 are most highly correlated. Further scores for Q2 and Q3 are highly correlated as well. Since Q1, Q3 and Q4 all pertain to data analysis it is not surprising that the responses are correlated. Similarly, since Q2 and Q3 relate to the class project, a major grade in the class, it is not surprising their scores are correlated.

As noted by a reviewer of this study, 100 percent participation in any survey is uncommon and could have affected the perception of the DCA. Since the DCA project was a major part of the students' overall grade, students may have felt unfairly coerced into participation. This may have biased downward student evaluations of the learning approach.

Discussion

Experiential learning is becoming increasingly important in university teaching. Hawtrey (2007) suggests that this is particularly true as the mission of universities reflects a commitment to develop-

ing more generic student skills and vocational learning. Students want and expect more practical applications of learning rather than standard lectures and rote memorization. Further, students as customers are demanding a greater level of quality. As most agricultural economics departments are at land-grant universities, this mission-focus may be even more prevalent.

The DCA approach attempts to improve the quality of classroom instruction by engaging students with an experiential learning experience. That does not necessarily mean the approach is ideal or even effective. To that point, there are (at least) two important questions regarding the use of a classroom experience: 1. Does it work? and 2. Why does it work? With regards to point 1, the instructor did not explicitly measure whether or not the approach works in terms of class performance. The small sample survey suggests a positive experience for the students. This is not compared to a baseline group, however. Comparative analysis of the DCA approach in the future could be informative.

With regards to question 2, the survey results suggest that the DCA approach helped increase students interest in data analysis. This can be important as undergraduate students can be intimidated by analytical methods. At the same time, improvements can be made with connecting the DCA approach to microeconomic theory. This could also suggest that the DCA approach may be more appropriate or relevant in an undergraduate quantitative analysis course or a more topical applied economics course.

Optimistically, there are many potential applications with this approach. In terms of what data to collect, the DCA approach could easily be constructed to facilitate hedonic pricing models as well. For example, students could individually or in teams monitor different sets of prices over time and space. This could be for anything ranging from food to housing to gas prices. Given the amount of information available online, an industrious student could easily put together an interesting and worthwhile data set with limited instruction or guidance. Similarly, students could gather large amounts of grocery store marketing data including prices, coupons and in-store promotions.

This approach could also be used as an application for other applied economics topics as well such as environmental or natural resources or community development. With some creativity and the benefit of sufficient numbers, an interesting data set could be created and analyzed, allowing students to explore their hypotheses of interest. Clearly, more versions of this approach would help to identify potential improvements.

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Teaching Assistant Perspectives on a Diversity and Social Justice Education Course for Collegiate Agriculture Students

Shalyse Tindell[1], Lisa Young[2], Eric O'Rear[3] and Pamala Morris[4]
Purdue University
West Lafayette, IN

Abstract

In recent years the United States has been growing in diversity, resulting in changes throughout the cultural landscape of our nation. These changes reach across collegiate instructing capacities uniting them with a new diversity of workers in the agricultural sector. Due to the fact that the agriculture industry is continuing to become more diverse, the need for industry workers to effectively communicate and interact cross-culturally is rising. One response to this need has been to integrate diversity and social justice education at collegiate levels into existing agricultural training and education. Resistance often accompanies diversity and social justice education, causing both professors as well as graduate teaching assistants (TAs) to be faced with the task of working through challenging educational situations. TA's are increasingly responsible for teaching undergraduate courses yet their academic perspectives are underrepresented in current literature. This paper will present specific challenges experienced by TAs when teaching a diversity and social justice education course to agricultural students at a land grant university as well as outline solutions implemented through informal discussions.

Introduction

The Agricultural sector is immensely important to any nation's ability to survive and thrive. As the United States becomes increasingly diverse in racial and ethnic composition, an agricultural workforce well versed in ways to successfully navigate a variety of cultural backgrounds is instrumentally important. A positive working environment within the industry is vital for future industry sustainability as well as ensuring the United States maintains its global agricultural rank. As a result of this need diversity and social justice education courses within collegiate Agriculture Departments have become particularly important.

This article assesses a variety of challenges related to teaching diversity and social justice education courses in agriculture through perspectives and experiences of Graduate Teaching Assistants (TAs) as instructors. This study presents opportunities as well as strategies employed that resulted in the facilitation and creation of productive learning environments within the classroom. Highlighting perspectives of teaching assistants is immensely important as evidenced by the steady rise in numbers of TAs teaching undergraduate courses over the years (Shannon et al., 1998). Individual reflections provide discussions on how TA's approached matters such as student resistance, power struggles and student perception of privilege. While this article contributes knowledge to the development of diversity and social justice curriculums within agriculture, the primary purpose is to provide Teaching Assistants' perspectives specific to a diversity and social justice course in a College of Agriculture.

The Field of Agriculture: A Changing Cultural Landscape

The population and cultural profile of the US has been rapidly changing over the years. It is becoming increasingly evident that the country is moving in a direction that is more racially and ethnically diverse. The Environmental Systems Research Institute (ESRI) compared data from the 2000 and 2010 census reporting that the overall US population grew by more than 27 million people, with the most dramatic population growth rates occurring in Hispanic and Asian ethnicities. It is reported that the US population will continue to diversify as younger generations become more heavily comprised of Hispanics, African-Americans, Asians and other races and ethnicities (Environmental Systems Research Institute, 2011).

[1]Master of Science, Department of Animal Sciences. Now a PhD student in Department of Curriculum and Instruction, 908-887-6502, stindell@purdue.edu
[2]PhD candidate in Department of American Studies, 843-244-1433, ljyoung2006@gmail.com
[3]PhD in Department of Agricultural Economics. Now an economist at the National Institute of Standards and Technology. 404-788-6174, eric.g.orear@gmail.com
[4]Assistant Dean and Associate Professor of Youth Development and Agricultural Education, 765-494-8293, pmorris@purdue.edu

These trends are being mimicked in a variety of U.S. industries, including agriculture. The US Department of Agriculture's National Agricultural Statistics Service (NASS) conducts a census every 5 years and the 2012 census revealed a 15% increase in the number of minority farmers since 2007. Asian American and Hispanic producers show the most growth, with increases of approximately 22% and 21%. These results, in conjunction with increases in the total number of Black, American Indian and Native Hawaiian farmers suggest that the cultural diversification of U.S. agriculture is occurring rather rapidly (National Agricultural Statistics Service, 2014).

College students pursuing careers in agriculture must be cognizant that all aspects of the agricultural industry are becoming more diverse. This diversity requires a degree of sensitivity towards others in the industry from different cultural backgrounds and belief systems. Preparation of students through diversity and social justice education courses can assist students in becoming enlightened regarding their personal attitudes towards different cultures within a safe and unbiased classroom environment. However, efforts to educate students on issues regarding diversity and cultural sensitivity can be emotionally charged and have been met with some resistance by university officials as well as students.

Diversity and Social Justice Education in Agriculture

In recent years, universities have recognized the importance of producing globally competent students who possess the ability to behave responsibly in diverse settings and interact comfortably with individuals from different cultural backgrounds. Universities have made strides in developing classroom curriculums that create safe and healthy learning environments for students to gain a better understanding of diversity and social justice issues.

One such course curriculum from a land grant university examines diversity awareness and sensitivity through a basic review of topics such as race and ethnicity, gender and sexual identity, ageism, classism, disability and religious orientation among other issues. Topics are covered in a classroom lecture setting and reinforced during weekly lab sessions facilitated by TAs. Student learning includes service-learning experiences, web-based curriculum and exercises, in-class discussions, research projects, demonstrations and simulations. Service-learning projects are often used by educators as a way of engaging students while encouraging them to become active participants in society and are one of the most crucial components of this course. Research shows that service-learning projects assist in the development of attitudes, policies and practices that help cultural competency (Flannery and Ward, 1999). As Woods (2004) imparts, through service-learning activities students "*are able to acquire an ethic of caring and community connectedness in an ever-growing cross-cultural society.*"

The structure of this specific diversity and social justice education course allows students to explore personal biases and become aware of their own sensitivities to cultural differences as well as how these traits may lead to maintaining oppressive conditions. This process can often be controversial as students struggle to articulate their perspectives and feelings, sometimes leading to discussions that are uncomfortable and hostile. Teaching Assistants for this course are well-trained in the Socratic Questioning method to help them guide discussions to manageable conclusions, but it still requires navigating an emotionally charged process.

Resistance to Diversity and Social Justice Education

A broad range of research exists relating to student resistance in learning environments, particularly in diversity education (Ahlquist, 1992; Shaw, 1993; Sleeter, 1994; Sleeter and Grant, 1994; Tatum, 1992). Yet, as scholars have noted, diversity courses do not automatically equate to inclusive environments (Tienda, 2013). Teachers and scholars continue to grapple with how to design and teach diversity and social justice courses in a way that is unbiased and transformational while getting to the root of privilege, oppression and other structural forms of inequality in society. A 2014 article by Dunn et al., outlines this process by reflecting on how many students operate under the false impression that we now live in a post-racial society. Largely as a result of Barack Obama's election as the nation's first African American President, many students believe that racism is now a thing of the past. The article walks through what might cause students to make callous, offensive remarks (knowingly and unknowingly), encouraging more concrete attention be given to how and why students offer resistance to diversity education. Additionally, Garrett and Segall (2013) encourage awareness of the distinction between ignorance and resistance related to multicultural education. Researchers point out that ignorance is often a defense mechanism against being unfamiliar with a subject and not necessarily resistance. Therefore, it is important for multicultural educators to realize that students might not be resisting, but instead attempting to work through a topic of which they have no basic understanding.

A study conducted in a predominately white and poor rural region of Central Appalachia by Asada et al. (2003), examined factors that contribute the most to resistance from students across disciplines. Findings showed that students were not usually fundamentally against multicultural education, or a diverse community, but they became less supportive if diversity education became mandatory. Additionally, students who were most resistant to multicultural education generally internalized negative racial stereotypes, ignored the presence of modern day forms of racism and believed

that white students suffered as a result of more inclusive education programs.

Cockrell et al. (1998) explored the concept of resistance further by identifying and categorizing forms of student resistance found in diversity education. They found three primary kinds of resistance: 1) resistance based on individualism and monoculturalism (most often articulated by white males), 2) resistance due to self-doubt and being challenged by peers and 3) resistance to multiculturalism as a critique of prevailing social structures which impede the formation of a "true" multicultural society with citizens who have "multicultural thought processes." Dividing resistance into these categories is important because it allows instructors to pinpoint an origin for student resistance and responding accordingly and effectively.

Another hindrance to diversity and social justice education can be a lack of support from the university. In some cases, if a university does not fully embrace diversity it can take steps to present the appearance of embracing diversity while being unwilling to support diversity initiatives financially (Clark, 2011). Diversity education has generally been taught utilizing one or two general approaches. One is a "focused" approach, which takes the form of seminars or a structured course dedicated to multicultural understanding. The other is an "integration" or "infusion" approach where the focus is ""integration" diversity efforts—in curricular, co-curricular and workplace arenas." (Clark, 2011) To achieve true multicultural education both approaches need to be employed, however, often only the "infusion" approach is used in order to avoid actually addressing diversity issues (Clark, 2011).

TA Perspectives in Diversity and Social Justice Education

Despite research conducted regarding student resistance in diversity and social justice education, very little exploration has been done that offers insight into perspectives of teaching assistants. Previous inquiries have focused on how to provide TAs with skills needed to be successful future professors, overlooking learning experiences that aided them on their journey. Although a study by Embrey and McGuire (2011) provides insight into TA comprehension related to diversity education along with implementation into teaching techniques, the void in TA perspectives remains significant. Additionally, large gaps in research persist when examining varying challenges faced as a result of teaching specific topics within diversity and social justice education courses. It is probable that more and more institutions will utilize TAs in capacities that were historically filled by professors as a way of controlling rising university costs, growing research in this area. In order to increase understanding of the TA perspectives offered in this paper, a general outline of the diversity and social justice education course and simple student demographics are included below.

The basic structure of the course can be divided into two main parts. The first section of the course teaches about the basics of culture, diversity, communications and conflict. This serves to lay a fundamental foundation for the course. For the remainder of the semester, subjects are focused on specific types of oppression. Topics discussed include oppression and discrimination based on appearance and size, race and privilege, immigration, religion, abilities and disabilities, gender, sexual orientation and socioeconomic status. Workplace discrimination and affirmative action are also discussed.

This course was developed at a Midwestern Land Grant University, specifically for the Agricultural Department by a professor directly involved with the Office of Multicultural Programs in the College of Agriculture. Although there are students from a variety of backgrounds enrolled in the course, the majority consists of white, middle-to-upper class young adults from very small, homogenous, Midwestern towns.

Key topics from the course have been chosen for discussion in this article as a way of reflecting on perspectives and experiences TAs have had while teaching this specific diversity and social justice course design. The course was designed as a lecture taught by the Professor, with eight breakout labs facilitated by individual TAs. Some of the challenges faced, as well as strategies used to solve these challenges, are discussed from three individual TA perspectives. Each of the TAs taught for at least a full year, or 2 semesters. While the three TAs who wrote for this article all identify as African American, they are each from different social, class and regional backgrounds and are at varying stages of their graduate career.

Reflections on Gender/Sexuality and Immigration by a PhD Candidate – American Studies

Barack Obama's election as the first African American President of the United States ushered in a critical moment that led many to proclaim that we are now living in a post-racial society. This belief in post-racialism—the idea that racism is largely a thing of the past and that we live in a colorblind society—means that many also fail to see the ways certain policies and social institutions function to maintain systems of unequal access and opportunity. It is within this post-racial illusion that I instructed over 50 students to engage in weekly critical discussions about issues facing the changing, multicultural landscape of the U.S. Since topics dealing with race and privilege often can be met with resistance from students, I found it beneficial to decenter discussions about privilege and instead encourage students to see how they each have life narratives that are actually more similar than different. This technique became most salient and effective during class topics that did not focus exclusively on race. While race is often centralized in research regarding effective pedagogical practices for teaching a diversity and social justice course, less attention seems to be given to other

structural and institutional forces that enact forms of systemic oppression and lead to the marginalization of other identities. In what follows, I outline how I navigated discussion and encouraged my students to think more broadly about how issues such as gender and immigration are all intimately intertwined to the incorrect belief that we now live in a post-racial society.

In 2013, the red equal sign symbolizing marriage equality quickly became popular on Facebook. Many people changed their Facebook profile pictures as a way of showing solidarity and making a political statement about overturning the Proposition 8 resolution that barred same-sex marriage. The prevalence of this icon suggested that the idea of post-racialism also brought with it a wider acceptance of gender equality, but this wasn't necessarily the case in my classroom, which consisted of students raised in a primarily conservative state. For instance, after reading a short article on how Indiana has one of the largest gender pay gaps, one student remarked that a man being paid more is justified because women don't usually have to devote the same amount of time and rigor to their jobs as men. During the class discussion, another student stated that she believed more women don't go for graduate degrees in the hard-sciences because they are more concerned with getting married and starting a family. Like the idea of post-racialism which suggests that any person of color can become successful if only they work hard enough, many students also seem to believe that if only women do the same thing as men, they'll reap the same rewards as men. In doing so, students disregard how other factors may impair women's ability to perform "like a man," particularly if she is a mother or caretaker. I explained that studies show that many women don't leave the workforce by choice, but that many felt pushed out due to the inflexibility and incompatibility of the workforce with caretaking needs (Stone 2007). Students often came in oblivious to how many jobs in the workforce continues to privilege men while disadvantaging women.

As a black, female teacher, I recognize that my own positionality is unique within these conversations. Students see someone who is marginalized by both her race and gender and thus immediately assume that my position is to advocate for groups with whom I identify. What I have found most helpful when instructing a group of largely Caucasian, male, students from farming backgrounds is that it is important to highlight other voices and perspectives as often as possible. I show video clips in class while assigning groups to bring in videos related to gender equality that they found helped them to form a more enlightened viewpoint. In this way, I get to decenter my experiences and move from being the "spokesperson" for black people and/or women, forcing students to seek out varied explanations as to how many different kinds of women are affected by gender inequality.

Furthermore, student participation in the semester-long cultural immersion projects provided many "teachable moments" for students to actually begin to experience what gender inequality looks like. One group mentioned that as one of their preparation activities for partnering with the Lesbian, Gay, Bisexual, Transgender, Queer (LGBTQ) Resource Center for their service-learning project, they were first going to visit mall stores and have one of the guys in the group dress as a transgendered woman. They were then going to record his interactions with sales associates in this role versus when he interacted with them as a cisgendered male. Before they carried out this project however, they were required to visit the community service organization they partnered with. After meeting with the director of the LGBTQ Resource Center on campus, he informed them that this wasn't a good idea because essentially they were mocking the experiences of transgendered individuals and it could come off as insensitive, particularly to someone who is transgendered. After revealing this to the class, one of the students in the group explained that she never realized how pretending to be someone she wasn't could be so insensitive, particularly after learning of the kinds of violence that transgender individuals face daily doing normal, everyday activities like shopping or walking down the street. Thus, the cultural immersion projects provided critical moments of awareness and self-reflection, helping them to form more nuanced perspectives about diversity and social justice issues, particularly as it involved developing a concrete understanding of sexual and gender inequality.

Since many students understand the idea of post-racial America as promoting a place of racial inclusion, discussing immigration often becomes a very tricky subject. Currently, Latinos are the largest minority group in the United States; however, obtaining the "American Dream" is often an elusive goal for them as many Latinos are plagued by poverty, criminalization and high levels of unemployment. Although the week of instruction on immigration is designed specifically to highlight the forms of structural oppression that an overwhelming majority in the Latino community face, I found it much more effective to approach immigration from a more nuanced perspective in which students could self-identify with the immigrant experience.

For instance, in one activity, students were instructed to write on the board the first words that came to their minds when they heard the word "immigrant." An overwhelming majority of them wrote words related to someone with a Latino identity. I used this exercise to ask students why they saw immigration as being so heavily related to a Hispanic person even though we had previously discussed how America itself is essentially a nation of immigrants. This discussion was held in light of the fact that each of them completed an Ethnic Roots essay at the beginning of the course describing their ancestry, which nearly all of them proudly traced back to various European countries. Even having done this a couple weeks before, many conceived of immigrants as non-European and largely Hispanic. After I drew attention to this, I noticed students began to ask more complex questions about immigration policies

because they were able to see their own familial past as part of an immigration story.

Towards the end of a class discussion, one student remarked that he had changed his mind about the Dream Act. He stated that he now supported it because he believed that everyone should have a chance to become an American citizen if they so desire, especially those who could implement beneficial social and political change in America if only they were able to receive a college education. In explaining this, he used his own immigrant grandparents and his own career goals as an example. Furthermore, students were given an impromptu quiz from the naturalization test.

Having them take this quiz allowed them to not only refresh their knowledge about the American government, but it also served to better familiarize them with the process of gaining citizenship in this country. After taking the quiz, many students remarked that it was difficult because they hadn't been made to think about questions relating to civic identity for quite some time. While some students were genuinely upset and offended at the fact that they were made to take a naturalization quiz as an American citizen, this prompted some to state that they were embarrassed to realize they didn't know as much about the American political system as their immigrant counterparts who became naturalized.

The week of instruction on immigration proved one of the most insightful. This was evidenced in student's final class reflection papers, particularly when one wrote that his favorite moment in the class was during the lecture when Mexican immigrants came in to speak about the kinds of personal, harrowing experiences they encountered while attempting to lead a normal life in America. The speakers shared experiences ranging from facing constant blatant discrimination to the numerous issues they meet as a result of being undocumented. Likewise, another student wrote: *"I learned a lot about the hardships faced by immigrants to this country and the guest speaker made me realize that there are many difficulties that these people face that I had never thought of"* (VR, personal communication, 2014).

As a TA, I have found that creating an opportunity for students to self-empathize allows them to look beyond the post-racial myth and dismantle how systemic forces enact a kind of violence in the lives of other marginalized subjects. As one student wrote, *"I originally thought that minority groups only had to do with race. In reality, minority groups can encompass a wide variety of traits… When I talk about myself to other people now, I am more aware of the minority aspects of my identity."* In order to quell student resistance in diversity and social justice education courses, it is imperative that students are able to insert not only their voices into the conversations, but also engage their own varied intersectional identities and experiences.

Reflections on Affirmative Action by a PhD - Agricultural Economics

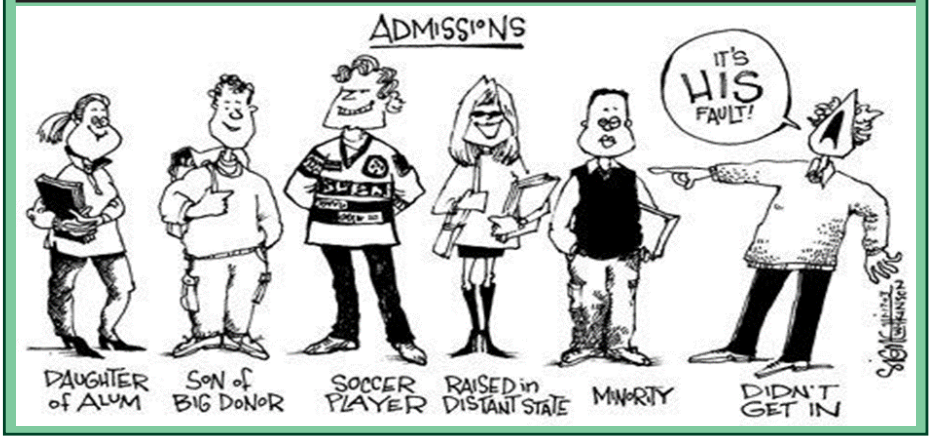
Serving in the role of TA opened my eyes to the fact that a great deal of students believe that we are indeed living in a post-racial era where all Americans, regardless of their gender or skin color, will be afforded similar opportunities in society and in particular, in the workplace. Teaching a subject such as Affirmative Action can be difficult when you do not believe that minorities are viewed and treated equally in the workplace or education institutions. Affirmative Action, which is also referred to as "positive discrimination," is centered on policies that help ensure that members of disadvantaged groups gain equal access to the same opportunities and resources given to the larger privileged group. From the beginning, I knew that there would be a strong misconception among the students that Affirmative Action was engineered to help only African-Americans. As an African-American male knowing these misconceptions, I felt that it was important that they understood the true scope of the policy and that all minority groups, including women, are protected under the Affirmative Action mandate.

During discussion, a number of students argued that Affirmative Action was nothing more than a form of reverse discrimination—discrimination against the majority in favor of historically disadvantaged groups. I found their arguments intriguing. Many of the students voiced that white men and women faced reverse discrimination in the job market. Even though the policy is structured so that Affirmative Action is only used in the decision process when candidates are equally qualified, their claim was that less qualified minorities are given jobs simply because of Affirmative Action. After deconstructing the true policy's definition, I was able to educate them on just how much the policy helps to level the playing field. Some of my white female students only saw Affirmative Action as something harmful to one's professional career. Their opinions swiftly changed as I explained that the policy was to their benefit as well, offering protection for all minorities including women.

To demonstrate, I presented the example of the Fisher vs. University of Texas U.S. Supreme Court case. The case involved Abigail Fisher and Rachel Michaelwicz, two University of Texas at Austin applicants who were denied entrance in 2008. Both women filed a lawsuit against the university claiming that they were denied admission based on them being Caucasian—and was therefore a violation of their Fourteenth Amendment. They believed that the school's Affirmative Action policy prevented "qualified" students like themselves from being admitted, while accepting what they considered "less-qualified" individuals from various underrepresented groups (Santoro and Wirth 2012). I provided them with this example as a way of helping them realize that Affirmative Action goes beyond the common workplace and as a way of prompting a discussion regarding whether they believed the women had a strong case. As expected, many of them felt that race and ethnicity played a major role in minorities being admitted into

college. In fact, many of them felt that skin-color was weighted heavier in the college admission process than a potential student's academic record. One student spoke on his personal experiences with being denied from a university despite his stellar academic record in high school. His friend, who happened to be African-American, was admitted into the same university. He argued race had to have played a factor in his acceptance since they were involved in the same extracurricular activities and his friends' grades were not as strong as his. I looked at this as an opportunity to present an alternative viewpoint.

Figure 1.



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I showed the above picture to my class to illustrate that various factors beyond the obvious can play into college admittance. For instance, universities with athletic programs often accept a large number of athletes who are not as strong academically as other applicants and a family's legacy and/or financial contributions to the school can influence eligibility. Situations such as these lead to a number of qualified students being overlooked. It was important that I clearly explained that race and ethnicity was only one of many factors that can influence admission decisions. After understanding this, they were then able to consider other reasons why the two white females might have not been accepted into the University of Texas at Austin.

I ended the class with a discussion on feasible alternatives to the Affirmative Action policy by asking how universities and employers could ensure equal opportunities for all possible candidates. We listed each of the alternatives one-by-one on the whiteboard. One suggestion was to have a blind selection. Employers and schools would review applications without knowledge of race and/or ethnicity. This way, they would be judging candidates simply based on their credentials and nothing else. Another popular suggestion was to not only ignore an applicant's race and ethnicity when reviewing their applications, but to also ignore their first and last name, since names can serve as an indicator of one's racial and cultural background. Again, ignoring such characteristics help to make the review process more fair.

Serving as a TA for a diversity and social justice education course revealed to me the importance of diversity education. A number of students have many misconceptions regarding topics like Affirmative Action. Educating them on such topics helps to ensure their post-graduate success and helps to combat forms of discrimination. Holding critical discussions for each topic covered in the course allows students to present their own viewpoints, where others are able to challenge them in a safe learning environment. I made it my duty to facilitate healthy discussions that could be enlightening for everyone, including myself. With diversity education courses you never quite know how much you have impacted the opinions of your students. You can only hope that some walk away with a greater sensitivity towards others who may come from different cultural backgrounds.

Reflections on Teaching about Race, Privilege, and Classism by a Masters Student – (Animal Sciences)

I found the race and privilege section to be one of the most challenging topics to teach in diversity and social justice education for a number of reasons. Two challenges can be illustrated using responses I have received in my course evaluations over the past 6 semesters I have taught the course: *"Do not sit a large group of white farmers in front of a faculity [sic] of Blacks and tell us not to be racist."* This quote demonstrates the sometimes perceived, but sometimes accurate notion that students see me as less credible to teach them about racism and privilege because I am an African American woman. The fact that throughout my tenure of teaching the course there has never been an entirely black teaching staff further reinforces my idea that student perceptions have a major influence on how they see me. For a black woman to state that racism is still very prevalent and that male privilege exists, is viewed as no more than a personal complaint born out of frustration from a perceived, but non-existent disadvantage.

Another student wrote that: *"Overall, I felt oppressed during the semester in an environment where middle-class, Christian white people were displayed in a light of only finding success only through "privilege," and I was left extremely unimpressed with the course."* This second response highlights the view that many of my students feel personally attacked in response to our discussions on privilege. Despite the fact that as instructors, we continually reiterate the fact that privilege is not inherently bad, or any one person's fault, but is rather a reality of society, many students remain adamantly opposed to acknowledging its existence because in order for privilege to exist, they must "give up the myth

of meritocracy" (McIntosh, 1989). To deny meritocracy is to deny the American Dream that perpetuates the notion that anyone can "pull themselves up by their bootstraps" because everyone in America has equal opportunities. When we begin to talk about racism and privilege, white students, especially white male students, feel as if they are being personally attacked and this becomes an obstacle to learning.

Adding to these challenges, the majority of current students are a part of the millennial generation where the myth of a post-racial society prevails. They have trouble seeing racism as a societal and institutional problem since most of them are in the majority and have never experienced it, nor do they personally know people who have. Furthermore, they fail to realize that racism is present in more than interpersonal interactions. Though most of them will admit that racism is still a problem even though race relations have improved since the sixties, many view the problem as being rare and occurring only in isolated incidences. Essentially, they agree that racism probably will never be completely eradicated, but because it is limited to a select few, it is not a significant issue and does not, for the most part, cause major problems today.

Strategies I have used to combat resistance to discussions on racism and privilege include the use of current events, the provision of a historical framework and the inclusion of outside opinions as well as personal testimonies. The use of current events provides students with a context for why we are discussing the issues of racism and privilege. It allows them to see that modern racism, although more subtle than in the past, still exists and is neither isolated nor rare. Providing students with a historical framework allows them to understand how actions of the past have shaped society today and reiterates that privilege is not due to the action of an individual. When discussing privilege, we include other types of privilege as well, such as the privilege of being able bodied, in order to help students understand that privilege is not linked to just race and gender, but to multiple social identities. Lastly, the inclusion of outside voices allows students to understand that I am not making a personal complaint. Students are assigned to read Peggy McIntosh's (1989) article "White Privilege: Unpacking the Invisible Knapsack" which explains white privilege from the perspective of someone who has experienced it. We discuss their experiences and I share my own experiences of being privileged in some instances and disadvantaged in others in order to maintain an open and honest environment with the students. I have found that employing these strategies over the course of my time teaching this course has decreased some of the negative attitudes and resistance associated with these sections, as well as keep the students from feeling personally attacked.

In my opinion, classism is one of the most interesting units that we cover in the course. The major strategy that I have used for countering classist mindsets has been to question students on how they have come to their conclusions. Most often, there have been assumptions made to which I will provide examples and scenarios that are counter to those assumptions. I do acknowledge that the assumptions that they have made may be true in some instances, but my goal is to get them to realize that those assumptions cannot be all encompassing. Statements such as the "homeless can budget very little towards higher education without outside aid," suggests that some of my students cannot fathom what it means to have very little, or nothing at all. This phenomenon allows very little room for empathy and is compounded once again, with the idea that everyone has equal opportunity and therefore anyone should be able to pull themselves up from any situation. The most interesting thing I have found when teaching classism is that it is one form of oppression with which many seem to be content. If I were to infer that any of my students were being racist, there would be denial and quite possibly anger. However, with classism (also weightism and nativism), many students are willing to admit that they harbor negative biases and although some take this realization as a recognition that they should change, many do not see a need to change because they believe classism to be a justified form of oppression.

I have heard this justification echoed in a few of their semester-long project presentations. Throughout the semester, the students are assigned to groups and are supposed to pick a culture in which to immerse themselves and perform a service-learning project. Many of the groups that choose socioeconomic class do so because they assume it will be the easiest to perform a service. However, for some groups, rather than immersing themselves in the culture by actually getting to know the people in the lower class and learning their stories, they observe from a distance while performing their service. I can always tell from their presentations which groups actually immersed themselves and which groups did not. For the latter, their presentation usually contains some reference to how someone they encountered was not really in need of aid because they had a smartphone or some other item that the student decided was not befitting for a poor person. In the groups that have actually immersed themselves during their projects, there is usually a better understanding that everyone's situation is different and that everyone deserves to be treated with dignity despite their class status.

Although teaching about racism, privilege and classism is never an easy task, I have found that shifting the students' focus away from me or them as individuals and to trying to recognize and understand differing perspectives makes the conversation less hostile. Once they recognize that they are not being attacked or that we are not trying to force them to change their worldview, but rather we are trying to teach them that not everyone has the same views because of differing experiences and opportunities, the students begin to open their minds to the idea of plurality in society.

Discussion

The importance of developing effective instructional methods for educating diverse student populations continues to intensify as the diversity profiles of primary, secondary and post-secondary school systems grows ever more diverse. U.S. colleges and universities have recently begun to recognize that their students need to be able to interact and work with individuals who may not look like them and/or stem from different cultural backgrounds. The collegiate course outlined in this article focuses on a number of topics such as gender issues, weightism, race, ageism, as well as language and linguistics. Its sole purpose is to help develop students into more culturally competent individuals, while recognizing their own personal biases along with those of their peers. A select group of teaching assistants (TAs), which may be a combination of undergraduate students who have previously taken the course, graduate assistants and/or faculty, facilitate weekly lab sessions, spearheading class discussions on course topics and relying on a number of group activities and projects to help explore and reinforce ideas covered in the lecture component of class. Guiding discussions on diversity-related topics can be somewhat difficult for TAs despite any prior training and exposure to diversity and social justice education techniques. Literature providing insight into TA perspectives and experiences related to teaching diversity and social justice education courses is minimal at best and suggests that there is a large academic void to be filled.

TA perspectives for the diversity and social justice education class outlined in this paper attempt to fill a portion of this void by sharing personal challenges on teaching a selection of topics covered in the course. Each encounters hesitation by students when navigating class discussions. Through encouragement and the use of class projects as well as probing techniques such as the Socratic Method, all of the TAs have been effective in creating a safe environment where students could share freely and openly amongst one another. The TA from American Studies realized the importance of developing opportunities for students to "self-empathize" when discussing issues like post-racial America. The TA from Agricultural Economics discovered that a great deal of the misconceptions or biased opinions garnered by students on issues such as Affirmative Action was directly related to their lack of understanding of current initiatives. Only through supplying students with accurate and relatable information will they truly be able to form substantive opinions. The TA from Animal Sciences recalled that often students are not able to empathize with oppressed groups and/or individuals if they do not consider themselves to be a part of that group. One particular group project attempts to combat this issue by providing an opportunity for students to immerse themselves in unfamiliar cultures. Following the completion of the semester-long projects many students leave with heightened levels of compassion towards those in oppressed groups.

Conclusion

A common thread presented among TA perspectives was the heavy resistance faced when facilitating discussions about issues that made students uncomfortable while challenging their views. Each TA was responsible for developing a personal method of engaging students in these discussions. Although approaches seem to be different, each was successful in overcoming barriers that any instructor in diversity and social justice education courses will inevitably face.

This article presented viewpoints from teaching assistants of a diversity and social justice education course though the scope of an agricultural department at a Land Grant Midwestern University. While the perspectives may not be comprehensive in regard to subject matter addressed, they provide needed insight into challenges faced in this type of educational setting and offer viable strategies for addressing those challenges successfully. This information builds on a small body of research related to diversity and social justice education and challenges for teaching assistants, but provides a foundation on which to build for future quantifiable studies in these areas. Such studies might include those that explore specific factors that correlate with resistance in an agricultural context, as well as studies that explore levels of effectiveness for strategies TAs employ for overcoming resistance.

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Genetic Engineering Online Lesson Leads to Increased Knowledge and More Accepting Student Attitudes[1]

G. Troupe[2], D. Golick[3] and D. Lee[4]
University of Nebraska-Lincoln
Lincoln, NE

Abstract

Genetic engineering has been used to aid production of many high acreage crops in U.S. agriculture for nearly three decades. Despite this use of genetic engineering to create widely grown crops that are classified as GMOs (genetically modified organisms), skepticism of this technology is prevalent and consumer attitudes have not become more accepting over time. There are many factors that contribute to an individual's attitude toward genetic engineering, such as knowledge level, risk/benefit perception, background (urban vs. rural), gender and trust of government safety regulation. An online resource known as *The Journey of a Gene* was recently developed to teach the process of genetic engineering and address attitude factors. This study was designed to test the impact of the online resource on student knowledge and attitudes. By surveying nearly 900 students, we found that the online resource was effective in increasing student knowledge and shifting student attitudes to become more accepting of genetic engineering technology. This increase in accepting attitudes varied by gender, background and trust in government safety regulation. Our results demonstrate that genetic engineering attitudes are not static among young learners and the use of online, science-based learning resources can promote a more informed generation of consumers.

Introduction

Although genetically engineered crops or GMOs have been a part of the world food system for nearly three decades, some consumers are still skeptical of the technology. Crop genetic engineering is the manipulation of a plant's DNA in order to improve crop management or end use qualities of the crop. Genetic engineering is commonly done by inserting genes from a source other than the crop plant to encode proteins that perform a novel function. Another common genetic engineering technique involves new gene insertion to block the expression of a gene that already exists in the plant. Over 90% of the soybeans, corn and cotton planted in the U.S. have been genetically engineered, primarily to benefit farm production (Fernandez-Cornejo, 2014). Papaya, rice and canola crops have also been commercialized with genetically engineered events and are currently available on the U.S. market.

Experts in biotechnology have long assumed that consumer attitudes towards genetic engineering would become more accepting over time, gradually diminishing in skepticism and risk perception while embracing the use of genetic engineering technology in our food system. However, consumer attitudes have not changed much since the entry of genetically engineered foods to the marketplace (Frewer et al., 2013). Many studies have found a positive correlation between knowledge of science or biotechnology and accepting attitudes towards genetic engineering (Mowen et al., 2006; Tegegne et al., 2013; Fonseca et al., 2012; Mowen et al., 2007; Sohan et al., 2002). A meta-analysis has indicated that a positive correlation between knowledge and attitudes holds across contexts and cultures (Allum et al., 2008). In addition to knowledge, an individual's attitude toward genetic engineering can be shaped by their view of the benefits and the risks of genetic engineering for their health, the environment and the economy.

Few studies have been conducted to directly link instructional practices with learner attitudes about genetic engineering. Our goal was to develop a resource that teachers could easily adopt and incorporate into classrooms. Our team designed *The Journey of a Gene* (passel.unl.edu/ge), an online educational tool built to teach the steps required to produce a genetically engineered crop. *The Journey of a Gene* presents learning through a problem-solving context and focuses on the story of developing disease-resistant soybeans for farmers. This resource organizes the science and technology of the genetic engineering process into four

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[2]Department of Agronomy and Horticulture, gtroupe@huskers.unl.edu, 402-805-7990
[3]Department of Entomology, dgolick@unl.edu, 402-472-8642
[4]Department of Agronomy and Horticulture, dlee@unl.edu, 402-472-1528

main steps. Within each step, students can view short videos and animations to learn the information needed to understand each step of genetic engineering. Each section concludes with a video of a scientist who takes the students into their lab, greenhouse or field to share how the step is done. The online learning environment also includes a section on risks and benefits which provides instruction on food safety testing for GMOs and shares video testimonials representing arguments both for and against the application of genetic engineering in our food system. Integrating this instructional resource into high school or entry-level college curriculums could educate future consumers.

This study was done to test the hypothesis that student use of *The Journey of a Gene* as a learning resource would lead to a more accepting attitudes toward genetic engineering. A survey measuring attitudes towards genetic engineering was given to nearly 900 students in one high school course and four college science courses. Half of the students took the survey before receiving the educational treatment (pre survey/control group) and the other half took the survey after receiving the educational treatment (post survey/treatment group) and the scores of these groups were compared.

Methods

Population and Treatment

The sample population and sampling frame for this study included four college science courses (biology, genetics, plant science and biotechnology) taught at the University of Nebraska-Lincoln and one Iowa high school course (biotechnology) during the fall semester of 2014. The courses were chosen based on relevance of the genetic engineering lesson material to the course content. The participating courses represented a diverse population of students based on class standing and professional goals. The introductory biology course included 689 students who were primarily college freshman and sophomores from all science and non-science majors. The genetics course was comprised of 29 students who were sophomores through seniors in agriculture-related majors. Similarly, the 71 participants in the plant science course were primarily freshman in agriculture-related majors. The biotechnology course was an online class that included 32 students and incorporated a wide variety of majors and including freshman to seniors and non-traditional students. The high school course was a biotechnology class and was comprised 21 of junior and senior students primarily from agricultural backgrounds. Altogether, the sample of these five courses was nearly 900 student participants. The instructors who taught these biology-related courses incorporated *The Journey of a Gene* content voluntarily. The deployment of the *The Journey of a Gene* as a learning treatment was timed to fit with the topic learning schedule in the course.

Variables and Measures

The dependent variables measured in this study were 1) attitudes towards genetically engineered organisms (GMOs) and 2) knowledge about the process of creating GMOs. The independent variable was an educational treatment, *The Journey of a Gene* educational module.

To measure these variables, a survey was adapted from two existing survey instruments: Sohan et al. (2002) and the Eurobarometer (http://ec.europa.eu/public_opinion/archives/ebs/ebs_341_en.pdf). The Sohan instrument was designed to correlate prior knowledge with attitudes. It was modified to fit the current study by writing new knowledge questions to reflect the use of *The Journey of a Gene*. This was accomplished by replacing the six current event multiple choice questions in the Sohan survey with 13 true/false questions reflecting the process of genetic engineering (Table 2). The new questions were general in nature such that individuals who already were familiar with genetic engineering would be able to answer the questions correctly. The Eurobarometer is well established as an instrument to measure the consumer attitudes toward genetic engineering. The Sohan and Eurobarometer instruments were combined by entering both survey instruments into a single online survey using SurveyMonkey, an online survey software.

Using the Sohan and Eurobarometer survey instruments together, attitude was measured using 43 attitude statements (Table 4) that were rated on a 4-point Likert-type scale. The response options were strongly disagree, disagree, agree and strongly agree. The attitude questions encompassed the following major components of attitude: impact on environment, impact on health, fear, impact on the economy, emotion, usefulness and risk perception.

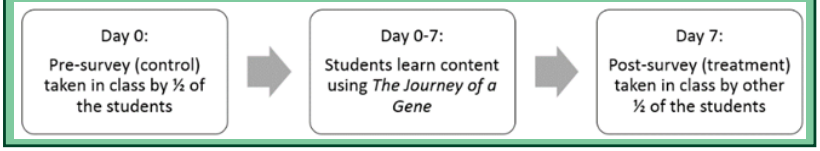
To describe and differentiate the survey population, demographic data was collected on the participants, including gender, childhood surroundings (urban or rural), degree program and whether they trust government safety regulations. These demographics were also used as possible attitude-affecting factors (Table 5).

Validity, Reliability and Pilot Study Procedures

Several measures were taken to maximize the validity and reliability of the questionnaire before the study commenced. Non-experts who were similar to the sampling frame reviewed the survey to provide face validity. These individuals provided details about the survey design, readability, ease of completion and understandability. Review of the instrument was also done by relevant experts, which included an educational researcher, genetic engineering expert, genetics professor and statistician to provide content validity. Cognitive interviews were also conducted with two individuals similar to the survey population to identify design flaws and potential points of confusion that could affect data collection. In addition, the instrument had already been tested in two prior studies in different contexts. Since the instrument

contains several questions relating to each construct, reliability was measured with Cronbach's alpha. The attitude survey, consisting of 48 items, was found to be reliable in a post-hoc analysis with an alpha level of 0.960. The knowledge survey, consisting of 13 items, had an alpha level of 0.413.

Figure 1. Data collection timeline



Survey Procedures

The Journey of a Gene online resource was incorporated into the lab or recitation sections in each of the courses described as approved by the University of Nebraska Institutional Review Board (IRB). Students were divided into pre (control) and post survey (treatment) groups by lab sections. The groups were assigned so that an equal number of sections offered at certain time slots would be distributed between the treatment and control groups to make the groups as similar as possible. In addition, if a teaching assistant (TA) taught two sections, one section was placed in the treatment group and one section was placed in the control group in order to minimize teacher effect. TAs were trained by the research team on the implementation of the survey and *The Journey of a Gene* resource one week prior to implementation of the study. Students were required to use an e-mail feature in the resource to report their quiz scores to their teacher for each of the four sections of the resource before coming to class. Students were given time to take the online survey during class to minimize non-response error. On the first page of the survey, students were presented with an online version of the informed consent form where clicking 'next' to begin the survey indicated their consent. Students were also reminded by their TA that their participation was voluntary and anonymous.

Implementation of the study varied by class to fit the course curriculum. Once the study began, it was completed within an eight-day period. The lab and recitation sections assigned to the pre group did not receive instruction on genetic engineering prior to taking the survey. The pre survey group sections took the survey on the first day of the study. Following this lab session, all students were given one week to go through *The Journey of a Gene* educational treatment as a homework assignment. The post survey group had studied *The Journey of a Gene* the week prior to taking the survey on the last day of the study (Figure 1). The design allowed each student to receive an equal educational experience.

Data Analysis.

To analyze the data from the survey instrument, the data was coded numerically in the survey software (SurveyMonkey). The Likert scale enabled participants to have a numerical score representing how accepting their attitude was toward application of genetic engineering and their understanding of the science facts that underpin genetic engineering technology. The attitude scores were reported as a cumulative score of all 48 attitude questions. Each attitude question received a score of 1-4, with 1 being least accepting and 4 being most accepting. The knowledge scores were reported by the percent of questions answered correctly out of 13. Incomplete surveys with missing values were removed from the data set. Some questions were also reverse coded so that all answers were measured on the same scale. The data were analyzed using SAS 9.4 (SAS Institute, Cary, NC). The pre and post survey group scores were compared using a two-tailed paired t-test (α=0.05). Paired t-tests were run to analyze whether the treatment effect was greater for certain demographics in the population.

Results

Knowledge about Genetic Engineering

To determine the impact of *The Journey of a Gene* on knowledge of genetic engineering, a two-tailed t-test was used to compare knowledge scores between pre and post survey groups. The post survey group had higher knowledge scores than the pre survey group and the difference between these groups was significant (Table 1). The Cohen's D standardized effect size was 0.53. Although the post survey group averaged only one additional correct answer than the pre group, the increase in score was contributed by increases in all 13 of the knowledge questions (Table 2). The increase in score across questions suggests that the online learning through *The Journey of a Gene* was effective in improving basic knowledge about the genetic engineering.

Attitudes toward Genetic

To determine the effect of *The Journey of a Gene* online resource on student attitudes toward genetic engineering, a two-tailed t-test was used to compare attitude scores from the pre and post groups. More accepting student attitudes were found in the post group; this difference was statistically significant (Table 3). The Cohen's D standardized effect size was 0.25. The shift to more accepting attitudes held true in all but five of the forty-eight individual attitude questions (Table 4). This result indicates that *The Journey of a Gene* resource resulted in a significant shift in attitudes toward genetic engineering.

Attitude Differences by Group

Table 1. Mean Group Scores on Knowledge Questions on the Science and Technology of Genetic Engineering

	Group Score*	SE	Lower	Upper	p
Pre (Control)	62.33	0.61	61.12	63.53	
Post (Treatment)	70.20	0.65	68.91	71.46	< .0001

*Scores reported as a percent correct out of 13 knowledge questions.

Table 2. Genetic Engineering Science and Technology Knowledge Questions and Mean Scores in Pre and Post Survey Groups

	Correct Answer	Percent of Students Answering Correctly		Difference
		Pre	Post	
Genetic engineering can be used to move a gene between any two organisms.	T	79	89	9.80 *
Genetic engineering has replaced traditional cross breeding in the majority of crop variety development.	F	35	38	3.39
There are organisms that move their genes into other unrelated species in nature.	T	63	65	1.83
Food safety testing is not done until after a genetically engineered crop is already on the market.	F	79	86	7.06 *
Genetic engineering involves changing a large portion of an organism's genetic makeup.	F	65	79	14.08 *
Genetic engineering is done by injecting new genes into seeds before the farmer buys them.	F	34	40	5.97
Genetically engineered plants can only reproduce by cloning.	F	76	81	4.68
Genes can be transferred between species because the genetic code is a universal language across species.	T	59	85	25.02 *
Genetic engineers can select the exact location where a new gene is inserted in a genome.	F	20	25	5.14
Genetic engineers will know what protein is encoded by the gene before they ever insert it.	T	75	83	8.47 *
Genetic engineering changes a single plant cell, which is then grown in to a whole plant.	T	75	81	6.58 *
Once a gene is inserted into a plant it becomes hidden and scientist cannot detect its presence.	F	84	88	4.45
Science has not progressed enough that the genetic engineer can control where the inserted gene is expressed.	F	68	72	3.65

*Indicates the difference between the percentage of correct answers in the pre and post groups is significant at a level of α=.05. The color in the difference column increases with intensity to indicate larger differences between pre and post group scores.

Previous studies have indicated differences in attitude toward genetic engineering associated with gender, urban vs. rural background, trust in government safety regulation and genetic engineering information source. To investigate whether these group differences existed in the student population and to determine if *The Journey of a Gene* had a greater impact in certain groups, two-tailed independent t-tests were used to compare the pre and post groups. Males were significantly more accepting of genetic engineering than females in both the pre group and the post group (Figure 2a and Table 6). The higher score for accepting attitude for females in the post group over the pre group was statistically significant (p=0.0008) while the higher attitude scores for males was not statistically different than the pre scores. Students from rural backgrounds were significantly more accepting of genetic engineering than students from urban backgrounds in both the pre and post groups (Table 6 and Figure 2b). The treatment effect, however, was approximately equal between the groups as indicated by the similar difference between group mean attitude scores pre and post (pre= 7.3833, SE=1.7878, post=7.1204, SE=2.0109). Similar results were found based on trust of government safety regulation. Students who indicated trust in government safety regulation had significantly higher scores than students who distrusted government safety regulation in the pre and post groups (Table 6 and Figure 2c). The treatment impact between pre and post within the trust and distrust groups was not statistically measurable.

Table 3. Mean Group Scores on Acceptance of Genetic Engineering in the Food System , Attitude Questions

	Group Score*	SE	Lower	Upper	p
Pre (Control)	117.09	0.90	115.33	118.86	
Post (Treatment)	121.70	1.01	119.73	123.68	0.0007

*Scores reported as a total score compiled from all 48 knowledge questions. Each attitude question which ranged from score of 1 (least accepting) to 4 (most accepting) on a Likert scale.

Table 5. Demographics of the Respondents from the Life Science Courses in this Study

		Number of Respondents	
		Pre	Post
Gender	Female	277	223
	Male	195	158
Student Background	Rural	219	161
	Urban	253	219
Primary Source of Knowledge	Blogs	21	16
	College	166	189
	Friends	95	46
	News	160	121
Trusting of Government	Trust	294	280
	Distrust	178	98

Table 6. Differences of Attitude Mean Scores by Demographic Group Among the Life Science Course Students in this Study

Treatment	Group	Group Score*	SE	Lower	Upper	p
Pre	Female	112.51	1.15	110.26	114.76	
	Male	123.84	1.36	121.16	126.51	
	Comparison	-11.33	1.78	-14.82	-7.83	<.0001
Post	Female	118.30	1.28	115.80	120.81	
	Male	126.84	1.52	123.87	129.82	
	Comparison	-8.54	1.98	-12.43	-4.65	<.0001
Pre	Rural	121.15	1.31	118.58	123.72	
	Urban	113.76	1.22	111.37	116.15	
	Comparison	7.38	1.79	3.87	10.89	<.0001
Post	Rural	126.01	1.53	123.01	129.00	
	Urban	118.89	1.31	116.32	121.45	
	Comparison	7.12	2.01	3.17	11.07	0.0004
Pre	Distrust government	104.04	1.29	101.51	106.57	
	Trust government	125.15	1.00	123.18	127.12	
	Comparison	-21.11	1.63	-24.31	-17.91	<.0001
Post	Distrust government	106.70	1.73	103.30	110.11	
	Trust government	127.25	1.03	125.24	129.27	
	Comparison	-20.55	2.02	-24.50	-16.59	<.0001

Discussion

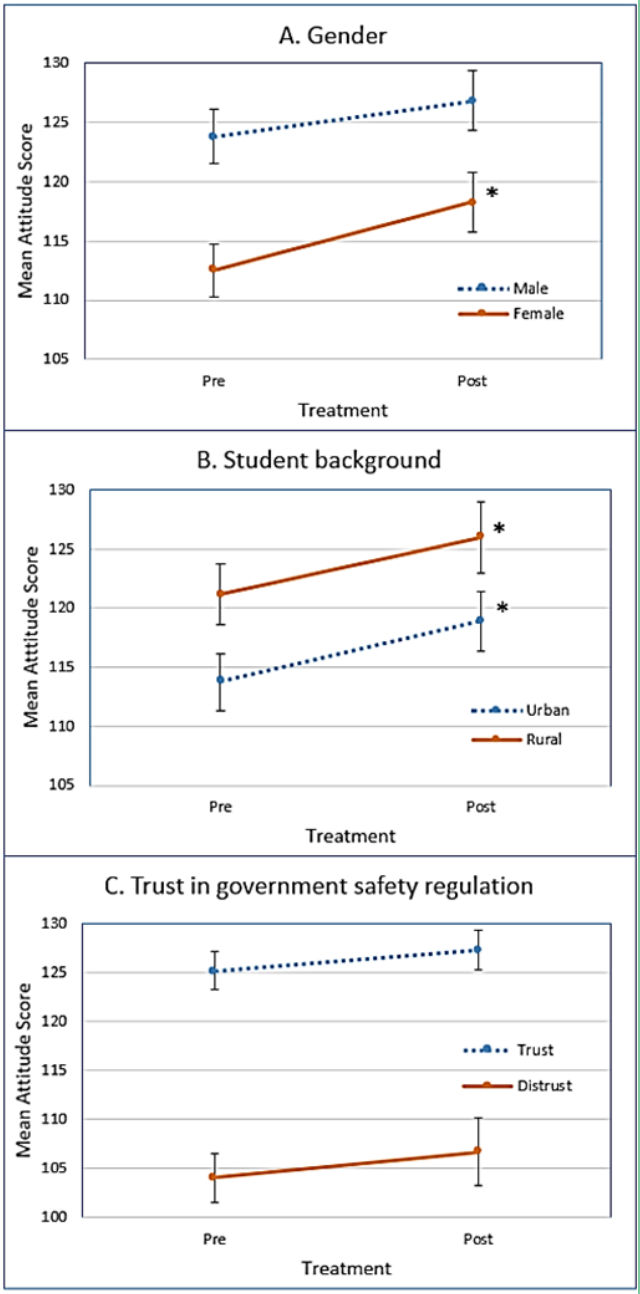
Our results demonstrate that genetic engineering attitudes are not static among learners who are at or entering the young adult consumer demographic. This study also supports

Table 4. Acceptance of Genetic Engineering in our Food System Attitude Questions and Mean Scores in Pre and Post Survey Groups

For each of the following issues regarding GM food please tell me if you agree or disagree with it.		Average Pre Score	Average Post Score	Difference	
	GM food is good for the US economy	2.91	3.07	0.16	*
	GM food is not good for you and your family	2.66	2.81	0.15	*
	GM food helps people in developing countries	3.06	3.18	0.12	*
	GM food is safe for future generations	2.64	2.92	0.28	*
	GM food benefits some people, but puts others at risk	2.40	2.32	-0.09	
	GM food is fundamentally unnatural	2.30	2.47	0.18	*
	GM food makes you feel uneasy	2.73	2.94	0.21	*
	GM food is safe for your health and your family's health	2.61	2.87	0.26	*
	GM food does no harm to the environment	2.43	2.59	0.16	*
	The development of GM foods should be encouraged	2.68	2.93	0.25	*
The first way is to artificially introduce a resistance gene from another species such as a bacterium or animal into an apple tree to make it resistant to mildew and scab. For each of the following statements about this new technique please tell me if you agree or disagree.					
	It is a promising idea	3.04	3.19	0.15	*
	Eating apples produced using this technology will be safe	2.69	2.81	0.12	*
	It will harm the environment	2.68	2.81	0.14	*
	It is fundamentally unnatural	2.37	2.50	0.13	*
	It makes you feel uneasy	2.66	2.83	0.16	*
	It should be encouraged	2.71	2.83	0.13	*
The second way is to artificially introduce a gene that exists naturally in wild crab apples which provides resistance to mildew and scab. For each of the following statements about this new technique please tell me if you agree or disagree.					
	It will be useful	3.18	3.31	0.13	*
	It will be risky	2.61	2.66	0.05	
	It will harm the environment	2.84	2.89	0.05	
	It is fundamentally unnatural	2.59	2.65	0.06	
	It makes you feel uneasy	2.81	2.94	0.12	*
	It should be encouraged	2.89	2.98	0.10	*
It is acceptable to direct the genetic material of an organism by:					
	inserting a foreign gene	2.47	2.70	0.23	*
	blocking the expression of an existing gene	2.76	2.83	0.08	
	using selective breeding programs	2.96	3.04	0.08	
	using artificial insemination	2.67	2.68	0.01	
It is acceptable to combine genes between:					
	the same plant species	3.16	3.21	0.04	
	different plant species	2.84	2.98	0.13	*
	the same animal species	3.07	3.07	0.00	
	different animal species	2.50	2.57	0.07	
	plants and animals	2.21	2.28	0.08	
For each item below, please indicate the level to which to agree or disagree.					
	Genetically altered foods should be labeled.	1.84	1.83	-0.01	
	Genetically altered foods are superior to traditionally bred foods.	2.28	2.25	-0.03	
	Genetic engineering may alleviate world food shortages.	3.03	2.99	-0.03	
	It is acceptable to genetically engineer plants for food.	2.85	2.98	0.13	*
	Genetically altered organisms such as animals are safe to eat.	2.53	2.62	0.09	
For each item below, please indicate the degree to which you agree or disagree.					
	Genetically altered organisms disrupt the balance of nature.	2.43	2.55	0.13	*
	Genetically altered organisms present a health hazard.	2.62	2.63	0.01	
	The risk of genetic engineering is outweighed by the benefits.	2.50	2.57	0.08	
	The risk of genetic engineering is minimal due to strict safety regulations.	2.57	2.77	0.19	*
	Genetic engineering may contribute to the disappearance of small farms.	2.14	2.32	0.18	*
	Genetic engineering may enhance the quality of life for all Americans.	2.59	2.69	0.11	*
	Genetic engineering may create new job opportunities.	2.96	2.97	0.01	

*Indicates the scores between the groups are significantly different at a level of $\alpha \leq .05$. Scores for each attitude question ranged from score of 1 (least accepting) to 4 (most accepting) on a Likert scale. If a question was asked in the negative, the scale was corrected so a higher score would always indicate a more accepting attitude.

Figure 2. Attitude scores by treatment and demographic.



Demographics: A) gender, B) student background, C) trust in government safety regulation. The pre treatment group represent students in the control group who had not used *The Journey of a Gene* educational treatment before taking the attitude survey. Post treatment group represents students whohad received the treatment before taking the attitude survey. Higher attitude scores represent student attitudes that are more acception of genetic engineering technology. All differences between scores by demographic represented in A-C are significant at a level of α=.05.

*Indicates the pre-post difference within the demographic is significant a level of α=.05.

the premise that learners can advance their understanding of the science that underpins genetic engineering and the differences between foods from GMO vs. non GMO crops by working with online learning resources that are appropriately crafted and integrated into life science courses. The shift in attitudes toward approving this technology in our treatment group is consistent with other studies that demonstrate a link between science understanding and the acceptance of GMO technology.

Many factors can impact the relationship between knowledge and accepting attitudes. These factors include trust in regulators (Qiu and Huang, 2006; Moon and Balasubramanian, 2004; Brossard and Nisbet, 2007; Priest et al., 2003; Hossain and Onyango, 2004), media coverage (Priest, 2001; Brossard and Nisbet, 2007; Hoban, 1998; Fritz et al., 2004), gender (Brossard and Nisbet, 2007; Hossain and Onyango, 2004; Mowen et al., 2006; Sohan et al., 2002), risk/benefit perception (Brown and Ping, 2003; Moon and Balasubramanian, 2004; Falk et al., 2002; Lusk et al., 2004; Lusk et al., 2005; Frewer et al., 2013), rural vs. urban background (Mowen et al., 2006; Tegegne et al., 2013), area of study (Sohan et al., 2002; Tegegne et al., 2013; Fonseca et al., 2012; Lamanauskas and Makarskaitė-Petkevičienė, 2008) and education level (Allum et al., 2008; Saad, 2001). All of these factors may contribute to the development of attitudes toward genetic engineering to varying degrees.

Trust, demographics, risk-benefit perception and knowledge have a combined, complex impact on an individual. The factor of knowledge, however, is the most pliable and realistically changed. For example, after a small biotechnology lesson, Minnesota high school students indicated they felt more positively about the use of genetic engineering in food production (Reicks et al., 1996). Similar results were found with a group of Virginia high school students who participated in a two-week biotechnology curriculum (Stotter, 2004)

Greater acceptance among post survey participants over pre survey participants indicates that *The Journey of a Gene* educational treatment likely influenced student attitudes to become more accepting of genetic engineering (Table 2). Our result is consistent with other educational interventions (Reicks et al., 1996; Stotter, 2004). The increase in attitude score was relatively small: 4.61 points on a 172-point attitude scale. Given *The Journey of a Gene* resource was implemented as homework which inherently comes with high degree of student choice, the impact on attitude reveals a high potential influence of education on this population. An attitude shift for high school or college students is important as these students are future household purchasers of food.

We also showed an increase in knowledge scores with the treatment (Table 1). Our knowledge questions were intended to measure what students knew about every step of the genetic engineering process. The questions also addressed some common misconceptions. Therefore, not all of the questions would necessarily fit within the same construct. The Cronbach's alpha reliability of the knowledge instrument was 0.413, however this measure assumes that all the questions are measuring a single construct. In a post-hoc analysis we found that there were likely three factors represented in our knowledge instrument. It is likely that there are actually multiple factors involved in a complete understanding of the process of genetic engineering. Thus, our knowledge questions may still be practical for

indicating an increase in understanding of many of the dimensions of the process of genetic engineering.

The Journey of a Gene's positive impact on attitude was likely a result of addressing a combination of the reported effectors of attitude, such as knowledge and risk-benefit perception. First, *The Journey of a Gene* most purposefully addressed knowledge, which is a well-supported contributor to accepting attitudes (Mowen et al., 2006; Tegegne et al., 2013; Fonseca et al., 2012; Mowen et al., 2007; Sohan et al., 2002; Allum et al., 2008). Although there are many content areas that could be addressed, *The Journey of a Gene* specifically worked to increase knowledge of the scientific process of creating a genetically modified crop. Another contributor to attitude, risk-benefit perception, (Brown and Ping, 2003; Moon and Balasubramanian, 2004; Falk et al., 2002; Lusk et al., 2004; Lusk et al., 2005; Frewer et al., 2013) was addressed in *The Journey of a Gene's* case study format. The case study format gave students insight into a current real-world soybean disease problem and introduced them to a farmer who would directly benefit from a genetic engineering solution. The case study approach gives students a view into the benefits of genetic engineering technology which they may not otherwise see directly.

The Journey of a Gene had the potential to impact many of the factors of attitude, but it affected students to different degrees based on their demographic. For example, females were less accepting of genetic engineering than males, which is consistent with previous studies (Brossard and Nisbet, 2007; Hossain and Onyango, 2004; Mowen et al., 2006; Sohan et al., 2002). When males and females of different college majors were compared, females enrolled as education majors were the least accepting of genetic engineering (Sohan et al., 2002). Additionally, teacher attitudes toward content are known to impact the attitudes of their students (Lock et al., 1995). Therefore, informing future teachers who will shape perceptions of the next generation of consumers is important. Future work should investigate how tools like *The Journey of a Gene* can better inform pre-service teachers.

Another demographic that we found represented a difference in attitude score was the level of trust in government safety regulation, which is also a known factor of attitudes toward genetic engineering (Qiu and Huang, 2006; Moon and Balasubramanian, 2004; Brossard and Nisbet, 2007; Priest et al., 2003; Hossain and Onyango, 2004). *The Journey of a Gene* resource had the potential to impact students' trust of government safety regulation by using videos to introduce students to the scientists behind the process of genetic engineering. By giving students insight into the safety testing of genetically engineered products, *The Journey of a Gene* had the potential to minimize perceived risk and increase trust. Not only do students hear the stories of scientists who produce genetically engineered products, but a section of *The Journey of a Gene* also focuses on the food safety regulation process required for genetically modified products. In our study, students who trusted government safety regulation had significantly higher scores than those who did not in both the pre and post survey (Table 6 and Figure 2), which is supported by previous works (Qiu and Huang, 2006; Moon and Balasubramanian, 2004; Brossard and Nisbet, 2007; Priest et al., 2003; Hossain and Onyango, 2004). Students who trusted the government safety regulation had the most accepting attitudes of the three demographics in both pre and post surveys, with the treatment having no statistically measurable effect. Students who distrusted government safety regulation had the lowest acceptance score of all the demographics groups (Table 6). Distrusting students in the post group were similarly unaccepting of genetic engineering after the treatment. Both trusting and distrusting groups held strong opinions. Neither group showed a significant change in attitude score in response to *The Journey of a Gene*. The consistent opinions of the students may indicate that trust is very difficult to effect through a short video series like the one presented in this study. The large difference in attitude scores between trusting and distrusting students may also indicate that trust is a particularly strong contributing factor toward the formation of attitudes toward genetic engineering. It could be advantageous to learn whether increased knowledge about the regulation process would lead to a greater trust and in turn an increase in accepting attitudes.

We also found that urban students were less accepting of genetic engineering than rural students, which is consistent with previous studies (Mowen et al., 2006; Tegegne et al., 2013). Although the study population included a wide variety of academic majors from urban and rural backgrounds, the study was conducted in Iowa and Nebraska, where the economy is agriculturally driven. Future investigation is needed to reveal whether the trends reported in this study hold true in other regions of the country that have fewer agricultural ties. Future studies that investigate urban settings will be important to reflect the national trend where a smaller and smaller proportion of the population is directly connected to agriculture (Alig et al., 2004).

If education truly leads to greater public acceptance, increasing educational efforts could prevent genetically engineered products from being held back by public protest, as occurred with the release of golden rice which was nutritionally enhanced for vitamin A using genetic engineering (Paine et al., 2005) as well as with Enviropig which was engineered to create less phosphorus pollution (Yang et al., 2008; Forsberg et al., 2013). Education has the potential to help ensure scientists and breeders will be able to continue to implement genetic engineering as a strategy to solve complex agricultural problems.

The increase in accepting attitudes between the pre and post survey groups in this study furthers our understanding of the potential for change in consumer attitudes toward genetically engineered foods. It indicates

that individuals who invest time to learn more about the science of genetic engineering have more accepting attitudes towards genetic engineering technology. If scientists and plant breeders intend to continue to use genetic engineering to solve problems in our food system, it is important to incorporate learning resources such as *The Journey of a Gene* into classrooms. Education is a key component to help consumers make informed decisions about purchasing products derived through genetic engineering and make societal decisions about advancing genetic engineering research.

Summary

In this study, we demonstrated that *The Journey of a Gene* (passel.unl.edu/ge) online resource was effective in increasing student knowledge and shifting student attitudes to become more accepting of genetic engineering technology. This increase in accepting attitudes varied by gender, background, trust in government safety regulation and primary information source. Our results demonstrate that genetic engineering attitudes are not static, but can become more positive through education. This result provides motivation to integrate genetic engineering education into high schools, thus creating a more informed generation of consumers.

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Using Social Network Analysis to Measure Student Collaboration in an Undergraduate Capstone Course[1]

G. Han[2], OP McCubbins[3] and T.H. Paulsen[4]
Iowa State University
Ames, IA

Abstract

Social network analysis offers a unique way for instructors to visualize collaboration and communication within a course and see relationships between individuals, groups, teams, or cliques. We used social network analysis to measure the growth of collaboration in the capstone AGEDS 450 Farm Management and Operation course at Iowa State University. With the strategic implementation of collaboratively intense assignments, student collaboration grew from the midpoint of the semester to the end of the semester. Overall density of the network increased from 0.25 at the midpoint to 0.35 at the end of the semester (40% growth). Each student's number of communication ties increased over the course of the semester to 17.2. Average geodesic distance between nodes decreased 11.7% from the midpoint to the end of the semester, resulting in an average pathway length of 1.66 to connect any two students; this improved communication efficiency in the course. No cutpoint existed at the midpoint or the end of semester, showing no risk of collapse in the network. The overall network became more complex, indicating a more inclusive collaborative environment. We recommend that instructors include structured activities that emphasize student collaboration to help develop strong information networks in other courses.

Introduction and Background

Capstone courses help students connect segmented academic theories with practical application to develop skills needed for entry into a career (Fairchild and Taylor, 2000). Although capstone course structure may vary by context, requisite learning activities should be included: projects, case studies or issue analysis, small-group work, oral communications, intensive writing and industry involvement (Crunkilton et al., 1997). With the inclusion of these activities, it is expected that students who complete a capstone course will develop or enhance the following skills: problem solving, decision making, critical thinking, collaboration and oral and written communication (Crunkilton et al., 1997).

The AGEDS 450 course is a capstone farm management and operation course required of undergraduate students majoring in agricultural studies at Iowa State University (ISU). The course is also available to other majors within the ISU College of Agriculture and Life Sciences. The course uses a working farm for which students must make real decisions. Because AGEDS 450 serves as a laboratory and provides an applied farm management experience (Trede et al., 1992), the course outcomes have been designed to provide students with the opportunity to apply skills in crop and livestock production, financial management, marketing and human relations that are needed in the daily operation and long-term strategic management of a production agriculture business.

Decision Making and Student Collaboration

Course outcomes for AGEDS 450 were determined by following recommendations of Crunkilton et al. (1997) and Andreasen (2004) to include the following capstone course components: problem solving, decision making, teamwork, critical thinking and communication. Decision making has been touted as an essential element in the education process (Andreasen, 2004) and is an important component in AGEDS 450. Trede et al. (1992) found that decision making ranked first among AGEDS 450 graduates in regards to appropriateness of instructional methods used in the course.

For the AGEDS 450 farm to operate productively, students are required to make various management decisions throughout the semester. Decisions include but are not limited to crop selection, fertilizer plans,

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[2]PhD student, Department of Agricultural Education and Studies, ph: (321) 609-1327, email: guanghan@iastate.edu

[3]PhD candidate, Department of Agricultural Education and Studies, ph: (859) 444-3966, email: opmcc@iastate.edu

[4]Assistant Professor, Department of Agricultural Education and Studies, ph: (515) 294-0047, email: tpaulsen@iastate.edu

grain marketing, equipment upgrades and technology implementation. Students work collaboratively through a structured course design. Each student is assigned to a committee on the basis of their interests and an application process at the beginning of the semester. There are eight committees reflecting various enterprise or management areas of the farm: buildings and grounds, crops, custom operations, finance, machinery, marketing, public relations and swine. The committees initiate the decision-making process, which affects the operation of the farm. Class participants elect a president, vice president and secretary who run official business meetings as a formal component of the course. Strategic changes or other decisions that affect the farm must be approved during the weekly business meeting. Using parliamentary procedure as an operating format, committees give weekly reports and recommendations to inform class members as they make decisions about operation of the AGEDS 450 farm.

Course instructors used several assignments during the second half of the semester which emphasized and required collaboration. Such assignments included:

State of the Farm: Students researched the history of the farm relative to their committee (e.g., swine, custom operations, or finance), provided an update on the current standing to their peers and determined short-term goals for the enterprise or management area of the farm over the course of the semester.

Strategic Issue: Students examined and researched a potential issue or opportunity to enhance long-term management or operation of the AGEDS 450 farm. Strategic issues *"focus on problems that impact all aspects of the farm operation from crop and swine production to equipment, land and labor management and related operational components"* (Paulsen, 2009). Designed with an interdisciplinary approach, the strategic issue assignment encouraged students to draw upon knowledge gained from previous coursework, internships, or personal experiences to think critically, problem solve and make decisions relevant to context-specific problems in the farm business.

These highly student-centered, team-oriented activities embody a learner-centered approach to problem solving and decision making, which helps students transition from academia to real-world agricultural settings.

Active exchange of ideas within small groups not only increases interest among participants but also promotes critical thinking (Gokhale, 1995). Johnson and Johnson (1986) determined cooperative learning teams achieved at higher levels of thought and retained information longer than students who worked individually. Collaboration provides students with the opportunity to engage in discussion, take responsibility for their own learning and thus become critical thinkers (Totten et al., 1991). Freeman (2012) determined that a student-centered approach to learning, known as team-based learning, produced student scores that were almost always higher than those of individuals. Barron (2000) reported students earned higher scores when working on solving problems in teams versus working independently. Furthermore, student collaboration has been shown to improve students' satisfaction in the learning environment (Strong et al., 2012).

Student collaboration is important in the learning environment. In higher education, instructors can learn from students and students can learn from and with each other (Weimer, 2012). Although student collaboration has played important roles in multiple educational settings (Barron, 2000), there have been very few studies conducted on the process of student collaboration. Determining the effectiveness of student collaboration is a worthwhile endeavor for several reasons. In the absence of such information, teachers may not be able to identify which teaching strategies are effective to improve student collaboration within a given course. Decision making in a real-world environment (e.g., an operational farm) hinges upon effective student collaboration.

Social Network Analysis and Terminologies

Social network analysis (SNA) is a unique methodology that provides insights into the relationships between individuals, groups, teams, cliques, agencies and organizations (Kapucu et al., 2010). SNA provides complementary visual and statistical components that enable researchers to analyze relationships within a social network (Scott and Carrington, 2011). Although SNA has been established for several years, it is still a relatively new method for agricultural education researchers.

A social network includes a number of actors (nodes) connected by relationships (ties). Actors (nodes) can be individuals, groups, or organizations; relationships (ties) can be of any kind (e.g., formal, informal, financial, personal, professional relationship, etc.) (Davies, 2009). In a directed network, relationships (ties) have two primary directions: in and out. When a tie is sent from an actor and received by another actor, the first actor forms a tie with an out-direction, while the second actor has a tie with an in-direction (Kadushin, 2012). The directions of ties present affects the strength of a network.

Nodes and ties can be graphically reflected in a network map. Nodes can represent different attributes of participants, such as gender, course section and organizations. Those attributes can be represented by different layouts, colors, or patterns of nodes. Further, each node can be sized by different measure indices.

Measure indices provide two perspectives of analyzing networks: top down and bottom up. Top down indices evaluate how well a network works as a whole, including size, density, distance, cutpoints and blocks.

The size of a network indicates capacities of limited resources within a network (Hanneman and Riddle, 2011a). Size is indexed by counting the number of nodes where there exists a unique, ordered pair of actors; k represents the number of actors (k * k-1).

Density reflects the proportion of all possible ties present. Further, density measurers the speed at which

information diffuses among the nodes (Hanneman and Riddle, 2011a).

Distance measures the efficiency of information diffusion in a network. Geodesic distance is the most commonly used concept in SNA; this shows the distance between two actors and is measured by the number of relationships in the shortest possible pathway from one actor to another (Hanneman and Riddle, 2011b).

Assuming a network is composed of several large or small cliques, a critical question worth considering is if the cliques will disconnect in the absence of certain actors. Bi-component analysis is an especially useful way to identify weak spots (cutpoints) in a network (Hanneman and Riddle, 2011b). If a node were removed, causing the structure to become divided into unconnected parts, this node is considered a cutpoint (Hanneman and Riddle, 2011b). The parts divided by cutpoints are called blocks (Hanneman and Riddle, 2011b). Therefore, cutpoints and blocks have the potential to threaten the stability of a network.

The bottom up SNA perspective focuses on each individual actor or each subgroup in the network. The most widely used approach to understand an individual actor's advantages and disadvantages is centrality (Hanneman and Riddle, 2011b). Actors who are more central to social structures are more likely to be influential or powerful (Hanneman and Riddle, 2011b). Degree is one of the typical measures showing centrality. Degree refers to the number of ties to and from a node. Since ties have directions (in and out) in a directed network, degree also has two types: in-degree and out-degree. A node's in-degree is the number of ties this node has received and out-degree is the number of ties this node has sent.

An actor with a large in-degree is a person with whom many other actors seek direct ties, indicating high prestige in a network; while actors who display a higher out-degree often have more influence within the group (Hanneman and Riddle, 2011b). In addition, N-cliques identify insights about substructures of a network (Carolan, 2013). A clique is the largest possible collection of nodes (more than two) in which all actors are directly connected to all others. N-clique is a subgroup formed by n actors. The number and magnitude of an N-clique reflects the inclusiveness of a network.

Conventional educational research has typically focused on the conceptualized behavior of individuals or groups but overlooked the relational information between or among individuals or groups (Carolan, 2013). SNA, with its corresponding computer software, has allowed researchers to determine more relational information and contribute deeper insights to observe, explain and predicate subjects' behaviors or thoughts within social networks. Researchers have used SNA to determine social interactions, diffusion of innovations, social influence, belief systems, efficacy of interventions, small-group dynamics and small-world and scale-free networks (Carolan, 2013, Roberts et al., 2010). Using SNA methodologies, Hoppe and Reinelt (2010) evaluated a leadership network, Kapucu et al. (2010) determined the change of students' friendship networks in a collaborative learning class, Prell et al. (2009) assessed stakeholders' connections with natural resources conservation initiatives; and Bartholomay et al. (2011) examined the University of Minnesota Extension's outreach to other external organizations. The literature has clearly laid out the functionality of SNA and provided guidance for the present study.

Purpose of Study and Research Objectives

The purpose of this study was to use SNA to evaluate and visualize the student collaboration network in the AGEDS 450 capstone course. Five research questions guided the study:

- Did student collaboration improve as the course progressed?
- Did each student develop more influence on decision making as the course progressed?
- Did student collaboration become more efficient?
- Did the collaboration network become more inclusive?
- Was the collapse risk of the collaboration network reduced?

Methods

Through careful review of the literature (Springer and de Steiguer, 2011; Kapucu et al., 2010; Scott and Carrington, 2011), we identified three steps necessary to answer the research questions: identifying the network, collecting social interaction data and data analysis.

Step 1: Identifying the Network

We selected a position-based approach (Laumann et al., 1983) to define the boundary of the network. In this study, the network's actors (nodes) were the 52 students enrolled in AGEDS 450 during the spring 2014 semester. Since the focus of this study was on student collaboration, the network relations (ties) were defined as relationships between students if they collaborated with each other in the course setting. The ties were either one- or two-directional and were indicated with arrows between nodes on a network map.

Step 2: Collecting Social Interaction Data

We chose the one-mode whole-network method to develop the survey instrument for data collection because this study focused on collaborative relationships linking participants (Marsden, 2011). To collect the whole-network data, participants completed a sociometric survey. The survey instrument contained a class roster and each student circled the names of other students with whom they had collaboratively worked to make decisions in the AGEDS 450 capstone course. We also used the survey to collect selected demographic information (i.e., age, major, committee assignment and year in school).

To compare the change in student collaboration over the course of the semester, we used the survey

Figure 1. Social Network Matrix Example

Participants	A01	A02	A03	A04	A05	A06	A07	...
A01		0	1	1	0	0	0	
A02	0		0	1	0	0	1	
A03	1	1		0	0	0	0	
A04	0	1	1		1	0	0	
A05	0	0	0	0		0	1	
A06	0	1	0	0	0		0	
A07	0	1	0	1	1	0		
...								

instrument at the midpoint of the semester and again at the end of the course. Fifty of 52 students completed the surveys, resulting in a 96.1% response rate. For confidentiality, each student was assigned an alphanumeric code after completing the instrument. Responses were coded into dichotomized data (1 and 0). For purposes of analysis, the code 1 meant the respondent had collaborated with a particular student; the code 0 meant the respondent had not collaborated with this student. We developed social network matrices with the dichotomized data. Figure 1 shows an example of a social network matrix. A01, A02 and A03… represent the student identification codes; 0 and 1 represent the collaboration relationship between students. In this study, two sets of social network matrices were developed: one for the survey at the midpoint of the semester and the other for the survey at the end of semester. SNA software packages use the network matrices as input to run further graphic and statistical analysis (Springer and de Steiguer, 2011).

Step 3: Data Analysis

We used UCINET, an SNA statistic and graphic software package, to analyze the matrices data. The outputs of UCINET are network maps and measures (Springer and de Steiguer, 2011). In this SNA study, the graphical analysis resulted in two sets of network maps. Measure indices included statistical analysis outcomes including size, density, distance, cliques, degree centrality (degree) and cutpoints. These outcomes provided the information necessary to answer the research questions.

Results and Discussion

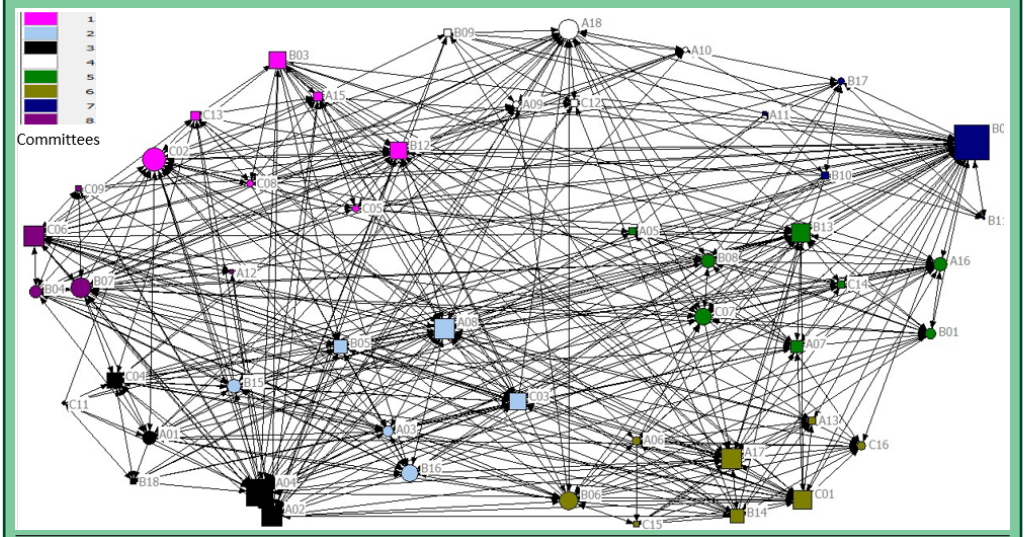
Research Question 1: Did Student Collaboration Improve as the Course Progressed?

Network maps provided a direct visualization of the structure of student collaboration in the AGEDS 450 course. Figures 2 and 3 show student collaboration network maps from the midpoint and end of the semester, respectively. Nodes on each map represent individual students and the ties (lines) represent their collaboration. There are 50 nodes on the both maps, representing the 50 students who participated in this study. In other words, the size of this network is 50 (Table 1).

Table 1. Network Size and Density

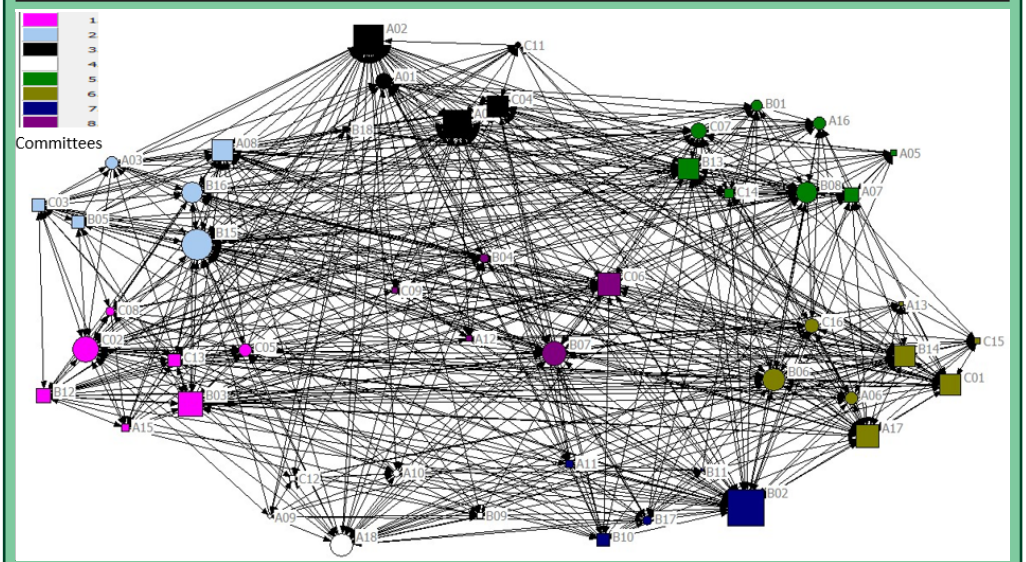
Measures	Midpoint of semester	End of semester	Rate of change (%)
Size	50	50	-
Density	0.25	0.35	+40.0

Figure 2. Midpoint-semester network map of student collaboration by committee, sized by degree.



Note. Committees: 1 = marketing, 2 = custom operation, 3 = machinery, 4 = finance, 5 = buildings and grounds, 6 = crops, 7 = public relations, and 8 = swine.

Figure 3. End-of-semester network map of student collaboration by committee, sized by degree.



Note. Committees: 1 = marketing, 2 = custom operation, 3 = machinery, 4 = finance, 5 = buildings and grounds, 6 = crops, 7 = public relations, and 8 = swine. Sections: 1 = section 1, 2 = section 2.

There are more ties on the end-of-semester map than on the mid-semester map. This reflects a change of collaboration density in the network over the course of the semester. At the midpoint of the semester, the density was 0.25; at the end of the semester, the density increased 40.0% to 0.35 (Table 1). Based on the measure of density, collaborative efforts increased as the semester progressed.

Research Question 2: Did Each Student Develop More Influence on Decision Making as the Course Progressed?

Nodes on the network maps (Figures 2 and 3) are sized by degree centrality, which is a measure that indicates power of influence in the network (Hanneman and Riddle, 2011b). On average, nodes on Figure 3 are observably larger than nodes on Figure 2. At the midpoint of the semester, the average in-degree/out-degree was 12.3 and it increased 40.0% to 17.2 at the end of the semester (Table 2). This finding indicates that on average, each student increased the number of collaborative relationships by nearly five (4.9). Each student earned higher prestige and built more influence with other students in the network over the duration of the AGEDS 450 course.

Research Question 3: Did Student Collaboration Become More Efficient?

Geodesic distance is a common measure index to show the efficiency of information diffusion in a network. The average geodesic distance between nodes was 1.88 at the midpoint of the semester and it decreased to 1.66 at the end of the semester (Table 3). In other words, if we arbitrarily select two students from the course, it took 1.88 pathways to get the students connected at the midpoint of the semester. A pathway is a direct connection (tie) between two students. At the end of the semester, 1.66 pathways were needed to connect any two students, which resulted in an 11.7% decrease in the average geodesic distance. This finding indicates that collaboration between students became closer as the semester progressed, indicating more efficiency in collaboration.

Research Question 4: Did the Collaboration Network Become More Inclusive?

At the midpoint of the semester, there were 74 cliques (Table 4). The majority (77%) of the cliques were small (3- or 4- person cliques); 18.9% of the cliques were midsize (5- person cliques); and 4.1% of the cliques were large (6- or 7- person cliques). At end of the semester, 72 more cliques were formed (Table 4). The proportion of small cliques decreased to 41.1%, midsize cliques increased to 34.9% and large cliques grew to 23.9%. The small cliques at the midpoint evolved into larger cliques by the end of semester. The network as a whole became more complex and involved more subgroups as the course progressed. This finding reflects that a more inclusive collaboration environment was formed by end of the semester.

Table 2. Average Degree of the Network

Measures	Midpoint of semester	End of semester	Rate of change (%)
Avg. in-degree	12.3	17.2	+40.0
Avg. out-degree	12.3	17.2	+40.0

Table 3. Average Distance of the Network

Measures	Midpoint of semester	End of semester	Rate of change (%)
Avg. geodesic distance	1.88	1.66	-11.7

Research Question 5: Was the Collapse Risk of the Collaboration Network Reduced?

At the midpoint of the semester, no cutpoint was found and only one block existed within the entire network (Table 5). At the end of the course, the lack of a cutpoint and total number of blocks remained the same (Table 5). This finding indicates that in the absence of any individual student, the student collaboration network had no risk of collapse either at the midpoint or end of the semester. The student collaboration network remained stable throughout the course.

Summary and Recommendations

Student collaboration in AGEDS 450 significantly improved from the midpoint to the end of the semester, after implementation of a series of collaboration-oriented course activities and assignments. Collaboration across the whole class increased, individual student influence on decision making grew, students collaborated together more immediately with higher efficiency, an inclusive collaborative environment was formed and the risk of collapse remained low. Thus, we conclude that the course design and teaching strategies used in AGEDS 450 facilitated collaborative relationships between and among students. Such relationships and the learning environment, benefit students by articulating knowledge, understanding, promoting higher order thinking and increasing group decision making (Gokhale, 1995; Lazonder, 2005). The AGEDS 450 course uses capstone course components outlined by Crunkilton et al. (1997) and student collaboration is an intentional course outcome. Specific activities derived from the capstone course components that may have led to the increase in student collaboration included group projects (e.g.,

Table 4. Numbers of N-cliques at the Midpoint and End of Semester

N-cliques	Midpoint		End	
	Number	Percent	Number	Percent
3-cliques	23	31.1%	11	7.5%
4-cliques	34	45.9%	49	33.6%
5-cliques	14	18.9%	51	34.9%
6-cliques	3	4.1%	25	17.1%
7-cliques	0	0%	10	6.8%
Total cliques	74	100%	146	100%

Table 5. Blocks and Cutpoints of the Network

Measures	Midpoint	End
Blocks	1	1
Cutpoints	0	0

State of the Farm and Strategic Issue presentations), business meetings and specific tasks (e.g., selecting seed, marketing grain, repairing buildings).

This study demonstrates a feasible and effective method to evaluate student collaboration. We encourage researchers and educators to conduct similar studies in courses that implement student-centered or team-based learning approaches, particularly capstone agriculture courses. In addition, because this study focused on one course within one semester without a control group for a true experimental comparison, the conclusion is threatened by a possibility of spontaneous growth of collaboration without any intervention. However, the interventions in this study were the course activities and assignments and it was not feasible to remove those course components.

Overall, SNA studies can help researchers and educators identify optimized teaching strategies and activities for fostering student collaboration. We recommend that additional studies expand to compare two cohorts of classes with different teaching strategies and use random grouping techniques to exclude extraneous variability, such as the natural growth of collaboration (Dinov, 2007). We also recommend increasing the frequency of network assessment (i.e., administering the SNA instrument) to more closely track the development of collaboration. Future studies should aggregate each committee into a single actor (node) to examine the multilevel networks developed within the course. This will allow for analysis of collaboration across committees, within committees and interpersonally.

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Impact of a University Summer Academy Program on Incoming College of Agriculture and Life Sciences (CALS) Students' Choice of Major

M. Schroeder[1], C. Vengrin[2], D. Westfall-Rudd[2] and S. Sumner[3]
Virginia Tech
Blacksburg, VA

Abstract

The summer academy is designed for accepted first-year or transfer students who want to get an early start on their academic career. In 2013, the summer academy had 25 different tracks, which consisted of two discipline-specific paired classes. This study focused on students enrolled in the tracks that were within the College of Agriculture and Life Sciences (CALS). Objectives of this study were to (1) examine the variables influencing the students' participation in the summer academy program, (2) examine the variables influencing students' choice of CALS specific courses and (3) determine if the summer classes impacted their choice of intended major. The CALS specific classes had a perceived influence on intended major for 28% of participants. Focus groups examined student motivations and the variables influencing choice of academic major to further elaborate survey findings. Focus group results indicated that early academic experiences may have an influence on future academic goals.

Introduction

Every summer a new group of high school seniors will graduate and begin preparations for college, but not all are fully prepared for this new environment. Being "college ready" includes not only academics, but also the ability to succeed in a college setting without remediation (Kallison and Stader, 2012). According to Kallison and Stader (2012) only 25% of students who took the ACT in 2011 met or surpassed the benchmarks for English, math, reading and science. In order for students to achieve college readiness, many high schools, community colleges and universities have implemented summer bridge programs in order to address the needs of the incoming group of students.

In order to help transition to college, summer bridge programs have been implemented in high schools, colleges and universities across the nation (Anastasi, 2007; Garcia and Paz, 2009; Kallison and Stader, 2012; Nartgun et al., 2012; Walpole et al., 2008; White, 1999). Examples of summer opportunities include the Department of Education's Upward Bound and GEAR UP programs as well as independent programs found on college campuses (U.S. Department of Education, 2012, 2013). The goal of these programs is to increase student preparedness for college, either by working with students during the summer before college, or by working with students during their high school years. According to Dainow (2001), attendance for summer programs is on the rise in most community colleges and many universities. Most programs utilize a six to eight-week program model in order to address the needs of the students and prepare them for the next chapter in their educational careers (Garcia and Paz, 2009; Kallison and Stader, 2012; Maggio et al., 2005; Walpole et al., 2008).

Most summer bridge programs are intended for first-generation college students or those from underrepresented minorities. Many schools offer summer courses for credit, but few schools in the country have programs specifically designed to allow incoming first-year students or transfer students to start their education before the fall semester. The summer academy at Virginia Tech began in 2012 and was developed from the Pennsylvania State Learning Edge Academic Program (LEAP) model (Pennsylvania State University, 2014). The purpose of the summer academy was to help ease the transition of students from high school to a large undergraduate university by allowing time for them to become famil-

[1]Department of Food Science and Technology, 1230 Washington St. SW, Blacksburg, VA 24061, Ph: 410-802-7683, Email: matths4@vt.edu
[2]Department of Agriculture, Leadership, and Community Education, 268 Litton Reaves Hall, Blacksburg, VA 24061, Ph: 540-392-5353; 540-231-5717, Email: cvengrin@vt.edu; mooredm@vt.edu
[3]Associate Dean, College of Agriculture and Life Sciences, 1070 Litton Reaves Hall, Blacksburg, VA 24061, Ph: 540-231-5290, Email: sumners@vt.edu

iar with campus life, academic expectations and new people. Students took two paired courses that began during the first week of July and concluded mid-August. The courses were selected from a list of "tracks" that are college or program specific, fulfill graduation requirements and form a solid academic foundation at the university (Virginia Tech, 2014). The courses were selected to be representative of both general courses and discipline specific courses that an incoming first-year student would experience. Each track was limited to 24 students and included a peer mentor to help with academic, personal, or campus problems. Students attended orientation and various other workshops, including time management, study skills and test taking strategies as part of the program. Participants also attended college introduction camp, which offered an immersive off-campus experience for students to form relationships and learn about the university. During the summer of 2013, the summer academy offered 25 different tracks for an estimated 250 students across various disciplines and colleges.

Purpose of Study

The summer academy was designed for incoming, accepted first year or transfer students who wanted to begin their academic career at the university early. Because of the amount of time, money and resources that CALS commits to having courses taught in the summer academy, the researchers wanted to know why students were motivated to come to summer academy, especially those that were enrolled in CALS classes. The researchers also wanted to know why the students chose a particular track and what courses they would recommend to add to the program. Specific objectives for the study were to (1) examine the factors influencing the students' participation in the summer academy program, (2) examine the factors influencing students' choice of CALS courses and (3) determine if the classes within their track impacted their choice of intended major.

Materials and Methods

This study utilized a sequential explanatory mixed methods design (Creswell and Plano Clark, 2011). This research method was employed to first examine possible reasons students attended the summer academy and qualitative questions were subsequently built upon the quantitative data results. This design allowed for further understanding of the quantitative results (Creswell and Plano Clark, 2011). The researchers designed a survey instrument, as no instrument related to the particular experiences of students within the summer academy existed. The instrument was pilot tested to a small group of students within CALS to determine validity. An email with an explanation of the study and an invitation to participate was distributed to all 42 participants in the CALS tracks of the summer academy. The surveys were sent out and after three follow-up emails, 21 were returned, of which three students were under the age of 18 and were excluded. Of the 18 viable surveys, five participants were male and 13 were female. Examples of survey questions included: "Why did you choose to enroll in the summer academy" with a list of possible options including "Other" and "Why did you choose this particular track" with a list of possible options and demographic information. Survey data was collected via Qualtrics.com and analyzed using Excel. The data collected from the survey was used as the primary basis for focus group protocol questions.

Focus group participation was based on convenience sampling utilizing all 18 participants that responded to the survey. The potential participants were invited to attend one of three scheduled focus groups. Participants were contacted via an email invitation letter explaining the voluntary participation as well as the format and purpose of the focus groups. Five students agreed to participate, representing 27% of total survey respondents. Of these five participants, two participants were male and three were female. All participants were given pseudonyms and some identifying details were altered to maintain confidentiality. The focus groups represented a diverse population of students including one transfer student from a community college, one student from a homeschooling background and one international student for whom the summer academy was their first experience in the United States. Focus group questions were designed as expansions of the survey questions. For example, a survey question asked about motivations to attend the summer academy and allowed students to select multiple options. The related focus group question asked students their primary influential factor to attend and to describe this factor in detail. Another example focus group question investigated how the courses taken in the summer academy influenced the students' decisions on a major. This allowed for in-depth description of the relationship between the summer coursework and the students' selection of a major. Focus group data was recorded and transcribed. Researchers then coded and analyzed the data for themes using a comparative method involving joint coding (Denzin and Lincoln, 2005; Rossman and Rallis, 2012). The Institutional Review Board (IRB) required both survey and focus group protocol. The chairperson of the university's IRB committee approved the research and project protocols.

Results and Discussion

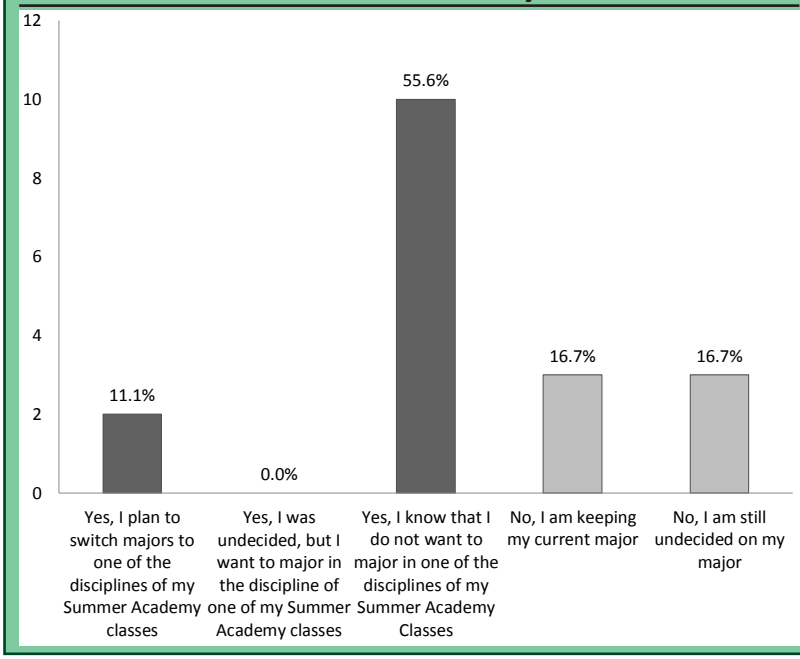
Survey

At the conclusion of the summer program, 42 students were asked to participate in an online survey and 21 responded, a response rate of 50%. Of those who responded, 72% of respondents were female, 28% were male and 28% were transfer students coming from a community college experience. Results indicated the factors motivating students to attend the summer academy included: the opportunity to begin their college experience early (56%), family encouragement (50%), participation in smaller classes (33%) and lessening first semester workload (28%).

Researchers examined the impact of the coursework within summer academy on students' decision of their college major (Figure 1). The CALS specific classes had an influence on intended major for 28% of participants. The students were all enrolled in courses within CALS. Two students reported that their experience in the summer academy impacted their decision to change their major and three students reported that the summer academy helped them decide to not major in a certain class they took during their time in the program. For ten students (47%), the summer academy did not change their major; however, this could mean that their major choice was confirmed by their experience within the summer academy.

Survey items provided some insight into why students chose to attend the summer academy; however, in order to better understand their decisions, the researchers developed focus group questions to investigate this decision-making process. Researchers also examined the data regarding decision of track and decision of major. Focus group questions were designed to better understand the survey results that indicated an impact of the summer courses on the students major and to explore the possibility that the summer academy could confirm a student's decision to major in a particular curriculum area.

Figure 1: Student response to survey question "Did your summer academy classes have any influence on your intended major?" (n=18). Highlighted columns indicate influence on major choice.



Focus Groups

The researchers followed a comparative method utilizing joint coding and analysis (Denzin and Lincoln, 2005; Rossman and Rallis, 2012). Similar comments were coded and categories interpreted in order to make meaning of the described phenomena (Rossman and Rallis, 2012). Seven categories resulted from the analysis of the participants' experiences of the summer academy. These categories were used as a framework to guide the organization of the findings. Although categories are discussed separately, they were not experienced in isolation of one another.

Family/personal reasons have influence of decision to attend summer academy

Many students felt a deciding factor in attending the summer academy was their parents. In some cases, the parent or guardian gave the student little to no choice in attendance. In other cases, students were encouraged, but not mandated to attend. There were some instances when the student brought the program to the attention of their parents. Parents also played a large role in deciding what track to take and their potential major. Parental influence weighed heavily on students' decisions in both attending the summer academy program and also in their selection of coursework and major. This finding aligns with research by Gonzalez-DeHass et al. (2005) who found that parental influence weighs on student motivation in regard to college and major selection. International and transfer students discussed that guaranteed housing and learning cultural differences of campus environment also had an influencing factor in attending the summer academy. Overall, findings indicated that there are both academic and personal circumstances that motivated students to attend the summer academy.

Students determine summer academy track based on academic needs and desires

For many students, the decision to take one track over another within the summer academy was a multifaceted process. Research suggests that a major disadvantage of summer courses is the limited subject choice. White (1999) found that 63% of students did not like the limited subject choice available during the summer. Some students in the summer academy were unable to find a track that satisfied them completely and others selected the track that aligned with their major choice. Students chose their particular track based on interest, the ability to fulfill academic requirements, or to become acclimated to a rigorous academic schedule. The courses comprising a track were not interchangeable; therefore, students had to determine which course or courses were the most important to take in an abbreviated summer session.

Summer academy builds sense of community between peers and professors through small class/lab size and "relaxed" environment

The summer academy allowed students to connect through a series of activities, classes and residential living experiences with their peers and professors. The students acknowledged that the small classroom environment, atypical for a university of this size, allowed for a more relaxed environment, similar to a high school

or community college setting. Since classes were small, students were able to experience more in depth interaction with peers and professors. Normal laboratory classes at a large university are 20-30 students. Students explained that the 24 student capacity on enrollment in summer classes was beneficial, since it allowed for more repetitions and time allotted for each experiment. According to White (1999), most students feel the educational environment of summer classes is advantageous. Summer classes offer students the unique ability to work in smaller class sizes, which can encourage a more focused learning environment where the emphasis is on more professor-student interactions and in-depth conversations (Anastasi, 2007; Nartgun et al., 2012). Many students enjoy the comfortable, relaxed atmosphere of summer classes (White, 1999).

Summer academy faculty members are encouraged to engage with students outside the classroom. Some professors chose to take students on hikes or bike rides through the community while encouraging an educational dialogue relevant to the course content. Students expressed that these opportunities allowed them to connect with the community and become familiar with university surroundings. Engaging in these conversations with their professors enhanced their summer academy experience both academically and professionally.

Though not all classes and tracks of the summer academy had laboratory experiences, the participants that had this component in their schedule enjoyed their experience. Students reported that the small class sizes allowed for more intimate interaction with laboratory exercises, more repetitions and more time for each experiment.

The small class sizes in the summer academy allowed students to develop close personal relationship with peers and professors and allowed for a more comfortable and relaxed educational environment. The summer academy brought students together from all disciplines to live and work together. The personal relationships that resulted from the classroom activities, professorial interactions and team building activities last throughout their time at the university, making it a valuable aspect to the summer academy program.

Challenges of summer academy: Compressed academic schedule and repetitive introductory success courses

Summer academy classes were five weeks in length. Before beginning course work, students took introductory college success courses on a number of topics including test taking skills and time management. Students who participated in this study found these classes lacking and commented that the classes taught many topics that they had previously experienced in high school. Transfer students in particular reported that they felt these classes were unnecessary as they had already completed a transition phase and were accustomed to the demands of collegiate level academics.

Participants explained that classes offered during summer academy were difficult even for those that had previous experience in the discipline. The compressed schedule combined with weekly quizzes and examinations was very demanding for students. Research conducted by Al-Dosary and Raziuddin (2001) and White (1999) suggest that rapid class pace and the consolidation of material into a compressed time frame are disadvantages of summer courses. The fast pace and close intervals of classes may not be suitable for courses that require development of skills over a long period of time (Al-Dosary and Raziuddin, 2001). Students (60%) and professors (66%) say the shorter time frame with the same amount of material as a 15-week class negatively affects learning (Al-Dosary and Raziuddin, 2001). Though in class time was the same between a normal 15-week course and a summer course, students felt the demanding academic schedule was a disadvantage of the summer academy.

College introduction camp and peer mentors enhance summer experience: Encourage sense of community and building relationships

The transition to college can be made smoother by engaging in group activities, interacting with peer mentors and building relationships. Socially, summer classes, especially in a college bridge or transition program, can bring peers together with similar adjustment anxieties (Garcia and Paz, 2009). Allowing peers with similar concerns or anxieties to come together in a comfortable, unique learning atmosphere can help in forming a foundation for their academic or social support network (Garcia and Paz, 2009).

College introduction camp was a mandatory portion of the summer academy experience. College introduction camp was also available to other incoming students for a fee, but the sessions were scheduled separately from the summer academy students' experience. The camp promoted bonding and unity within the incoming student population. It was a unique experience to fully integrate students into the culture and traditions of the university. College introduction camp allowed for students with similar adjustment anxieties to become familiar and acquainted with one another in a non-threatening environment. Many students reported that college introduction camp was a positive experience, which allowed them to form lasting relationships with peers. Participants indicated that some of their best friends were made during this three-day experience.

Peer mentors, who are upper class students, served as student assistants during the entire summer academy and also helped with the transition to college life. Peer mentors organized activities, counseled students and promoted a sense of community within the program participants. Participants described that some of their most memorable times at summer academy were the activities directed by the peer mentors.

Through college introduction camp and peer mentor leadership, students formed a solid support network

before the fall semester began. Research suggests that having this early support, both socially and academically, can encourage retention, especially among first generation or underrepresented students (Garcia and Paz, 2009). Social interaction can lead to increased self-esteem, interest in intellectual matters and higher education aspirations (Maggio et al., 2005). These experiences helped to build lasting memories and a sense of community.

Summer academy classes helped ease transition to the university name: Lessened course load, eliminated prerequisites and offered a sound GPA buffer

Students chose to attend the summer academy for a variety of reasons. Both transfer and regular first-year students noted that starting their time at the university with a good grade point average and a lighter fall course schedule would lower their academic anxiety. Research suggests that summer classes can ease the course load the following semester, get back on track, or compensate for failures during previous academic terms (Al-Dosary and Raziuddin, 2001; Nartgun et al., 2012; Dainow, 2001). Participants described the difficulties of maintaining a good grade point average during the fall. Because they had performed well during the summer courses, their grade point average at the conclusion of their first year was adequate in their opinion. The lighter class load during the fall semester can be beneficial for the sometimes tough transitional challenges that incoming first-year students encounter.

Some participants described the importance of the summer academy classes in eliminating prerequisites that could not be eliminated by advanced placement (AP) credits, thus allowing them to double major. This elimination of prerequisites can allow students to pursue major or minor classes more quickly. Prerequisites, especially at a large undergraduate institution, that may be difficult to enroll in during regular semesters can also be fulfilled during the summer, allowing students to stay on track and graduate on time (White, 1999). A study conducted by White (1999) found that 64% of students were motivated to take summer courses in order to progress towards their degree.

Summer academy track has lasting effect on academic and personal choices in college

The courses that students took in the summer academy program are based on track selections. These tracks allowed students to get exposure to classes within a major so that they could begin to consider possible academic pursuits. For this study, the main focus was to determine if the summer academy experience had an impact on students' choices of major selection. For some students, the summer academy had an indirect impact on their intended major choice by allowing them to determine if the major was right for them. For other students, their experience confirmed their decision to continue with the major that they were already considering.

One student, Laura, suggested that taking the summer academy courses allowed her to double major. Without these early courses, she would not have been able to complete a double major without taking additional time to finish her degree(s). Other participants garnered an unknown interest in the courses taken during the summer academy. For other students, the summer academy experience confirmed their decision to stay within their major and pursue their career goals.

Laura, who was also a transfer student, found the summer academy experience helpful in determining a professor to advise her. As she was further along in her academic career than the incoming freshmen, this gave her an advantage in continuing her progression to completing her degree. Giving students early guidance can ultimately impact their future career and have benefits for society as well as for the employer (White, 1999). Overall, students within the focus group indicated that the summer academy had a positive impact on their choice of college major, either by confirming their intended major or by introducing new majors and minors.

Implications

The early classes that an incoming first-year student has upon entering college may have an impact on their future academic choices. At a large university with many different academic pursuits available, new possibilities or interests may arise as a result of early collegiate classes. Students chose to come to a summer bridge program like the summer academy to get a head start on college as indicated by the survey results. White (1999) found that 64% of students were motivated to attend summer classes in order to progress towards their degree and Al-Dosary and Raziuddin (2001) found that summer classes can ease course load the following semesters, which was mentioned by the focus group participants. However, with paired, discipline-specific classes, participants found an interest in other academic areas that were unfamiliar to them as a result of the summer academy. This may suggest that students currently not enrolled in a discipline specific major may benefit from taking a wide variety of classes early in their college career with the hope of finding their academic passion.

Programs like the summer academy also allowed students to form solid relationships with peers and professors even before the fall semester began. Participants noted the importance of these relationships and the ease of transition to college. Garcia and Paz (2009) noted that a summer program can bring together peers with similar adjustment anxieties, which can help them form relationships early on in their college experience. Small classes offered a similar environment to high school, but with the rigor of a college level class. The personal interaction with professors can help students feel more comfortable and become acquainted with a new environment. This result is confirmed by Anastasi (2007) and Nartgun et al. (2012) who found that

the small class sizes allow for more student-professor interactions and in-depth conversations. Having these familiarities from high school can ease the transition to a large university before the hectic fall semester.

Summary

Summer bridge programs like the summer academy seem to have a positive impact on incoming first-year students and transfer students. Students can become acquainted with a large university before the general student population returns to campus while possibly eliminating some prerequisite classes in order to double major. The small class sizes coupled with living arrangements allow for personal interaction with peers and professors. Results indicate that classes that an incoming first-year or transfer student may have an impact on future academic choices such as major, minor, or class selection. Future research is currently ongoing and will focus on "graduates" of the summer academy program to track their grade point averages, class and major/minor selections as well as general collegiate success to see if the summer academy had a long lasting effect on students.

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Factors Motivating Students to Respond to Online Course Evaluations in the College of Agricultural and Life Sciences at the University of Florida

Seth Heinert[1] and T. Grady Roberts[2]
University of Florida
Gainesville, FL

Abstract

This qualitative study sought to identify motivating factors for students to complete online course evaluations. Researchers of this study did personal interviews with instructors (*N*=7) who had a higher than average response rates for course evaluations. In addition, the researchers held a student focus group (*N*=17) purposively selected for their diverse perspective. Researchers coded the data using the constant comparative method. Themes from instructors included the context surrounding the instructor and student, the course itself, logistical challenges and motivational factors. Themes from students included them asking, "What's in it for me", their willingness to respond if certain conditions were met, logistical challenges, confusion and frustration. Implications for practice include creating a culture of respect and reciprocity, using formative assessment and frequent reminders, developing incentive structures, anticipating logistical challenges, providing in-class time to complete evaluations and helping students find value in the course evaluation process. Recommendations for further research include further exploring student motivations and conducting a similar study for online courses.

Introduction

Course evaluations are a tool used frequently at institutions of higher education. Their purpose is to gather data that can guide course planning and represent the student perspective. Administrators incorporate course evaluations into evaluation package for annual review, tenure and promotion decisions and salary increases (University of Florida, n.d.). Course evaluations, according to Norris and Conn (2005), *"provide one critical source of information for the improvement of course, curriculum and practitioners; pedagogic efforts and their use as a component of faculty review is a well-established tradition in higher education not likely to disappear any time soon*" (p. 26).

Recently, the University of Florida transitioned from administering course evaluations for all courses in a face-to-face format using paper and pencil questionnaires to an online format. As of fall 2011, the University of Florida administered all course evaluations online (University of Florida, 2014). Almost immediately after changing to the online delivery, the response rates of course evaluations dropped significantly across the University of Florida. The College of Agricultural and Life Sciences (CALS) was no exception. The fall 2010 response rate prior to course evaluations moving completely online was 70.13 %. However, following the migration to online delivery in the fall of 2013, the response rate fell to 45.26 %.

Response rate refers to the proportion of the selected sample that agrees to an interview or returns a completed questionnaire (Ary et al., 2010). Generally, as response rates decrease, the potential for a biased sample increases (Israel, 2009). Nonresponse reduces the sample size and may bias the results (Ary et al., 2010). Some evidence suggests there is no statistical difference between mean scores for course evaluations administered online, even with a lower response rate, than traditional paper and pencil versions with a higher response rate (Avery et al., 2006; Thorpe, 2002). Nevertheless, low response rates, in effect, call into question the validity of results of course evaluations.

Across the nation, universities have worked to motivate students to respond to online course evaluations. Crews and Curtis (2011) promoted using incentives. Other methods included giving reminder messages or using a sweepstakes in which students who responded entered for a chance to win a prize (Dommeyer et al., 2004). Additionally, faculty reminders, assuring students of the use of their responses, providing prizes, assuring students of the anonymity of their responses and familiarizing students with the online environment have also been described (Nulty, 2008). Finally, Norris and Conn (2005) added that faculty should explicitly announce the

[1]406 Rolfs Hall, PO Box 110540, Gainesville, FL 32611, (308)241-0277, sheinert@ufl.edu
[2]117C Bryant Hall, PO Box 112060, Gainesville, FL 32611, (352)273-2568, groberts@ufl.edu

availability and location of the evaluation within a few weeks of the end of the course, explain the value of the course evaluation process and student feedback and remind students to complete the evaluation. Several universities across the nation have implemented many of these tactics with mixed degrees of success.

The University of Florida proactively attempted to address nonresponse by issuing several documents to faculty on how to improve response rates. The evaluations coordinator at the University of Florida promoted tactics such as posting on the class discussion board, emailing the class listserv with the dates and uniform resource locator (URL) for evaluations, as well as e-mailing reminders to students exactly one week before the final date of class or the final exam (Johnson, 2012). Despite these efforts, response rates dropped and currently remain low across the University of Florida as well as CALS.

Methodology

The purpose of this study was to describe factors that motivated students within CALS at the University of Florida to complete, or discouraged them from completing online course evaluations. One specific objective guided this study, which was to understand instructor and student perceptions of motivating factors for students to complete online course evaluations.

Researchers gathered data in two rounds during the spring semester of 2014. First, the researchers conducted semi-structured interviews with instructors (Ary et al., 2010). Instructors were selected purposively from CALS at the University of Florida based on having a response rate of over 80% on their course evaluations in the 2011-2012 academic year. Interviews lasted approximately 30 minutes and were audio recorded and transcribed verbatim. One researcher conducted the interview while the other researcher took notes. Pseudonyms replaced the actual names of participants in this manuscript in order to protect their individual identity. Following the instructor interviews, the researchers conducted one student focus group (Ary et al., 2010). The researchers recruited participants from two large courses within CALS with an effort to maximize diversity within participants based on gender, academic major and cultural diversity. The researchers e-mailed fifteen students inviting them to come on a particular date and time to a central location where the focus group could take place. One researcher conducted the focus group while the other researcher took notes. The focus group lasted approximately 90 minutes and was audio recorded and transcribed verbatim. In order to protect the anonymity of participants, the researchers did not record any individual identifiers for focus group participants. The University of Florida Institutional Review Board approved the study protocol and all participants provided written informed consent prior to participation in the study.

Triangulation and member checking increased the trustworthiness of this study (Ary et al., 2010). The triangulation employed in this study was a form of structural corroboration that included different sources of data and different methods. Member checking for accuracy was done throughout the interviews as well as focus group. Researchers improved dependability and confirmability through an audit trail in the form of transcripts. The researchers controlled personal bias primarily through reflexivity (Ary et al., 2010).

Researchers analyzed the data from the interviews and focus group using the constant comparative method (Ary et al., 2010). This manuscript contains the themes and subthemes that emerged. The authors divided findings into two sections delineating the perspectives of instructors from those of students.

Results

The following section details the themes and subthemes for both the instructor and student portions. Additionally, Table 1 offers a summary of themes and subthemes.

Table 1. Summary of Themes and Subthemes Driving Student Response Rates in Online Course Evaluations Reported by Instructors and Students.

Instructors		Students	
Theme	*Subtheme*	*Theme*	*Subtheme*
Context	Relational and caring Communicative Promotion and tenure Feedback	What's In It for Me?	Pointlessness RateMyProfessors.com
Motivation	Incentives Reminders Purpose	Response Motivators	Incentives Bipolar feelings Time in class Instructor passion and compassion Formative vs. summative feedback
Logistics	Previous system Time and devices Explanations Participant fatigue	Logistic Challenges	Participant fatigue Low priority Cognitive load
Course	Coursework Dynamic methods	Frustration	Who looks at them? Ambiguous motivators

Instructor Perspectives

The researchers interviewed seven instructors for this study: two males and five females; two held the rank of full professor, one was a tenured associate professor and four were assistant professors. Instructors indicated four themes that may have affected the response rates to their course evaluations: context, motivation, logistics and course. Each theme had several sub-themes.

Context

The context surrounding course evaluations with higher than average response rates consisted of three primary factors: the student, the instructor and the course evaluation itself. Subthemes were relational and caring, communicative, promotion and tenure and feedback.

Relational and Caring

Instructors generally approached their courses from a relational standpoint. They made many attempts to develop rapport with students throughout the semester. They showed they cared about student learning. Richard

said he would work to develop a relationship with all of his students so they would want to complete the evaluation, in part, because of the connection with him.

Communicative

Instructors set a communicative tone in their classes. Often, this communicative tone led instructors to discuss course evaluations early in the semester.

Promotion and Tenure

Instructors felt personally motivated to get a good response rate on course evaluation because evaluations are a part of the promotion and tenure package. Some instructors would visit with students about this process and connect the value of the student completing the course evaluation to the instructor personally. Richard stated, "…essentially [this is] going to help me make progress towards tenure."

Feedback

Instructors expressed value in receiving feedback from students. Most felt feedback was important to making improvements in the course, as well as their own pedagogy. Nearly all instructors used some form of formative feedback that ranged from midterm course evaluation to written student responses on an index card. Instructors highlighted to students how feedback from both formative and summative evaluations had led to changes in the current course. Nancy said, "… I have tweaked some stuff, just based on student feedback …"

Motivation

Motivation played a pivotal role in increasing student response rates. Subthemes for motivation included incentives, reminders and purpose.

Incentives

The topic of incentives surfaced frequently, but with varied use and skepticism of a few. Generally, instructors used either indirect incentives or none at all. Some instructors used indirect extra credit or allowed students to use notes on the final exam as ways to incentivize students to complete the course evaluation. Instructors also harnessed peer pressure by showing the percentage who had responded to the course evaluation in class and students would then pressure each other to respond so that everyone would receive the incentive. Some instructors stopped using incentives, calling into question the quality of feedback received from the incentivized students.

Reminders

Many instructors reminded their students to take the course evaluation. Most reminded students multiple times and in multiple ways such as through e-mail, in-class, through peers and in casual conversations. "…I'm reminding them. I probably send out 3 or 4 e-mails…," said Vicky. Instructors felt they needed to remind students frequently, as students were often distracted with other responsibilities at the end of the semester; students with good intentions became forgetful when pushed for time.

Purpose

Many instructors took time to discuss the value of students taking the course evaluation, what it was used for, how it benefitted the university and the individual faculty member. *"I encourage my students not to just, you know, click the numbers and stuff, but to provide in depth feedback,"* said Nancy. Instructors commented on how ignorant students were about the purpose of course evaluations. Even college juniors and seniors seemed to be unaware of the role course evaluations play in faculty promotion and tenure.

Logistics

Several issues related to the logistics of administering the course evaluation also emerged. The previous system, explanations and participant fatigue were emergent subthemes associated with this theme.

Previous System

Some instructors maintained the mentality of the previous paper and pencil evaluation system administered in a face-to-face classroom setting. These instructors would announce to the class to bring their electronic device to class on a particular day in order to take the course evaluation. James said, *"I treat it like the old evaluations and say, we are doing evaluations today. We are going to take about 10-15 minutes, go out of the room and have the T.A. proctor…"* It was, however, equally as common for instructors simply to expect student to take the evaluation on their own time. A few instructors felt access to electronic devices was a barrier for students.

Explanations

Many instructors explained to students the logistics of completing the course evaluation. This often included explaining the anonymity of responses as well as explaining the value of course evaluations. Nancy would walk students through the procedures of completing the evaluation as well as show them the administrative screen she could see to assure students their comments were anonymous.

Participant Fatigue

Students received all of the course evaluations at the same time for the courses taken within the current semester. Instructors feared that this might discourage students from doing the evaluations at all. Further, instructors were skeptical about the quality of the feedback students may provide if theirs was, for example, the fifth evaluation the student completed within the same sitting.

Course

Instructors associated student engagement and willingness to participate in the course evaluation with

characteristics of the course. Coursework and dynamic methods were two emergent subthemes associated with this theme.

Coursework

Instructors felt the courses in question were challenging and rigorous. Several instructors commented that theirs was not a course students would take if it were an elective. Instructors commented on the dynamics of the course itself as being challenging and engaging. Concepts of relevancy, rigor and challenge continued to surface with all the instructors as they described their courses.

Dynamic Methods

Instruction within the courses varied. No instructor used lecture exclusively. Many instructors indicated the tone of their courses were very conversational. Instructors felt this might be important, as students were comfortable with the instructor due to the interactions this varied instructional mode facilitated.

Student Perspectives

Final participation for the student focus group consisted of seventeen students; four seniors, ten juniors and three sophomores; ten were males and seven female. Twelve students self-identified as pre-professional students. Sentiments from students who participated in the focus group coalesced around four themes that may have affected the response rates to online course evaluations: what's in it for me, response motivators, logistic challenges and frustration. Each theme had several sub-themes.

What's in It for Me?

Students lacked personal connection to the course evaluation. Generally, students viewed course evaluations as a tool to benefit them in selecting courses or professors. Subthemes associated with this theme were pointlessness and RateMyProfessors.com.

Pointlessness

Participants felt the course evaluations did not lead to change. The primary evidence they cited was the persistence of poor professors and courses at the university, despite receiving what they were sure were years of poor course evaluations. One focus group participant stated, "*I'm like, clearly the department already knows how bad of a teacher he is, so what am I going to gain by wasting my time to fill out an evaluation about something that everyone already knows."* A few participants also cited the fact that they were graduating, the implication of course being the course evaluation would not directly benefit them or those they knew so they would not go through the effort of completing it.

RateMyProfessors.com

Participants often referenced the website Rate My Professors (http://www.ratemyprofessors.com/). They found the information from this website useful for selecting a professor as the site included the narrative about the professor, which provided some perceived transparency to the review process. Some participants indicated they preferred the written portion of the course evaluation to the numeric portions of the course evaluation as it provided them the opportunity to vent and to expound. There was a sense of frustration that the narrative portion could not be published on the University of Florida website, as it is on the Rate My Professor website, for other students to see. When reviewing the numeric portion of the course evaluation for potential professors, students did not find this information terribly useful.

Response Motivators

Students indicated they were more likely to respond to the course evaluation with certain motiving factors. Subthemes included incentives, bipolar feelings, time in class, instructor passion and compassion and formative versus summative feedback.

Incentives

Participants indicated they were the most likely to complete the course evaluation if incentives were provided by the professor. One participant put it as, *"…if I am being offered extra credit, I'll do those [evaluations] first and then I'll do the ones I feel the most strongly about. And then if I am like, ah, I have free time, I'll just do the rest, but if not, skip it."* Often, if the class met a certain threshold of responses, then the entire class would get some form of reward. Some participants indicated concern that the use of incentives could decrease the quality of data of the course evaluation. For example, one participant indicated he would likely complete the evaluation as quickly as possible just to get it done, with very little concern for the quality of response he was giving.

Bipolar Feelings

Participants indicated they were likely to complete the course evaluation if they strongly liked or disliked a professor or course. One student commented, "I will fill out the evaluation if I really like the teacher or if I don't like the teacher." Additionally, many indicated that the overriding emotion was that of negativity; if they disliked the professor or their teaching they were more likely to respond than if they liked the professor or their teaching.

Time in Class

Participants indicated they appreciated it when instructors offered time in class to complete the evaluation. One participant stated that he had good intentions, but if an instructor did not give time in class, he may forget.

Instructor Passion and Compassion

Participants indicated they were more likely to complete the course evaluation if the instructor cared about

the course and about students. Instructors who showed they valued feedback and used formative assessments throughout the semester appeared as caring. One focus group participant said, *"I've had situations where you email the professor seven times and not gotten a response and then you ask, can you fill out the evaluation forms and I'm like, yeah, right, why am I going to help you?"*

Formative Versus Summative Feedback

Participants often indicated they valued formative assessments that would influence the direction of a course they were currently taking. Further, if an instructor had used formative assessment previously in the course and the student was able to make a connection between student input and a modification to the existing course, they were more likely to fill out the summative course evaluation.

Logistic Challenges

Several challenges with the logistics of completing the course evaluation emerged. Comments focused on the timing of the course evaluations that opened at the end of the semester when students were completing final exams. Subthemes associated here were participant fatigue, low priority and cognitive load.

Participant Fatigue

Participants felt fatigued when completing the course evaluation. As one participant put it, "[Course evaluations are] all dumped on you at once." Students would often try to complete all of the course evaluations at the same time. However, if participants were pushed for time, or felt fatigued, they were likely to complete the evaluations for courses they felt strongly about first, or the ones for courses whose instructors offered incentives. Other evaluations may or may not be completed.

Low Priority

Several participants indicated that at the time of the release of course evaluations, which students received in the form of an e-mail, students also received a deluge of other emails. Students focused on myriad issues at the end of the semester and, consequently, completing a course evaluation simply slipped lower on their priority list.

Cognitive Load

Participants indicated they felt that completing the course evaluations all at the same time created a large cognitive demand. Several participants indicated frustration from trying to remember details from multiple courses simultaneously as they were trying to complete all of the evaluations at the same time.

Frustration

The tone of several student comments was that of frustration. The emotions appeared to range from apathy to relative open hostility toward the course evaluation. Subthemes were who looks at them and ambiguous motivators.

Who Looks at Them?

Students intended this as both a cynical statement as well as an actual question. Many participants did not know what happened to their evaluation after they hit submit. One participant stated, *"The department, like, I feel like it just go to the trash basically. Like I don't feel like it is being evaluated and counted afterwards."*

Ambiguous Motivators

More than one participant indicated they were told the reason to fill out the course evaluation was because it was demanded by the department chair. Participants indicated this did not serve much toward motivating them to complete the course evaluation.

Discussion

Instructors perceived a context based on reciprocity, communication, concern for student input and service yielded improved response rates for online course evaluations. Students echoed these sentiments by indicating they were more likely to complete the course evaluation if they felt strongly positive or negative toward an instructor. Perhaps eliciting emotions from the student and making personal connections between instructor, student and the material at hand allowed the student to feel personally connected to the situation and therefore more likely to do something to benefit others. Spence and Lenze (2002) also noted value in creating a culture that took student criticism seriously.

Instructors used several tactics to boost response rates. Many used incentives successfully which was also identified as a strong motivating factor by students. Instructors must consider the possible tradeoff between the quality and quantity of responses received when incentives are used. The use of incentives and their effectiveness matched the results of other studies (Crews and Curtis, 2011; Dommeyer et al., 2004). Additionally, using peer pressure, open dialogue about progress on response rates and frequent reminders also helped to encourage students to find the time and motivation to complete the course evaluation. Further, frequent reminders in various forms such as e-mail, in person and peer to peer helped boost response rates which was consistent with other several other studies (Guder and Malliaris, 2013; Norris and Conn, 2005; Ravenscroft and Enyeart, 2009).

Handling logistical issues may affect students' choice and ability to complete the course evaluations. Students appeared to appreciate being given time in class. The university deployed evaluations all at once and at a very busy time of the academic year. Therefore, it is little wonder that students placed a low priority on completing the course evaluation. Providing time in class, similar to the paper and pencil system, may provide the necessary means for a student who would otherwise not complete the course evaluation.

Students were looking for evidence that their efforts to provide feedback would lead to change. Instructors who helped students understand the purpose of course

evaluations had greater response rates, which aligns with conclusions made by Guder and Malliaris (2013). Norris and Conn (2005) also noted the importance of explaining the value of course evaluations to students. Findings from this study indicate both staff and students recognized the value of using formative assessments. Instructors must make a strong connection between perceived effort on the part of the student and perceived reward in the form of a change in the course. This may also point to the value students seemed to place on the Rate My Professors website, as it seemed to fill an information void that students felt lacked in the current structure of the summative assessment of course evaluations. Interestingly, one study indicated this website set a tone that generated comments about instructors' personality, workload ease and entertainment value over actual knowledge gained (Davidson and Price, 2009).

Recommendations for Practice

First, incorporate the variety of tactics descried in this study, such as using formative assessment, frequent reminders and incentives. Second, anticipate logistical challenges students may encounter before and during the completion of online course evaluations and work to mitigate them. Consider giving time in class, or scaffold the deployment of online course evaluations so students have time to complete the evaluation without feeling overwhelmed. Finally, help students find value in the course evaluation process by explaining the purpose of course evaluations and providing examples of how their efforts yield change in individual courses as well as campus wide. By drawing examples of how previous student input helped shape policies, procedures and class culture, students may feel more empowered in the process of course evaluations and therefore more willing to complete them.

Recommendations for Future Research

First, explore the notion of student motivation more thoroughly. As student motivational dynamics shift, their willingness to participate in routine university procedures may decrease, despite the implementation of best practices. A firm understanding of the relationship between student motivation and willingness to participate in procedures, such as online course evaluations, would provide necessary insight. Second, conduct a similar study concerning courses taught exclusively online. The field of online learning is growing and suffers the same, if not a worse fate, of poor course evaluations response rates. Researchers should study courses taught within colleges of agriculture that are exclusively online with a similar focus as this study.

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Factors Influencing the Communication Skills of College of Agriculture Ambassadors

D. Edmonds[1], N.E. Fuhrman[2] and D.W. Duncan[3]
University of Georgia
Athens, GA

K. Elliott[4]
Metro Nashville Public Schools
Nashville, TN

Abstract

First and second-year College of Agriculture Ambassadors shared similar factors which influenced their attainment of communication skills. Focus group findings revealed five overarching domains, including: Ambassador experiences, recommendations for other students, influences on participation as an Ambassador, past communication experiences and personal preparation for speaking. Experiences which most directly influenced Ambassador's communication skills included those which forced students to step out of their comfort zone with regards to communicating with university and industry professionals. The importance of observing others with both strong and weak communication skills was emphasized. Ambassadors recommended that faculty build assignments which promote student attendance at university functions where they can observe professionals communicating. Such assignments could involve students attending poster sessions and lunch-and-learn workshops with industry leaders. Ambassadors also recommended providing opportunities for students to serve as leaders in class discussions. Assignments that create a learning environment where students are comfortable making communication mistakes and can reflect on those errors (such as through video observation) are also recommended.

Introduction

From an employer standpoint, undergraduate and graduate students lack soft skills needed on the job (Brooks et al., 2008). Soft skills, including communication, decision-making, problem-solving, self-management, teamwork, professionalism and leadership experiences, are complimentary to a students' content knowledge-base and can influence the likelihood of successfully navigating an interview (Crawford et al., 2011). One main skill that is especially important and has been stressed in the literature is communication (Guenthner and Moore, 2005; Schneider, 2015; Thomas, 2010). Employers, teachers and even college students themselves have been studied and all agree that communication skills are in need of improvement among college students about to enter the workforce. However, research concludes that students perceive their "soft or practical skills" to be stronger than that of employer perceptions. A recent report released by the Association of American Colleges and Universities highlights the discrepancy between students' and employers' views. While 62% of students said they were well prepared in written and oral communication, only 24% of employers believed that to be true of recent college graduates (Schneider, 2015). Leaders in the 21st century must be able to communicate in diverse situations and with diverse individuals and the need for enhancing student communication skills has been discussed for over a decade (Watt, 2003).

Employers are less likely to hire individuals lacking strong communication skills (Stephens, 2013; White, 2013). In a study by Bronson (2007), the majority of high school students lacked many professional characteristics, including communication skills. In fact, communication has been listed as the most important soft skill to employers (Crawford et al., 2011; Schneider, 2015). The types of communication skills that employers are looking for, listed from most important to least important, respectively, are listening effectively, communicating accurately and concisely, effective oral communication, communicating pleasantly and professionally, effective written communication, asking good questions and communicating appropriately and professionally using social media (Crawford et al., 2011).

[1]Former Master of Agricultural Leadership student, Department of Agricultural Leadership, Education and Communication, Athens, GA 30602, Phone: (336) 406-8971, Email:dedmonds@uga.edu

[2]Associate Professor and Graduate Coordinator, Department of Agricultural Leadership, Education and Communication, Athens, GA 30602, Phone: (352) 226-1199, Email: fuhrman@uga.edu

[3]Professor, Department of Agricultural Leadership, Education and Communication, Athens, GA 30602, Phone: (706) 542-3898, Email: dwd@uga.edu

[4]Director of STEM Education, Metro Nashville Public Schools, Nashville, TN 37204, Phone: (615) 259-8662

These soft skills are important to potential employers, especially in the agriculture field (Guenthner and Moore, 2005). Agriculture leaders must be able to communicate with diverse groups and do this effectively to maintain group motivation and support for an organization's mission (Kaufman et al., 2010). A study by the Center for Agribusiness and Economic Development at the University of Georgia showed job candidates (undergraduates seeking positions) were overly focused on technical skills and not soft skills such as communication and leadership (Brooks et al., 2008). Moreover, the researchers found job candidates had poor communication skills, needed more emphasis on leadership skills, critical thinking, problem solving and analytical skills. Communication is an important skill needed for employment and understanding how to better prepare future employees and leaders is key to giving them a competitive advantage in the workforce.

Although building communication and other soft skills is important, college students often have a negative perspective about strengthening these skills (Mangan, 2007). In fact, Mangan (2007) called on college faculty to strengthen soft skills in college students and Dwyer and Davidson (2012) more recently suggested that public speaking skills specifically should be targeted. Soft skills are not just related to particular careers, they are needed in every career and Peckham (2009) emphasized the importance of communication specifically. Although the importance of communication skills in college students is well known, little has been discussed concerning where college students acquire such skills.

Although building soft skills like communication in students is critical, educators are often not equipped to help students build such skills (Hofstrand, 1996). Some teachers lack effective communication skills, so they need reinforcement in these skills themselves (Stephens, 2013). Teachers and professionals are aware of this need to help students in communication, but often lack the knowledge of how to incorporate communication strategies into their classrooms and assignments. Understanding what college students believe have contributed most significantly to strengthening their communication skills would be beneficial as curriculum is developed to target communication skills.

Soft skills can also be strengthened outside of the classroom. In addition to classroom instruction, extra-curricular activities are an opportunity for college students to hone and polish their communication skills. College student organizations (extra-curricular opportunities) generally fall under the following categories: governing bodies, college Ambassadors, Greek letter social organizations, student government groups, academic clubs and professional honor societies, publication and media groups, service groups, intramural sports clubs, religious organizations and special interest/cultural groups (Astin, 1993; Montelongo, 2002). Extra-curricular activities add different dimensions to a students' college experience, can reinforce the goals of higher education and can help undergraduate students with the transition from college to the workplace (Tchibozo and Pasteur, 2007). Additionally, participation in extra-curricular activities has been shown to be a strong predictor of workplace competence—even stronger than grades (Kuh, 1995).

College Ambassadors are often the first individuals' potential college students interact with when visiting campus; thus, they should, in theory, have strong communication skills. They help to recruit new students, answer questions about the college or university and potential majors and options, give campus tours and act as a direct contact for prospective students (Woelk and Weeks, 2010). The typical Ambassador program has five main components, including leadership development, promotional activities, standardized college presentations, student benefits and building relationships (Arnold, 2012). If a student becomes a college Ambassador, this experience can reinforce personal development and professional leadership skills (Arnold, 2012). Communication is obviously a key skill for student Ambassadors and many students who have participated in an Ambassador program state their experience helped them gain leadership development, communication and self-confidence (Arnold, 2012). However, it is still unknown as to what contributed to building Ambassadors' communication skills which can be associated with their overall Ambassador experience.

Purpose and Objectives

The purpose of this study was to examine the factors which influenced College of Agricultural and Environmental Sciences Ambassadors in their attainment of communication skills, allowing for more purposeful incorporation of these factors into high school and college courses. The following research objectives guided this study: (1) describe the demographics of the College of Agricultural and Environmental Sciences Ambassadors; (2) describe the past experiences of Ambassadors which contributed to their communication skills; (3) identify the current practices of college Ambassadors which have contributed to their communication skills; and (4) describe recommendations that Ambassadors have for strengthening future communication skills in other students.

Methods

This qualitative study sampled all fifteen College of Agricultural and Environmental Sciences Ambassadors (census) on the University of Georgia Athens campus and involved them in two separate focus groups with each focus group consisting of seven to eight students. Decisions about which focus group a student participated in were made based on each students' experience as an Ambassador. Students in their first year as an Ambassador participated in focus group one; students in their second year as an Ambassador participated in focus group two. The Ambassador selection process used by College administration was based first

on ensuring that student diversity represented that on campus, followed by a representative mix of student majors, year in school and leadership experiences held by the student. Regardless of their tenure as an Ambassador, students participated in a training that consisted of a retreat before the school year to practice speaking skills and preparation for their Ambassador duties. The Ambassadors also participated in a yearlong course for one-credit hour meeting weekly to practice leadership and speaking skills and hear from guest speakers specializing in communication and leadership.

Data Collection

The fifteen student Ambassadors were invited to participate by email and focus groups were conducted at a convenient time for the Ambassadors. The University of Georgia Institutional Review Board approved the study protocol and all participants provided written informed consent prior to participation in the study. The focus group questions (Table 1) were written based on the objectives of the study and the findings from a synthesis of available literature. Both groups of Ambassadors were asked the same questions about their communication and Ambassador experiences. The focus groups met face-to-face and were audio recorded. A note-taker was also present during each focus group to assist with writing notes for the facilitator to refer back to while Ambassadors responded. Students were also given a communication demographic questionnaire about their curricular and extra-curricular activities to determine if such activities contributed to their communication skill acquisition prior to participating in the focus groups. This researcher-created demographic survey was completed before the focus group began.

Data Analysis

The data from the two recorded focus group sessions were transcribed verbatim. Domain analysis, a form of content analysis, was used to summarize the data and identify reoccurring, emerging themes as recommended for focus groups by Jackson (1999). Dominant themes were listed in order of their occurrence in the raw data without any direct identifiers. The authors and several other researchers reviewed the focus group data and conducted separate domain analyses before comparing findings to ensure consistency in interpretation. The transcribed focus group data were peer reviewed to reduce the introduction of bias and the themes which emerged were validated by an outside source. Reoccurring themes were referenced with findings from the demographic questionnaire to identify potential influences and experiences that contributed to those themes. Recommendations were then made based on the transferability of the findings.

Results and Discussion

This study examined two aspects of the College of Agriculture Ambassador experience: (1) what influenced College of Agriculture students to become Ambassadors and (2) what students gain personally and professionally from being a college Ambassador. Tables 2 and 3 describe the demographic characteristics of participants in the two focus groups along with a pseudonym representing their name. Thirteen Ambassadors participated in the focus group discussions and demographics questionnaire. The participating Ambassadors were made up of eight females and five males. There were three females and four males in focus group one and five females and one male in focus group two. The ethnicity of the Ambassadors included eight Caucasian students, two African American students, one white/American Indian student, one Asian student and one student

Table 1. Focus Group Questions

1.	In some cases for some people, verbal communication skills come natural to them and in others verbal communication is a skill that they have to work on to be comfortable. Who in here is a naturally strong verbal communicator? Explain. Who in here had to work on their verbal communication to get where they are today? Explain.
2.	Good communicators usually have techniques and strategies they use when they communicate, so they will be effective and more comfortable. What specific techniques do you practice to be an effective communicator?
3.	What experiences would you have liked to have had in high school, college, or beyond to better prepare you to excel in communication?
4.	Many individuals have a fear of speaking and this makes them nervous. What makes you most nervous when communicating?
5.	As an Ambassador you all have proven to be good verbal communicators. What motivated you to want to apply to be a part of the ambassador program?
6.	How has your experience as an Ambassador prepared you for either graduate school or a career?
7.	In your opinion, what are some things that could be incorporated in a classroom in high school or college that would benefit future Ambassadors?
8.	How has the Ambassador training impacted you positively or negatively?
9.	What challenges have you faced in the program or training?
10.	If you were in charge of the training, what might you add/do differently?

Table 2. First-year Ambassador Demographics

Participant Pseudonym	Major	Minor	Previous Communication Courses Taken	*Club Involvement
Claire	Environmental Economics and Management		Introduction to Public Speaking	National Forensic League (NFL), High School Speech and Debate
Leon	Agribusiness		Introduction to Public Speaking	4-H, FFA
Tim	Agribusiness		Speech Communication	
Tammy	Biological Science		Introduction to Agricultural Communications	4-H (elementary), Delta Sigma Theta Sorority Inc., Resident Assistant
Carrie	Agricultural Communications		Telecommunication, Special Problems in Agricultural Communication	4-H, Block and Bridle
Michael	Agricultural Communications		Introduction to Public Speaking, Journalism, Speech	FFA, FCA
John	Agricultural Communications		Introduction to Communication in Agriculture and Environmental Sciences	4-H, FFA, FBLA

Note. *Club involvement included K-12 education and college.

representing "other ethnicity." The graduation year of ten of the participants was 2015 and three of the participants were to graduate in 2016.

The focus groups provided many different perspectives and experiences that influenced Ambassador's communication skills and the development of other soft skills. Both focus groups revealed similar discussions and topics; therefore, no topic or domain differences were noted between the two groups based on student tenure as an Ambassador, nor did student demographics influence domains shared.

The following five domains emerged from the raw data and are presented in order of their occurrence along with select raw quotes from focus group participants.

Table 3. Second-year Ambassador Demographics

Participant Pseudonym	Major	Minor	Previous Communication Courses Taken	*Club Involvement
Susan	Agricultural and Applied Economics		Introduction to Public Speaking	4-H, FFA
Lisa	Biological Sciences		Introduction to Public Speaking	FBLA
Kaitlyn	Poultry Science		Introduction to Public Speaking	4-H
Nancy	Animal Science	Agribusiness	Introduction to Public Speaking	FCCLA
Sam	Food Science		Introduction to Public Speaking	
Sally	Agricultural Communications	Agribusiness	Special Problems in Agriculture Communications, Advertising and Public Relations, Telecommunications, Journalism, Agricultural Sales, Introduction to Public Speaking	4-H, FFA, Beta, FCA, SAC

Note. *Club involvement included k-12 education and college.

1. Ambassador Experiences

The participants reflected on their Ambassador experience and training that had impacted them personally and professionally (Table 4).

The Ambassadors also spoke highly of their Ambassador experience because it greatly impacted them through exposure to opportunities to grow in their knowledge about their career path or gain professional experience. They discussed many opportunities they participated in to broaden their horizons, gain networking opportunities and professional life skills.

Table 4. Ambassador Experiences Contributing to Current Communication Skills

Participant	Response
Tammy	I think that the Ambassador program has impacted me positively because it's like I'm being exposed to a lot more things that I haven't been exposed to before. I kind of feel like I've had the wool over my eyes, for a lack of better words before this because I wasn't really sure like, I didn't really know how many jobs or opportunities that are involved in agriculture, and like I've seen that there are so many, and I kind of wished I had known this beforehand cause it's senior year now. It's been a good experience and a good networking experience too.
Nancy	We are able to interact with other people in job settings and really important people that we may not have had the opportunity to learn how to talk to or be able to get that experience and that's incredibly valuable for me and so that I'm not nervous anymore or that you just learn how to get those communication skills that are needed in those environments and especially for grad school, time management is a huge thing with this and I think just definitely being able to talk to anyone that you could possibly need to talk to rather it's a child or on up to a CEO of a company.
Susan	We are also able to learn how to work in a group and with different people because at the events we go to, we are not in the same group every time we do an event. We have to learn how to interact with everyone in the group. We also learn people management, so you have to learn how to manage people and make sure that everyone gets the information they need so they are not clueless when they go do things. Our advisor has very high expectation of us, so that is definitely a big thing. They expect us to be early to everything and communicate everything to him; like when we cannot make it to something, they expects us to be able to communicate with him and if not they do not take it lightly. So we get that boss experience before being out in the real world.

2. Influences on Participation as an Ambassador

Ambassadors reflected on what influenced and motivated them to become an Ambassador (Table 5). Specifically, participants mentioned that the Ambassador program seemed like a fun way to get involved in the College and to give back to the College and others mentioned the opportunity to share their story with future students. Networking opportunities were a significant influence on these students' decision to become an Ambassador.

Table 5. Influences on Participation as an Ambassador

Participant	Response
Carrie	It just seems like a fun way to get involved with the college as a transfer student, it's sometimes, hard to get involved with organizations, but this was everyone had an equal chance to get selected and I like that. You really get to meet people that you would have never gotten to meet in any other organizations, so I really appreciate that too.
Susan	The networking opportunities that we have are awesome and we get to tell our story to different students and give them advice that we wish that we have had as freshman or high school seniors making decisions, so we really get to help those students that come on tours or that just needing questions answered at different events that we go to.
Tammy	I think my motivation stemmed from the fact that I felt that the college has invested so much in me, therefore I wanted to give back to the college. I really like to share my love for the college. Coming to a big college it was kind of hard at first to find my niche, so I guess I want to help others find it faster than I did.

3. Past Communication Experiences

The Ambassadors also reflected on their experiences from elementary, middle, or high school and any organizations they partici-

Table 6. Past Communication Experiences Contributing to Current Communication Skills

Participant	Response
Leon	FFA, every application that I filled out since the 9th grade for any type of job, school program like this, I've always reverted back to FFA and the things I've learned there. My experiences there have always helped me along.
Sam	I think that one of the best ways that I learn to speak well is to hear speakers that are good, like good examples, especially when they come to class and you get to ask questions afterwards. They know and they've been practicing for a long time and they have tricks that I wouldn't know, so just observing them and listening to them, you pick up a few things.
Claire	I participated in the National Forensic League in high school, which is a nation-wide speech and debate organization. I spent most of my Fridays and Saturdays, freshman through senior year presenting speeches, both auditories and impromptu, so I have that experience with presenting and memorizing speeches. I also had the experience of thinking of a five minute speech given only two minutes before the presentation.

pated in that influenced their communication skills prior to becoming an Ambassador (Table 6).

The past communication experiences of the Ambassadors were greatly impacted by participation in organizations and clubs and this participation often gave them exposure to effective communicators who served as role models. The Ambassadors gained communication skills through their involvement in personal development activities and by observing effective and ineffective communicators and these experiences influenced their own communication skills.

4. Personal Preparation for Speaking

The participants also shared personal strategies and techniques to prepare themselves for speaking with others and handling potential speaking anxieties while giving a speech (Table 7).

5. Recommendations for Other Students

Finally, the participants reflected on their past experiences that they wished they had when formulating recommendations for other students (Table 8).

Providing students the opportunity to practice communication skills in classes and become involved in organizations and clubs, such as FFA and 4-H, were strategies that the Ambassadors provided that could influence a students' attainment of communication skills prior to and during their college experience.

The Ambassadors all had different backgrounds that influenced their communication skills. The experiences and recommendations that the Ambassadors shared were classified by the researchers as either "point source" or "non-point source" in terms of assignments and experiences. "Point source" experiences were classified as specific activities which could be directly traced back to the students' attainment of soft skills. These would include, for example, a specific assignment in a college course, or events related to an extra-curricular activity. "Non-point source" experiences were those which have components that collectively worked to build soft skills, but which are difficult to identify any one aspect as contributing solely to building soft skills.

Both point source and non-point source experiences were shared by the Ambassadors. This was prevalent in the discussions on the Ambassador experience, recommendations for other students and past communication experiences. Many point source experiences were provided, such as assignments, speeches and involvement in clubs and organizations. Point source experiences were the most prevalent experiences discussed in this study and students researched in earlier studies noted that leadership positions gave them the opportunity to learn in the "real-world" classroom (Haber, 2006).

Non-point source experiences were less prevalent in the raw data. Along with communication skills, 77% of the participants discussed professionalism and personal growth that they have obtained in their experiences as a student and an Ambassador; 69% of the participants mentioned some experiences they wished they had been provided to help prepare them professionally and to allow them more practice with communication. The participants shared what influenced them to become an Ambassador, which was mostly improving their communication skills, professional preparation, networking opportunities and preparation for the workforce. Many mentioned that they wanted to be an Ambassador to build upon their past experiences to help themselves personally and professionally and some mentioned that they felt the need to give back to the College because it had helped them to further their education.

Non-point source experiences were important to the Ambassadors' attainment of communication skills, as well as other soft skills, but these non-point source experiences were less common. In a study by Fuhrman and Ladewig (2008), students had a more positive learning experience with out-of-class assignments involving communication and leadership when those assignments were less structured compared to assignments with specific instructions and guidelines. Students can have a sense of ownership in their educational experiences when assignments are less structured and allow students to be creative. Students will participate and create experi-

Table 7. Ambassador's Personal Preparation for Speaking

Participant	Response
Lisa	One of the things that I do, is that I tend to speak very fast when I'm in front of friends and people that I'm comfortable with so the thing I try to do is slow down and to enunciate my words so that people will understand me better. And also, by slowing down it helps me, if I have nerves it helps to eliminate my nerves and everything. So that's just one of the things I do.
Susan	Whenever I'm speaking to a big group, one thing that I try to do is to kind of get rid of any nerves or any awkward moments that might happen is to not look directly at people but look above people's heads when you are speaking to a group, just to so you don't make direct eye contact with someone, but they know that you are looking in their direction.
Carrie	To be an effective communicator, you need to have direct eye contact, really try to make your voice heard out into the crowd and really try to be as personable as possible when talking to either students, professors, or just random strangers. You are just really trying to get them to remember you and what you are representing.

Table 8. Recommendations Shared by Ambassadors for Other Students

Participant	Response
John	I would say growing up in 4-H, you can do different tracks of things and leadership is one of the principles that they try to instill in you like from the 5th grade all the way up until you graduate from high school and I think that pretty much anyone has the ability to be a leader and I thinks that something that should be recreated for everyone growing up because being able to serve as a leader in any situation gives you the ability to effectively communicate with others and also learning how to push yourself and I think that's a something that everyone needs to, or everyone should take advantage of before they get to college.
Nancy	Opportunities to get to talk in large groups, opportunities to give speeches, opportunities to just talk without anything planned and then I think opportunities to interact with adults and important people. I don't know how you would facilitate that but that's really kind of trial by fire. In my opinion like there's no way to really, I guess you could figure out a way to practice it but until you actually sitting there talking to someone really important you don't know how you are going to do it. That's the only way I could really gotten good at it or ok with it I guess.
Sally	One thing that would be really beneficial is if there was some way you could do a professor luncheon thing, where students interact or stuff like that and just learn skills about how to really communicate with people in the workforce and stuff like that.

ences that are more relevant to their lives, career goals, interests and personal growth.

Faculty should allow students the flexibility to take ownership in aspects of out-of-class assignments which have the potential to build soft skills. For example, students could be encouraged to attend a seminar or conference and mingle with invited guests. Although less structured (e.g., lacking structured questions to ask guests), this type of experience was mentioned by participants in this study as being influential in building their communication skills in a "participant observer" type role. If students are given the freedom to be creative in their assignments, it opens the door to employ critical thinking skills and produces a higher quality of work and skill growth. In another study, the act of role playing was an educational strategy to develop leadership and communication skills, especially in developing "people skills" (Guenthner and Moore, 2005). In the role playing study, students developed a better understanding of issues, improved their communication skills and had a choice of a topic that they wanted to research (Guenthner and Moore, 2005). When students have the freedom to choose topics and create their own structure for an assignment or speech, students can relate more and gain more communication and leadership skills. Not only are students gaining communication skills, leadership skills and confidence, they are also learning more of the content matter (Guenthner and Moore, 2005). As discussed in the focus groups in this study, participants mentioned allowing students to choose speech topics that they are interested in, participate in organizations and club experiences of their choosing and watching other speakers and leaders as recommendations for building communication skills in other students.

Point source experiences seem more common in the educational system and many Ambassadors shared stories about these experiences. In a study by Culp and Cox (2002), ten principles for effective youth leadership development were shared. Some of the principles of an effective program included high expectations and confidence, experiential learning and opportunities for leadership, collaboration and networking with others and positive relationships with important adults. When students are presented with high expectations, they are encouraged to come out of their shell and develop more self-possessed communication skills. The Ambassadors in this study described some of these experiences and situations that made them step out of their comfort zone and helped them to better themselves as an effective communicator.

Recommendations

The following recommendations were shared by Ambassadors that they experienced personally or wished they had experienced which could help other students:

1. Public speaking opportunities to help develop speaking skills, such as extemporaneous and prepared speeches, with a variety of audiences.
2. Creating an environment to foster good demonstration skills. For example, providing feedback to students on how to improve and what they are doing well and creating scenarios that represent real-life presentations, such as mock job interviews.
3. Attending conferences, events, or poster sessions to learn by observing others.
4. Opportunities to serve as a leader in a class case study or through a club or student organization.
5. Interacting with adults and professionals to prepare for communication in the workforce, such as professor luncheons.

Other recommendations for college faculty based on this study that would benefit students include:

6. Offering a 1-credit seminar course on communication skill attainment.
7. A mentoring experience where faculty are videotaped teaching and asked to reflect on their communication skills with a teaching and learning professional.
8. Slowly incorporating communication experiences into existing curricula and monitoring student reactions with formative data collection techniques. Once student data is collected, share a summary of student responses with the class and be prepared to make changes to reflect student feedback.

Many of the Ambassadors mentioned strategies they acquired from participating in FFA or 4-H, but similar experiences can be used in any subject to help students improve their communication skills. Not all students are involved in clubs and organizations that encourage students to practice and gain these skills, so there is a need to incorporate those strategies in classes and throughout the students' educational time in college. Point source and non-point source experiences may help students succeed in an interview by building confidence and grow in a career by building skills to collaborate with others. Lastly, being involved in extra-curricular activities not only can be a strong predictor of workplace competence (Kuh, 1995), but can also help improve their perceived communication skill competence.

Additional research is needed in this area. Specifically, greater attention is needed to better understand the reactions of more experienced Ambassadors (e.g., second year Ambassadors). The more experienced Ambassadors did not indicate greater communication growth, so perhaps the focus group questions were not sensitive enough to detect skill growth in these students. More specific focus group questions may be needed for students with more experience as Ambassadors. Students may have acquired communication skills through their participation as an Ambassador, but the focus group questions were not able to detect such skill attainment.

Summary

Factors which influenced College of Agriculture Ambassadors' communication skills most significantly could be classified as "point source" experiences. These experiences, such as students interacting with industry professionals and campus leaders in a relaxed atmosphere with limited structure, were influential in building Ambassadors' communication skills. Observing ineffective communicators could also be valuable. Many of the Ambassadors mentioned strategies they acquired from participating in FFA or 4-H. However, not all students are involved in FFA or 4-H where communication skills are emphasized, making the need for college faculty to create a comfortable learning environment conducive to building student communication skills even greater.

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Using Review Sessions to Promote Student Learning in an Animal Reproduction Course

Daniel H. Poole[1] and Jeannette A. Moore
North Carolina State University
Raleigh, NC

Abstract

The purpose of this study was to evaluate the effectiveness of question-and-answer based review sessions to stimulate student learning (assessed as an increase in exam score) in an animal reproduction course. Data were collected over 2 semesters from students (n=107) enrolled in a Reproductive Physiology course at a major land grant university. Prior to each of the three lecture exams, students had the option of attending a review session the evening (1700 to 1900 hrs) before the exam. Student attendance at review sessions was approximately 30% of the class. Review session attendance was positively correlated to exam score ($P<0.10$) and student performance on medium and high cognitive level questions ($P<0.03$). Overall, students who attended the review sessions earned more points on the exams than those who did not (76.1±0.98 vs. 69.6±0.98, respectively). Students who attended the review sessions required the same amount of time to complete Exam 1 and Exam 2 as those students who did not attend ($P>0.22$), but spent more time answering Exam 3 questions ($P=0.08$). In conclusion, improved exam scores as a measure of student learning were associated with student participation in review sessions.

Introduction

Review sessions, held outside of the regular class meeting time and mediated by a course instructor or teaching assistant, are designed to provide students additional support and preparation for exams. These sessions can consist of a variety of formats including oral study sessions, administration of a practice exam, or traditional question-and-answer opportunities with instructors (Neef et al., 2007). Cross (1987) stated that students learn more when actively involved in the learning task, thus student involvement in review sessions has the potential ability to promote student learning and success within the classroom. However, student participation and subsequent academic performance, beyond exam scores, following review sessions is not commonly empirically evaluated.

Aamodt (1982a) reported that students who attended a question-and-answer based review session the night before an exam scored higher on a cumulative final exam in an introductory psychology course than students who did not attend. In a subsequent study, Aamodt (1982b) evaluated which aspect of the review session was most beneficial for the students. Students who attended a question-and-answer review session that consisted of key concepts scored better on the final exam than students who attended a general question-and-answer review session or did not attend a review session (Aamodt, 1982b). Based on these papers, it was concluded that reviewing key information the night before an exam provided the students with the instructor's exam expectations, which may explain the improved exam score.

Several studies have examined the effectiveness of using practice exams as a method of review (Balch, 1998; Bol and Hacker, 2001). This method of review has shown improvement in student performance via increased exam scores. Exam scores were greatest when review questions, which resembled the exam in form and content, were provided to students compared to students who did not receive review questions (Balch, 1998; Bol and Hacker, 2001). Subsequent studies compared the effectiveness of various review session types and reported that review sessions which included a review of instructor expectations or realistic practice exams were the most effective, followed by the sessions involving only a review of instructor expectations (Rust et al., 2003; Neef et al., 2007). Review sessions that included only question-and-answer opportunities without review of important material (Aamodt, 1982b) or unrepresentative practice opportunities (Neef et al., 2007) did not produce large improvements in exam performance.

Using exam scores has been the predominant mode to evaluate student learning and / or success following participation in review sessions (Aamodt, 1982b; Balch, 1998; Bol and Hacker, 2001, Rust et al., 2003; Neef et al., 2007). This approach would be supported if students were challenged to think on multiple cognitive levels formulated around the principles of Bloom's Taxonomy (Bloom et al., 1956). Assessment of student learning is

[1]Department of Animal Science, North Carolina State University, Box 7621, 123 Polk Hall, Raleigh, NC 27695, dhpoole@ncsu.edu

dependent upon the complexity of the exam questions in this system. If exam questions primarily contain lower cognitive level questions, then exam scores following participation in a review session may solely reflect a student's ability to memorize material as opposed to learning it. Using Bloom's approach, exam questions are categorized from simple knowledge to complex synthesis and evaluation of the subject information to stimulate deeper thought or creativity in the field (Bloom et al., 1956). Students who successfully develop greater cognitive abilities and critical thinking skills are more likely to have greater success in their careers (Paul, 2004). Therefore, it is of interest to evaluate if student participation in question-and-answer based review sessions improves a student's ability to acquire these skills.

Purpose of Study

The purpose of this study was to evaluate the effectiveness of question-and-answer based review sessions to stimulate student learning in an animal reproduction course as assessed by higher scores on exams and on answers to questions requiring a higher level of cognitive understanding. The following objectives and hypotheses were developed and tested to meet this purpose.

Describe the exam scores of Reproductive Physiology students in relation to the level of student participation in an extra-curricular review session.

Investigate if student participation in question-and-answer based review sessions results in improved student performance and reduced time needed to complete exams compared to their peers who did not attend the review sessions.

Evaluate if student participation in question-and-answer based review sessions improves student learning as measured by higher exam scores and better performance on exam questions requiring higher level thinking skills.

To accomplish objectives 2 and 3, the following hypothesis was developed:

H1: Students who attended the question-and-answer-based review sessions would have significantly higher scores and require less time to complete their exams compared to those who did not attend.

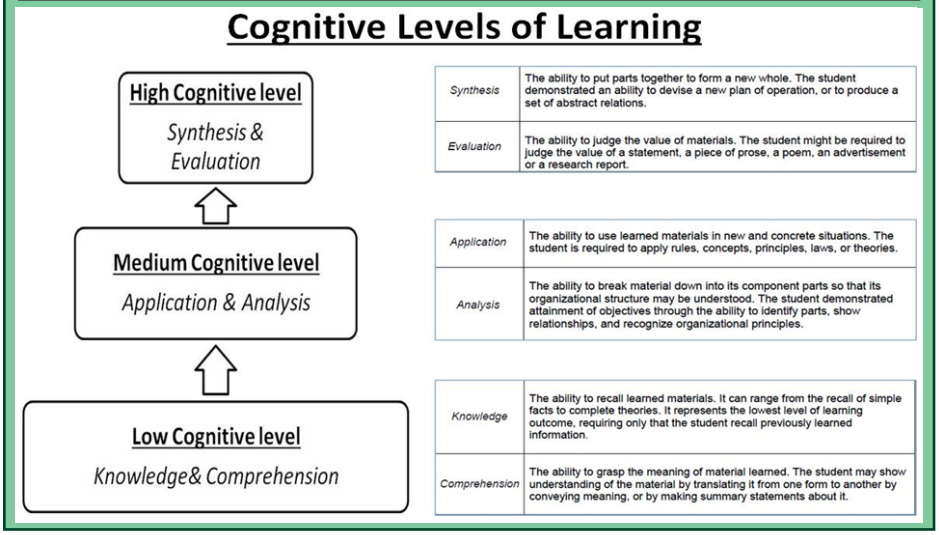
Materials and Methods

Reproductive Physiology at North Carolina State University was chosen as a representative course because the course material is a universal component of animal science curricula nationwide. Students enrolled in the course enter with a wide range of academic and animal experience. This investigation was a descriptive census (all members of the class) study (Patton, 2002). Due to the restrictions of a census study, participants were not selected randomly but were considered representative of undergraduates in the College of Agriculture and Life Sciences who had previously or will enroll in this course. The goal of this study involved efforts to improve instruction and thus was deemed exempt by the North Carolina State Institutional Review Board and no identifying information was used in the data analysis.

Assessment and Data Collection

The reproductive physiology course had 3 lecture exams and a cumulative final exam representing sixty percent of the overall grade of the course. The lecture exams tested students using a variety of formats including multiple answer- multiple choice, true or false, fill in the blanks, short answer and essay questions. In the second year, short answer and essay questions were ranked according to Bloom's taxonomy as low, medium and high to evaluate student performance based on cognitive level of understanding (Figure 1). Low levels of cognition included basic knowledge and comprehension, medium levels of cognition focused on application and analysis of the information and high levels of cognition focused on a student's ability to synthesize and effectively evaluate the information. For this study, data were collected on the 3 lecture exams. Students enrolled in the course had the option of attending an extra-curricular question-and-answer based review session held the evening before each of the three lecture exams. These review sessions were optional; students received no points for attending any of the sessions and were not penalized for not attending any of the sessions. The time (1700 to 1900 hrs) of the review session was chosen to provide the students adequate time to prepare for the exam prior to attending the review session. During the review sessions, prepared students addressed questions on the major concepts covered on each exam. Review sessions were not simply a reiteration of the lectures. Students in attendance were engaged to describe and

Figure 1: Cognitive levels of learning, adapted from Bloom's Taxonomy, used to designate exam questions to either low, medium or high cognitive levels used to evaluate the students knowledge of the course information.



teach the concepts in question to other attendants to stimulate student-centered learning. Each exam's review session was conducted under the supervision of the faculty instructor and therefore students who attended help sessions received no "inside information" about the exams. Overall, the review sessions lasted until all questions were answered (approximately 1.5 hours).

Data were collected in several ways. A teaching assistant documented student attendance at every review session, which was recorded in Microsoft Excel® until analysis following completion of the course. Time needed to complete the exam was recorded when a student returned his or her exam to the instructor. This value was determined by subtracting the finished time from the time the exams were distributed. All exams were graded by the faculty instructor and the answers were recorded in Microsoft Excel® until analysis. Short answer and essay questions were ranked by the faculty instructor as requiring low, medium and high cognitive skills to successfully complete the question prior to administering the exam, but this information was not provided to students. The total number of points earned for each of the cognitive levels was recorded on a per exam basis. Student performance based on cognitive level was determined by calculating the total number of points he or she earned in relation to the total number available per level of cognition. Scores are given as percentages and were assigned letter grades based on the following grading scale: A, 90%–100%; B, 80%–89%; C, 70%–79%; D, 60%– 69%; F, less than 60%.

Data were analyzed using Proc Mixed of SAS 9.2 (SAS Inst. Inc., Cary, NC). For the descriptive statistics, which included the exam scores and level of student participation in review sessions, means and standard deviations were calculated in Microsoft Excel®. Exam scores and student participation in review sessions were converted to percentages for ease of comparison. Review session attendance was correlated to the exam outcome, time needed to complete the exam and student performance based on cognitive level of understanding. P values of ≤ 0.05 represented significant differences, whereas P values of > 0.05 and ≤ 0.1 represented a statistical tendency.

Results and Discussion

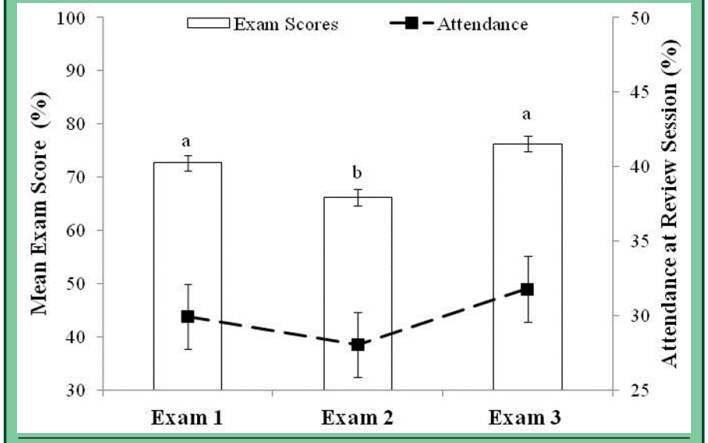
The target population consisted of 107 undergraduate students (18% male and 82% female) from a reproductive physiology course during the Fall semesters of 2012 and 2013. Of the 107 students, 91% were Animal Science majors, 6% were Zoology majors and 3% were exchange or non-degree seeking students. Additionally, students in the course were distributed into the following academic ranks: juniors (50%), seniors (31%), sophomores (16%) and exchange students (3%).

Exam scores for exam 1, 2 and 3 displayed a typical bell curve in student performance with the mean scores of the exams over the two semesters presented in Figure 2. Exam 3 had the highest mean at 76.3% (SD = 14.06), followed by Exam 1 with a mean of 72.7% (SD = 14.76) and Exam 2 had the lowest mean of 66.2% (SD = 14.58), which was significantly lower compared to the other exams (Figure 2; $p<0.01$). Elevated exam scores for the third exam may have been a result of several contributing factors, such as increased motivation to improve course grade and familiarity with exam format.

Approximately 30% of the students enrolled in the course participated in the extra-curricular review sessions (Figure 2). There was no difference in the number of students who participated in the review sessions prior to exams 1, 2 or 3 (29.9%, 28.0% and 31.8%, respectfully; Figure 2; $p>0.05$). These data are similar to previous reports by Moore (2008) which observed only a 26% attendance rate at optional help sessions in an introductory biology course. In a follow up report, Jensen and Moore (2009) reported that lower GPA students did not attend the optional help sessions scheduled just prior to three exams. In the current study, students who earned B or C letter grades on exams were more likely to attend review sessions than lower scoring students, regardless of when the sessions were offered during the semester; this is in agreement with Jensen and Moore's findings.

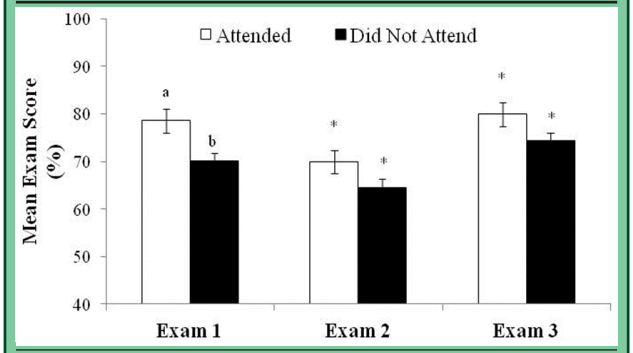
Students who attended the question-and-answer based review session prior to the exams had significantly higher scores (Exam 1: 78.56 %vs. 70.12%; Exam 2: 69.92% vs. 64.60%; Exam 3: 79.96% vs. 74.32%) compared to those students who did not attend (Figure 3). These data are consistent with previous reports demonstrating improvement in student scores following participation in a traditional question-and-answer based review session (Aamodt, 1982a, 1982b). It was hypothesized that students who attended the question-and-answer-based review sessions would be better prepared for the exams and require less time to complete their exams compared to students who did not attend the review sessions. Students who attended the question-and-answer based review sessions prior to the exam required the same amount of time to complete their exams (Exam 1: 62.10 vs. 59.83 minutes; Exam 2: 64.37 vs. 61.24 minutes; Exam 3: 70.47 vs. 64.16 minutes) as those students who did not attend (Figure 4).

Figure 2: Mean scores for exams 1, 2 and 3 for the entire class (left axis) and the percentage of studentswho attended the review sessions (right axis) over the 2 semesters observed in this study.



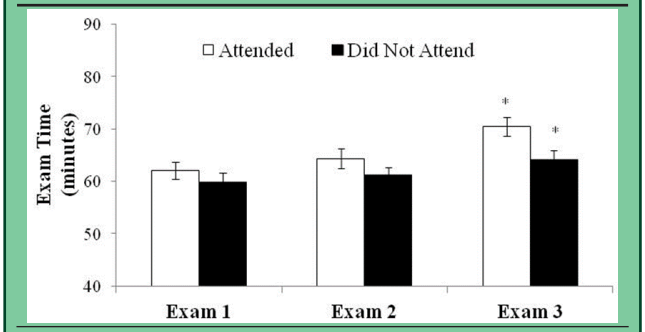
Different letters denote a significant difference in overall exam scores ($p< 0.01$)

Figure 3: Comparison of the mean exam scores for exams 1, 2 and 3 between those students who attended the question-and-answer based review session and students who did not attend.



Different letters denote a significant difference within an exam ($p < 0.01$), asterisks indicate a tendency within an exam ($0.05 < p < 0.1$).

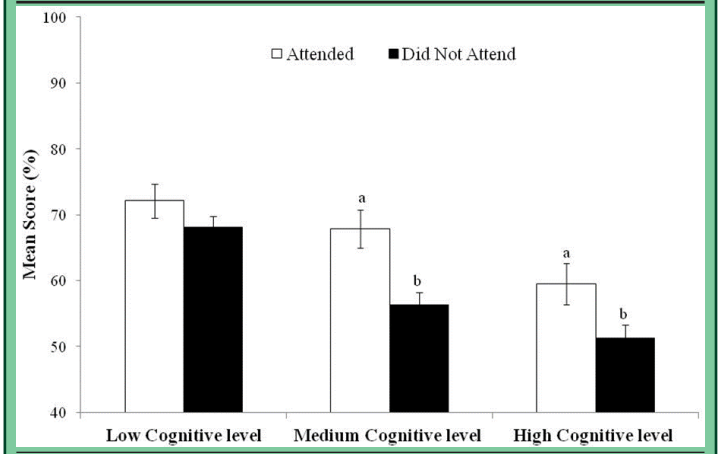
Figure 4: Comparison of time required, in minutes, to complete exams 1, 2 and 3 between those students who attended the question-and-answer based review session and students who did not attend.



Asterisks indicate a tendency within an exam ($0.05 < p < 0.1$).

Student responses on short answer and essay questions ranked with low, medium and high cognitive levels of learning were evaluated to determine if participation in question-and-answer based review sessions improved student learning. Students who attended the question-and-answer based review session had significantly higher scores on medium (67.90% vs. 56.33%) and high (59.46% vs. 51.23%) cognitive level questions compared to those students who did not attend (Figure 5). This difference was not observed in scores from those who attended (72.10%) compared to those who did not attend (68.06%) the review session with low cognitive level questions (Figure 5). Students who participated in the review sessions provided thoughtful, thorough answers with necessary support to complete their argument compared to students who did not participate in the review session. In order to develop these detailed responses, it would be expected that students would require additional time; however, this was observed only for Exam 3. According to Kapinus (2014), faulty written responses reflect a lack of experience or knowledge of the subject material. The skills and knowledge that underlie understanding the expectations of and writing responses to, higher cognitive level questions requires deliberate instruction of strategies and experience (Kapinus, 2014). Active participation in question-and-answer based review sessions could provide students with necessary knowledge and skillset to improve student learning in an animal reproduction course.

Figure 5: Comparison of the mean score (%) of short answer and essay questions ranked with either low, medium or high cognitive levels of learning for students who attended the question-and-answer based review session and students who did not attend.



Different letters denote a significant difference in exam scores within cognitive level of learning ($p < 0.05$).

Summary

Traditional question-and-answer based review sessions have been shown to be an effective supplemental learning method. Improvement of exam scores and student learning were associated with student participation in review sessions. Participation in this type of review session increased the probability of student success in the form of improved test performance and course grades. A student's ability to provide thoughtful, thorough answers to essay questions that required a higher level of cognition was positively correlated with active participation in the question-and-answer based review session.

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The Value of Undergraduate Research: A Study of Agribusiness Alumni Perceptions[1]

Lynn Hamilton[2], Richard Warren Grant[3] and Marianne McGarry Wolf[4]
Cal Poly - San Luis Obispo
San Luis Obispo, CA

Leah Greden Mathews[5]
University of North Carolina-Asheville
Asheville, NC

Abstract

The benefits of undergraduate student research in the natural sciences, including gains in analytical and critical thinking skills, written communication and self-assurance, has been well-documented. This study was designed to assess the value of undergraduate research experiences among agricultural business students. Over 500 alumni who graduated from California Polytechnic State University over the last few decades responded to a survey administered in 2013. Results reveal the value of undergraduate research in agricultural economics to students' career and personal development as well as the potential for changing perceptions of the benefits over time. A critical issue for agricultural economics departments is how to allocate resources in order to most cost-effectively provide research experience in the undergraduate curriculum.

Introduction

The agricultural economics profession has long understood the value of graduate student research. However, little attention has been focused on the value, both short- and long-term, of undergraduate research. The National Survey of Student Engagement determined that on average 33% of college students in the U.S completed or are currently working on a senior project at their University (NSSE, 2012). Faculty who supervise undergraduate research in any capacity as capstone course instructors, senior project advisors or as principal investigators can attest to the intellectual growth and advancement in critical thinking witnessed in their students. The skills gained from an independent research project or senior project have beneficial effects on the students after completion and prepare students for the world after college (Bauer and Bennett, 2003).

However, it is quite costly to provide students with the benefits of an undergraduate research experience. For example, at California Polytechnic State University (Cal Poly) in San Luis Obispo, senior projects are required of all undergraduate students. In the Department of Agribusiness, historically, each student was required to conduct an individual senior research project spanning two quarters; a faculty member is assigned one-third of a weighted teaching unit (WTU) per senior project student. The first quarter of the project consists of classroom instruction on developing the introduction, literature and methodology; during the second quarter students are each assigned to an individual faculty member to complete their projects as an independent study course. This portion of the senior project is particularly costly in terms of faculty resources. Four WTUs result from working with only 12 students per quarter, as opposed to the normal classroom enrollment of 35 to 80 students. With recent and on-going budget cuts, departments that require such undergraduate projects are devising ways to reduce this curriculum component; moving to single-quarter, group-based projects rather than two-quarter, individual projects. In that scenario, the faculty resource needs are reduced by about fifty percent.

Benefits of Undergraduate Research

Benefits of undergraduate research typically include clarification of career plans, improved preparation for graduate school, skill development and personal benefits (Lopatto, 2004). Alumni who had an undergraduate research experience perceived a greater skill set, a more profound sense of accomplishment from their undergraduate degree and were more likely to become

[1]The Cal Poly Human Subjects Committee conducted a minimal review of this project and found it exempt from further review

[2]Professor, Agribusiness Department, One Grand Ave, 93407, 805-756-5032; Email: lhamilto@calpoly.edu

[3]Undergraduate Research Assistant

[4] Professor, Wine and Viticulture Department

[5]Professor, Economics Department, One University Heights, 28804, 828-251-6551, Email: lmathews@unca.edu

a graduate student (Bauer and Bennett, 2003). The skills that alumni reported gaining through their undergraduate research experience include the ability to analyze literature, work independently, understand scientific studies, work as a leader and speak proficiently.

Students from liberal arts colleges were overwhelmingly positive about their experiences and described benefits of several different types, including preparation for graduate school, "thinking and working like a scientist", shifts in attitudes to learning and working as a researcher (Seymour et al., 2004). Faculty perceptions of the student benefits of undergraduate research are similar to those reported by the students themselves (Hunter et al., 2007).

Russell et al. (2007) analyzed surveys completed by 15,000 students in science, technology, engineering, or math (STEM) fields from various types of institutions. They found that undergraduate research opportunities increase understanding of how to conduct a research project, confidence in research skills and awareness of what graduate school is like. In addition, they found that a key element in increased interest in STEM careers and higher degrees was the "inculcation of enthusiasm" about research. Ward et al. (2002) conducted a content analysis of open-ended evaluations from undergraduate research students in engineering and the sciences. They found that students perceived their learning through undergraduate research to be greater than in traditional classroom instruction. Some of the benefits from undergraduate research identified by these students included skill acquisition, ability to act independently, appreciation of teamwork and the ability to work with setbacks and/or ambiguity, among others.

Bauer and Bennett (2003) surveyed University of Delaware alumni about their perceptions of their undergraduate research program. They found that alumni who had participated in undergraduate research had greater perceived enhancement of many skills than those who did not. These included being able to speak effectively, acquire information on their own, act as a leader, understand scientific findings, carry out research, analyze literature critically, possess clear career goals and develop intellectual curiosity. Lopatto (2004) reports that science undergraduates from 41 institutions indicated gains on 20 potential benefits of undergraduate research. Burke and Cummins (2002) report on a student-faculty collaborative research project in management that led to significant benefits for the faculty and student compared to traditional independent study courses.

Until recently, few studies have addressed the effects of undergraduate research experiences in the social sciences and humanities directly perhaps because social scientists and humanists rarely employ the type of experimental research that is conducive to undergraduate participation (Ishiyama 2002). Ishiyama (2002) found that humanities and social science students who participated in undergraduate research early in their studies gained significant analytical and logical thinking abilities and the ability to learn on their own.

Methods

This study surveyed alumni from Cal Poly's Department of Agribusiness, a large, primarily undergraduate agribusiness program that incorporates mandatory senior research projects as well as other undergraduate research opportunities such as capstone courses and faculty-directed projects. We developed a 29-question survey designed to assess the perceived value of the undergraduate research experience in attaining the first job, in getting promoted and the alumni's perception of their problem solving, creativity and critical thinking abilities. We asked alumni if they were satisfied with their college education and if they believed it prepared them well for their careers. Alumni were asked if they thought their senior project was a factor in their career success and to rate it in relationship to other collegiate experiences. We also queried the alumni about the points in their careers in which they found the skills learned or their research topic beneficial; skills such as writing, critical thinking and analysis. To better understand the value of undergraduate research as compared to other aspects of campus life, we asked alumni to evaluate other collegiate activities in terms of their impact on career preparation. These activities included academic clubs (those housed in the Department or College, such as the Agribusiness Management Club), internships, athletics, non-internship employment during college, fraternities/sororities and other non-academic clubs. Alumni were asked to rank these experiences based on how each influenced their career success. We also asked about their satisfaction with the senior project experience and whether they thought the senior project should be continued as a curriculum requirement. Alumni were asked to provide their college GPA and we also collected basic demographic data on gender, age, race and income. The survey was pre-tested on a group of 10 alumni at the end of January 2013.

After making minor modifications based on the pre-test feedback and receiving University approval we sent the survey February 15, 2013, via a SurveyMonkey email link to 3,227 Cal Poly Agribusiness Department alumni. This list is administered and maintained by University Advancement and access must be approved by Public Affairs; this step is in addition to human subjects' approval by IRB. As this survey was distributed electronically, the contact list is comprised of only living alumni with e-mail addresses who have maintained some type of contact with the University either through Alumni Relations or Advancement. A reminder e-mail was sent out two weeks after the initial distribution. The survey was open for approximately 30 days.

The survey distribution efforts resulted in 553 responses for a response rate of 17.1%. According to institutional statistics from PolyLink, Cal Poly's electronic alumni communication platform, the click-through rates on alumni surveys average 3% (McNally). Clearly Agribusiness alumni were more responsive than is typical.

The data were downloaded from SurveyMonkey into SPSS. Frequency distributions were run on all

variables. The respondents were divided into three age categories to see if their age cohort made a difference in their responses. We grouped the respondents into early career (ages 20–35); mid-career (ages 36–55) and late career/retired (ages 56 and up) categories. The groups were relatively evenly distributed; the youngest age category contained 189 respondents, the middle category had 188 alumni while the late career/retired category included 118 respondents.

We ran cross tabulations on all of the questions to see if the age groups responded differently regarding the value of senior projects and other undergraduate research efforts, as well as the skills learned and benefits gained from the experience. Paired sample t-tests were used on questions that resulted in average values, such as question 10 that asks alumni to rate the benefits gained from their research effort, such as written and verbal communication skills, creativity, data collection and analytical skills and self-confidence.

Results and Discussion

Nearly all of the alumni believed their college education had prepared them well for their careers, with 35% responding Strongly Agree and 44% responding Agree to that question, as shown in Table 1. The late career cohort agreed the most with that statement, with nearly 48% strongly agreeing that their education prepared them for their careers; while only 24% in the early career group strongly agreed with that statement. The differences in age group responses were significant at the 0.001 level.

We were interested in the types of research experiences alumni had participated in as undergraduates. Though most alumni (86%) had completed an individual senior project, others had completed senior projects during internships (17%), or worked on group senior projects (10%), as shown in Table 2. The mid-career cohort reported the highest percentage of senior project participation (95%). The early career cohort reported a wider variety of research experiences. This is likely because Cal Poly introduced more flexible senior project options in recent years; for example, nearly 20% of the younger respondents reported working on group senior projects. The difference between age groups on these two options was significant, with a p-value of 0.00. Only about 5% of the alumni had worked on an independent study project outside of their senior project. Respondents may have misunderstood the capstone course option. Only 22% indicated they had taken such courses, but in reality, nearly every alumnus would have been required to complete that type of class. We believe that the term "capstone" may not have been familiar, or they may have forgotten the course names/numbers that were provided as examples. This is evident when analyzing the age group differences: nearly 40% of the early career alumni noted their participation in these classes, while only 17% of the mid-career and 4% of the late career group responded to the capstone course option.

Table 1. Alumni Responses to Educational Preparation for Careers

Q. 4 My college education prepared me well for my career.

Answer Options	Overall	Ages 20 – 35***	Ages 36-55***	Ages 56 and up***
Strongly Agree	35%	24%	40%	48%
Agree	44%	46%	45%	38%
Somewhat Agree	18%	25%	12%	12%
Somewhat Disagree	2%	3%	2%	2%
Disagree	1%	1%	1%	0%
Strongly Disagree	0%	0%	0%	0%

****Significant at P=0.001*

Table 2. Cal Poly Alumni Undergraduate Research Experiences

Q. 6 Which of the following did you participate in at Cal Poly?

Answer Options	Overall	Ages 20 – 35	Ages 36-55	Ages 56 and up
Individual Senior Project***	86%	75%	95%	88%
Group Senior Project***	10%	20%	5%	2%
Industry-related senior project	17%	21%	13%	16%
Independent study with faculty	5%	6%	4%	6%
Independent study with industry	5%	7%	6%	3%
Capstone course***	22%	40%	17%	4%
Other	8%	7%	7%	7%

***Significant at P=0.001

Table 3. Perceptions of Career Success Attributed to Undergraduate Research

Q. 7: I attribute my independent research/senior project to my career progression or success today.

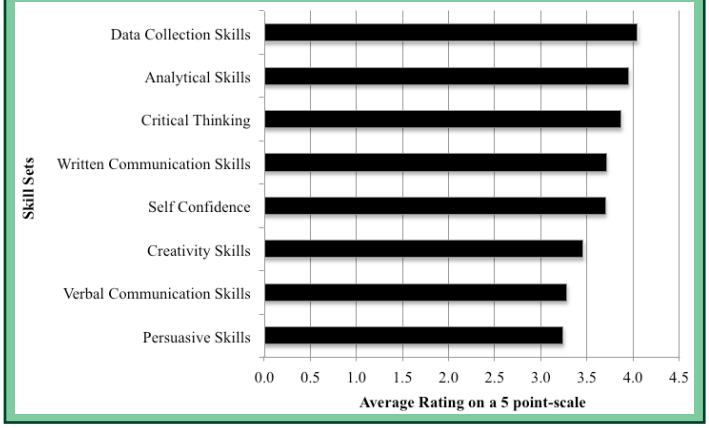
Answer Options	Response Percent	Ages 20 – 35**	Ages 36-55**	Ages 56 and up**
Strongly Agree	9%	4%	9%	16%
Agree	17%	15%	18%	21%
Somewhat Agree	32%	30%	35%	35%
Somewhat Disagree	14%	17%	11%	14%
Disagree	19%	22%	17%	11%
Strongly Disagree	10%	11%	11%	4%

***Significant at P=0.01*

Cal Poly has a "Learn by Doing" philosophy of education and the senior project has been one of the pillars of that philosophy. We were curious to see alumni's perceptions regarding the relationship of their undergraduate research/senior project to their career success. Results were more mixed on this question, as shown in Table 3. Overall, 32% somewhat agreed, with another 25% agreeing more strongly that the senior project positively affected their career success. However, more than 42% disagreed that their project had helped with their careers. Again, there was a split among the age groups; the late-career cohort attributed their senior project more strongly to their career success, while the early career cohort disagreed. The difference was statistically significant, above 99%.

Even though alumni did not universally agree on the value of the senior project itself to their career development, we wanted to investigate how the undergraduate research effort helped the alumni develop specific skills. We provided a list of attributes dealing with written and verbal communication, creativity, persuasive skills, critical thinking, analytical skills, data collection skills and self-confidence. Alumni ranked each on a five-point Likert scale. Figure 1 shows the mean rank for each skill set. Data collection, analytical, critical thinking and written communication skills ranked the highest. As the senior project is primarily a written research project, it is not surprising that verbal communication and persua-

Figure 1. Skills Gained from Undergraduate Research



sive skills had the lowest average rating. Paired-sample t-tests were used to test the differences between the averages; the differences were all significant at the 99% level except for Verbal Communication and Persuasive skills.

Anecdotal evidence from alumni suggested that their senior project had other benefits in their career development. We asked alumni to indicate at what points in their careers they found some benefit from their undergraduate research effort and what kind of skills did they learn that applied to their careers. As shown in Table 4, working independently, developing problem-solving skills and written communication skills were the most popular responses. These skills also indicated a "rear-view mirror" effect with over 60% of the late-career group noting that problem-solving skills and working independently were important to their careers, while only 45% of the early and mid-career alumni noted these as important skills garnered from their senior projects. These differences were significant at greater than 99%. Similar age group differences occurred with the attribute of "gaining a sense of accomplishment."

In terms of satisfaction with the senior project or other research experiences, nearly half of the respondents were either Very or Extremely Satisfied. More than a third of the alumni were more ambivalent, responding as Somewhat Satisfied. These opinions also differ by age cohort. Generally, the two older age cohorts were more satisfied with their senior project experiences, though there was some variation, as shown in Table 5. The early career alumni seem a bit more ambivalent about their senior project experience. The differences were significant at the 99% level.

Despite some ambivalence about the specific benefits or career preparation skills attributed to the senior project, respondents overwhelmingly supported its continuation. More than 83% thought it should be continued and about half of the respondents (254) weighed in with specific written comments. This question was also subject to age group differences with the late career group being the most stridently in favor of continuing the senior project – 91%, as compared to 79% for the early career alumni. The responses by age category were also statistically significant.

To get a better sense of how alumni's research experience compared with other collegiate activities in terms of career preparation, we asked alumni to rank the top six of nine collegiate experiences in terms of which contributed the most to their career success. Not surprisingly, internships were ranked number one by nearly a third of the alumni. Holding a job during college was ranked number two by 28% of the respondents and senior project was ranked second by 21% and third by another 21 percent. Academic clubs related to students' major or minor field of study were also considered relevant; 21% ranked them as third in importance. We gave respondents up to three options to choose as Not Applicable – we assumed that very few students would have experienced all nine activities. Interestingly, the senior project had the lowest number of N/A rankings – less than 3% of respondents said it was not applicable to their career success, compared to other experiences.

When comparing responses among the cohorts, the late-career group ranked senior projects higher than the other age groups (18% ranked it number one, as opposed to 9% and 5% respectively for the mid- and early career groups). This result was statistically significant at the 99% level. Meanwhile, the early career alumni ranked internships the highest, at 33% versus 16.5 and 7.6% for the mid- and late career groups, respectively. These findings are consistent with the results of previous questions and reflect the differing educational opportunities available to the age cohorts.

Results from this study corroborate and document the benefits of undergraduate research identified in the previous literature to agricultural economics/agribusiness students. Specifically, Cal Poly alumni responding

Table 4. Alumni's Perceptions of Career and Skill Benefits from Undergraduate Research

Q. 11: At what points in your career have the skills learned from your research project been helpful?

Answer Options	Overall	Ages 20 – 35	Ages 36-55	Ages 56 and up
Finding your first job	27%	30%	23%	26%
Getting promoted	9%	7%	7%	13%
Problem solving at work**	48%	42%	41%	63%
Verbal communication skills**	25%	30%	19%	28%
Written communication skills	45%	45%	39%	52%
Working independently**	49%	44%	46%	62%
Gaining a sense of accomplishment**	42%	37%	39%	51%
Very little help in my career	18%	18%	16%	18%
No help in my career	9%	10%	11%	4%
Other (please specify)	9%	8%	7%	14%

***Significant at P=0.01*

Table 5. Alumni Satisfaction with Their Undergraduate Research Experience

Q. 12 How satisfied were you with your undergraduate research experience?

Answer Options	Overall	Ages 20 – 35**	Ages 36-55**	Ages 56 and up**
Extremely	18%	19%	15%	23%
Very	31%	26%	35%	31%
Somewhat	36%	38%	34%	33%
Not Very	10%	10%	10%	8%
Not At All	5%	6%	6%	2%
Does Not Apply	1%	0%	0%	3%

***Significant at P=0.01*

to our survey indicated the highest ratings to their gains in data collection, analytical and critical thinking skills, written communication and self-confidence. Though only one-quarter (25%) of respondents attributed their career progression/success to the undergraduate research project, there was overwhelming support (83%) to continue the requirement.

It appears from these results that alumni who graduated earlier (that is, the older age cohorts) are relatively more satisfied with their undergraduate research experiences than recent graduates. There are several possible explanations for this difference. First, the Agribusiness Department had a more favorable faculty/student ratio when the older cohort attended Cal Poly. The higher value placed on the undergraduate research experience may be partially due to students receiving more faculty attention during their senior project. Additional life experience may have allowed students in the older age cohorts to find additional opportunities to reflect, recognize and make connections with their undergraduate research experiences. A larger percentage of the younger alumni cohort (relatively recent graduates) report participating in an internship than the older cohort and this, too, could explain some of the difference in perception by age cohort. Given that the senior project options available to students expanded over time, it is not surprising that the results vary across alumni cohorts.

Even with the mounting evidence of the benefits of undergraduate research to students, faculty and institutions (Osborn and Karukstis, 2009), university budgets are more constrained and it is becoming more difficult to offer undergraduate research experiences due to the amount of faculty resources required to effectively supervise the projects. One might then ask if we could – or should – seek more cost-effective ways to deliver these types of experiences. In the fall of 2013, Cal Poly began offering a group project option to satisfy the senior project thus allowing more projects to be supervised per faculty member. While many of the benefits of group projects may be the same as those for individual projects, they may yield a slightly different set of benefits to students including the potential to build teamwork, leadership and/or collaborative writing skills. Faculty may need to develop new skills themselves to facilitate group projects as well as criteria to effectively monitor and evaluate individual contributions to group outcomes.

Another alternative that could be considered is to ask students and alumni if they are willing to pay for undergraduate research experiences for themselves or for future students. Universities could develop a differential tuition charge with fees reflecting the higher delivery cost, much as they currently do with lab and equipment fees. Alumni could be asked to earmark their donations to support undergraduate research activities.

It may be that a hybrid internship-research project would provide the most 'bang for the buck' for both students and faculty. This option would require students to complete an internship and write a related research paper that would be supervised by a faculty mentor. This hybrid option could provide students with career preparation benefits while also providing many of the other benefits of undergraduate research such as critical thinking and written communication skills. Faculty time would be reduced compared to the current individual undergraduate research project option, thus conserving departmental resources.

Summary

This research adds to the literature on the benefit of undergraduate research in at least two ways. First, by sampling students in Agribusiness, we offer evidence that some of the same benefits of undergraduate research that accrue to students in other disciplines also are realized by students in the social sciences. Second, because of the long-standing undergraduate research requirement at Cal Poly, we had a large sample of alumni to survey. This allowed us to analyze the stability of alumni perceptions of the undergraduate research experience by age cohort, something that to our knowledge hasn't been previously reported in the literature. These perceptions demonstrate both the value of undergraduate research and the potential for changing perception of benefits over time. Future research will extend this study to include other programs and universities, including those without undergraduate research requirements, to more fully understand the value of undergraduate research and other capstone projects with the ultimate aim of being able to identify how departmental resources can be allocated to most cost-effectively provide such enrichment to the undergraduate curriculum.

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Relationships Between "Flow" and Undergraduate Experiences in a College of Agriculture Leadership Course

Michael W. Everett[1] and Matt R. Raven[2]
Michigan State University
East Lansing, MI

Abstract

Leadership courses are considered to be an important curricular component in colleges of agriculture throughout the United States with many of them now offering agricultural leadership majors. Many students entering colleges of agriculture had leadership training experience prior to college through involvement in the National FFA Organization and/or 4-H. However, many did not participate in an organized leadership program. Socio-Psychological measures of "flow" during an undergraduate leadership course were used to determine relationships of undergraduates with and without previous leadership experience. Flow Theory was used to determine relationships between: 1) students' prior leadership training and number of "flow" experiences; 2) "flow" experiences and intrinsic motivation and engagement; and 3) "flow" and domains of learning in an undergraduate leadership course. There was a positive relationship between "flow" and students within an undergraduate leadership course who had previous exposure to leadership (38.8%). Additionally, undergraduate students were more likely to be in "flow" when participating in activities in the cognitive (39.4%), psychomotor (40.9%) and affective (32.7%) domains of learning. Using the Experience Sampling Method (ESM) to determine "flow" relationships with undergraduate learning expands the current suite of instruments available to understand leadership classroom experiences.

Introduction

Leadership is a highly sought-after and valued commodity in today's society (Northouse, 2016). Colleges of agriculture faculty have recognized this and as a result, leadership courses and programs are an important component in university agricultural curricula across the United States (Birkenholz and Schumacher, 1994; Velez et al., 2015). Many students entering colleges of agriculture had prior leadership training and experience through involvement in the National FFA Organization and/or 4-H. However, there are also a number of students who did not participate or have access to an organized leadership program like FFA or 4-H. It is important that faculty responsible for leadership courses and programs understand how future leaders learn and what the optimal learning conditions for undergraduates to develop needed leadership skills are. It is also critical to understand the influence prior experiences have on leadership courses and programs. The National Research Council (2009) has issued a call for post-secondary agricultural curricula and teaching to utilize dynamic approaches to learning for post-secondary students. Approaches suggested by the National Research Council (2009) should leverage experiences that provide students with "real-world" interpretation of ideas, concepts and skills that will in turn create learners and leaders who are successful in their future careers. The socio-psychological concept of "flow" is one theory that has the potential to leverage these "real-world" approaches.

Flow Theory or "flow" is defined as "the holistic sensation that people feel when they act with total involvement" (Csikszentmihalyi, 1975, p. 36). Occurrences of "flow" are often defined as "optimal experiences" or occasions when an individual is fully engaged in an activity (Csikszentmihalyi, 1997). Four components comprise "flow" and provide optimal experiences including being: 1) in control of the experience; 2) attentive during the experience; 3) curious about the experience; and 4) intrinsically interested in performing the experience. Flow Theory includes the symbiotic relationship between perceived challenges of an activity by an individual with respect to skills learned that an individual can apply to the particular challenge (Shernoff et al., 2003). "Flow" research has been cited in the context of secondary (Bassi and Delle Fave, 2004; Shernoff et al., 2003) and post-secondary education (Asakawa, 2010; Askawa, 2004; Everett and Raven, 2015; Rogatko, 2009). However, limited research exists that utilizes "flow" in relation to leadership education in an undergraduate context.

This study draws from previous theory and empirical literature to explore undergraduates in a College of Agriculture and Natural Resources (CANR) leadership course. This study utilizes undergraduate leadership students' self-reported challenge, skill, interest, enjoy-

[1]Academic Specialist, Department of Community Sustainability (Corresponding Author), everettm@msu.edu
[2]Professor, Department of Community Sustainability, mraven@msu.edu

ment and happiness during class sessions in an effort to better understand learning and opportunities that create optimal experiences in undergraduate leadership education. Although the focus of this study is undergraduate students in a leadership course, previous research suggests that Flow Theory is applicable to a variety of post-secondary settings (Asakawa, 2010; Asakawa, 2004; Everett and Raven, 2015; Rogatko, 2009). Limited research exists regarding socio-psychological factors that may provide support for understanding relationships of students with previous leadership experiences. However previous research by Everett and Raven (2015) suggest that Flow Theory may have the potential to quantify these dynamic approaches in an educational setting. Everett and Raven utilized the Experience Sampling Method (ESM) to determine if pre-service undergraduate Agriculture, Food and Natural Resources Education (AFNRE) students exhibited "flow" and during what learning activities optimal experiences occurred. They concluded that ESM had the potential to identify optimal learning experiences for undergraduate learning.

The purpose of this study was to utilize Flow Theory and the (ESM) to determine if differences existed in how students with prior leadership experiences perceived leadership compared to students with no prior experience. This study was guided by the following research questions:

1. What was the relationship between students' prior leadership training and the number of "flow" experiences in an undergraduate leadership course?
2. What was the relationship between students' "flow" experiences and intrinsic motivation and engagement?
3. What was the relationship between students' "flow" experiences and domains of learning in an undergraduate course in leadership?

Flow Theory

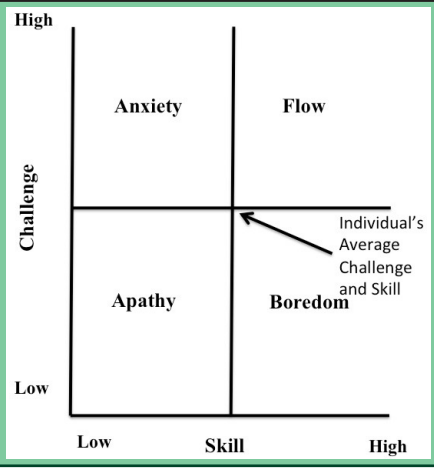
Vygotsky (1978) operationalized "flow" in the context of learning in terms of "the zone of proximal development." In Vygotsky's definition, the "zone of proximal development" was characterized by providing students with a task that challenges an individual while falling just beyond an individuals' skill level in that activity (1978). The "four-channel model of flow" is generally based on the "zone of proximal development" by the following assumptions: (1) "flow" occurs when perceived challenge and skill are above an individual's personal average; (2) anxiety occurs when perceived challenge is greater than skill; (3) boredom occurs when perceived skills exceed challenge; and (4) apathy occurs when both perceived challenge and skill are below the personal average (Csikszentmihalyi, 1997; Csikszentmihalyi and Csikszentmihalyi, 1988) (Figure 1).

Intrinsic motivation and engagement are key constructs to a student's motivation to learn (Asakawa, 2010; Senge, 1990). Shernoff et al. (2003) defined Flow Theory as a symbiotic relationship between challenges and skills to meet a particular task. "Flow" has been utilized with college students to understand perceived enjoyment, interest and concentration levels of individuals during specific activities (Asakawa, 2010; Asakawa, 2004; Everett and Raven, 2015; Rogatko, 2009). According to Asakawa (2010), students who experienced "flow" on a regular basis were more likely to be fully engaged in the activity as well as having goals and expectations consistent with learning outcomes. Asakawa (2010) aimed to determine if college students' "flow" experiences led to individuals that do things for their own sake or are intrinsically motivated in their tasks. According to Senge (1990), learning and engagement are strongly associated with intrinsic motivation. Engagement of learners provides the opportunity for learning to occur in a way that achieves success while providing students with an appropriate level of challenge that meets a students' skill level (Shernoff et al., 2003). Intrinsic motivation includes the combined scores of interest, enjoyment and the inverse of wishing you were doing something else (Csikszentmihalyi and Csikszentmihalyi, 1988), whereas engagement scores are calculated based on the amalgamation of concentration, interest and enjoyment scores (Shernoff et al., 2003). The Experience Sampling Method (ESM) is the methodological approach used to measure "flow" (Csikszentmihayli, 1975) and questions associated with intrinsic motivation (Csikszentmihalyi and Csikszentmihalyi, 1988) and engagement (Shernoff et al., 2003). The ESM provides an enriching and innovative way to implement educational research by enabling the researcher to ask new and interesting questions about how students, teachers and school leadership engage with education while shaping learning and outcomes for success (Zirkel et al., 2015).

Methods

Data were collected at Michigan State University in the fall semester of 2014 in an upper division leadership course. The course is required for all Agriculture, Food and Natural Resources Education (AFNRE) students

Figure 1. The four-channel "flow" model applied to Experience Sampling Method. The origin for the optimal experience is the individual average of challenge and skills. Only when an individual is above that point does "flow" begin (Adapted from Csikszentmihalyi and Csikszentmihalyi, 1988; Massimini and Carli, 1988).



and is an elective for other students across the University. There were 29 undergraduates enrolled in the course and all students participated in the research study. The Experience Sampling Form (ESF) research instrument for this study was a modified version of the ESM (Hektner et al., 2007). The Michigan State University Institutional Review Board deemed this study exempt.

This study used event-contingent sampling (i.e., taking a paper-pencil survey during specific activities over the course of the semester class). Participants were provided with instructions at the first class session by the researcher prior to taking the first ESF survey. At the first class session, participants were provided with a consent form and ESF and asked to fill out the surveys based on a specific event during each class session. Respondents were asked to fill out the ESF one time for each class session. Students were asked demographic information during the first class session and developed a self-selected code that would identify respondents during future ESF surveys. The ESF was designed to elicit information related to participants' demographics (age and gender), whether they had previous leadership experience, whether they held a leadership role within an organization and questions related to "flow" as they were reflecting on the activity (e.g., challenge, skill, interest, happiness, enjoyment and concentration).

For this study, 29 participants completed a total of 330 ESF's, which amounts to a response rate of 81% (14 measured activities x 29 = 406 total potential responses). In an effort to obtain consistent and reliable ESM data, incomplete surveys were not included in the data set for analysis. By comparison, Everett and Raven (2015) had a response rate of 76% for a sample of pre-service undergraduate AFNRE students using the ESM. Thus, the response rate of the present study was deemed acceptable by the researchers.

Respondents were asked to participate by filling out an ESF paper-pencil survey immediately following a specific activity during the course. Activities were categorized and coded into three groups. Each of the teaching activities was coded into either the cognitive, psychomotor, or affective domain of learning (Newcomb et al., 2004). Groupings were based on the definition of each domain of learning as developed by Newcomb et al. (2004) (Table 1).

Dependent Variable.

The dependent measure of "flow" was categorized into four-channels (anxiety, apathy, boredom and "flow") measuring the level of challenge and skill, as well as associated indicators of interest. "Flow" was measured by the quotient of challenge to skill levels perceived by respondents in the ESF learning activity survey. "Flow" statements were adapted from previous work by Hektner et al. (2007). Responses for both challenge and skill survey items were based on a 5-Point Likert scale ranging from Not at all to Very much. Average challenge and skill levels among respondents were calculated as the intersection of the four constructs in determining whether "flow" was occurring and at what level (Figure 1).

Table 1. Domains of learning, examples of domains measured, and frequency of stage in an undergraduate leadership course during an Experience Sampling Method (ESM) activity fall semester 2014 (n = 330 responses).

Domain of Learning	Examples	# of Stages
Cognitive	Observation, reflections, assessments	8
Psychomotor	Manipulation of Lego blocks to achieve teamwork	2
Affective	Guest speakers, ethics discussion, trait characterization	4

Note: Data is from *Leadership for Community Sustainability* a 300-level course with 29 students taught in the 2014 fall semester at Michigan State University.

Independent Variables.

The independent variables for this analysis fall into two categories. The first category references demographics questions related to age and gender. The second category of independent variables measured aspects related to previous leadership experiences including the type of organization and any leadership roles held in the organization (e.g., officer, committee chair). A 5-Point Likert scale interval was utilized with this undergraduate sample as a way to simplify options for filling out instrument questions (1 – Not at All to 5 – Very Much) (Hektner et al., 2007).

Data were analyzed using the SPSS 22.0 statistical software package. Descriptive statistics were calculated to determine measures of central tendency for independent variables. Chi-square associations were used to compare "flow" channels, intrinsic motivation, engagement and domains of learning. For the purposes of assessing the four-channel "flow" model data, ESF survey responses were converted to z-scores to control for individual response bias. Challenge and skill survey questions were used to determine channels (i.e., anxiety, apathy, boredom and "flow") within the four-channel model (Csikszentmihalyi and Csikszentmihalyi, 1988; Massimini and Carli, 1988) (Figure 1). Intrinsic motivation was calculated using the composite scores of interest, enjoyment and the inverse of wishing you were doing something else (Csikszentmihalyi and Csikszentmihalyi, 1988), whereas engagement scores were calculated based on composite scores of concentration, interest and enjoyment (Shernoff et al., 2003).

Results and Discussion

The average age of respondents in this study was 22.5 (SD = 8.1) with 62% of respondents indicated having prior experience in leadership. Examples of leadership organizations included: 1) The National FFA Organization; 2) 4-H; 3) Geology Club; 4) National Outdoor Leadership School (NOLS); 5) National Honor Society (NHS); 6) Outdoor or Environmental Club; 7) Sorority/Fraternity; and 8) Student Congress. Additionally, 75% percent of the respondents in this study were female. The average age of respondents with prior leadership experience was 20.1 (SD = 9.6), whereas the average age of students in the course with no prior leadership experience was 26.2 (SD = 11.7). Finally, all students who indicated having prior leadership experience also indicated holding

leadership roles in their respective organizations (e.g., organization officers, committee chairs, regional officers, state officers).

ESM results indicated that of the 330 responses, 39% of the respondents with previous leadership were more likely to be in "flow" than those respondents without prior leadership experiences (35.6%). A chi-square test of independence yielded a small positive, significant relationship between "flow" and leadership experience χ^2 (3, N = 330) = 9.58, $p < 0.05$ (Table 2). Respondents with prior leadership experience who were not in the state of "flow" were next most likely to be in a state of apathy (25.9%), whereas respondents without previous leadership experience who were not in "flow" were next most likely to be in a state of anxiety (26.4%) (Table 2).

Results of all participants in an undergraduate leadership course indicated that there was a positive relationship between "flow" channels and intrinsic motivation (M = 3.53, SD = 1.0) and engagement (M = 3.73, SD = 0.9) (Table 3). A chi-square test of independence yielded a significant relationship between "flow" channels and intrinsic motivation χ^2 (12, N = 330) = 33.59, $p < 0.01$ and engagement χ^2 (12, N = 330) = 46.15, $p < 0.01$ (Table 3).

There was no significant relationship between "flow" channels and domains of learning. However, descriptive results indicated that "flow" was the predominant channel among all respondents (Table 4). Among students with prior leadership experience, "flow" was the predominate channel among all domains of learning. Finally, of those respondents with no prior leadership experience, "flow" was the predominate channel for activities in the cognitive and psychomotor domains of learning, however respondents indicated being in the boredom channel more often than any other channel in the affective domain of learning (Table 4).

Table 2. Relationship between "flow" channels and previous leadership experience of undergraduate leadership students during an Experience Sampling Method (ESM) study (n = 330 responses).

Previous leadership experience	Anxiety	Apathy	Boredom	Flow
No	34 (26.4%)	19 (14.7%)	30 (23.3%)	46 (35.6%)
Yes	32 (15.9%)	52 (25.9%)	39 (19.4%)	78 (38.8%)
χ^2 (3, *N* = 330) = 9.58*				
Total Frequency	66	71	69	124

*$p < .05$. **$p < .01$. Note: Data is from *Leadership for Community Sustainability* a 300-level course with 29 students taught in the 2014 fall semester at Michigan State University.

Table 3. Relationship between "flow" channels, intrinsic motivation, and engagement of undergraduate leadership students (n = 330), students with prior leadership experience (n = 201), and students with no prior leadership experience (n = 129).

	No-Prior Leadership Mean (S.D.)	Prior Leadership Mean (S.D.)	Undergraduate Course Mean (S.D.)
Intrinsic Motivation	3.48 (0.9)	3.57 (1.1)	3.53** (1.0)
Engagement	3.57 (0.8)	3.53 (1.0)	3.72** (0.9)

*$p < .05$. **$p < .01$. Note: Data is from *Leadership for Community Sustainability* a 300-level course with 29 students taught in the 2014 fall semester at Michigan State University.

Table 4. Relationship between "flow" channels and domains of learning of undergraduate leadership students during an Experience Sampling Method (ESM) study (n = 330 responses).

Flow Channel	Cognitive	Psychomotor	Affective	Total Frequency
Previous Leadership Experience				
Anxiety	19 (16.9%)	6 (21.4%)	7 (11.5%)	32
Apathy	32 (28.6%)	3 (10.7%)	17 (27.9%)	52
Boredom	17 (15.2%)	7 (25.0%)	15 (24.6%)	39
Flow	44 (39.3%)	12 (42.9%)	22 (36.0%)	78
No Prior Leadership Experience				
Anxiety	21 (27.6%)	3 (18.8%)	10 (27.0%)	34
Apathy	10 (13.2%)	4 (25.0%)	5 (13.5%)	19
Boredom	15 (19.7%)	3 (18.8%)	12 (32.5%)	30
Flow	30 (39.5%)	6 (37.4%)	10 (27.0%)	46
All Responses				
Anxiety	40 (21.3%)	9 (20.5%)	17 (17.3%)	66
Apathy	42 (22.3%)	7 (15.9%)	22 (22.4%)	71
Boredom	32 (17.0%)	10 (22.7%)	27 (27.6%)	69
Flow	74 (39.4%)	18 (40.9%)	32 (32.7%)	124

Note: Data is from *Leadership for Community Sustainability* a 300-level course with 29 students taught in the 2014 fall semester at Michigan State University.

Summary

Understanding previous student leadership skills and abilities within the context of learning is critical to the development of future leaders (Northouse, 2016). This study aims to add to current "flow" research in an undergraduate setting (Asakawa, 2010, Asakawa, 2004; Everett and Raven, 2015; Rogatko, 2009), established theory (Csikszentmihalyi, 1975) and methodological approaches in the context of education (Zirkel et al., 2015). Results indicated that there was a direct relationship between "flow" channels and students who participated in the undergraduate leadership course. Students with and without prior leadership experience were more likely to be in "flow" than any other channel measured. However, students with previous leadership experience were second most likely to be in a state of boredom. This result indicates that when students were not having optimal experiences they were more likely to be bored. This suggests that consideration should be placed in types of activities that were presented to students and that more challenging activities need to be used with students possessing prior leadership experience in order to assist in student engagement. Additionally, students with no prior experience who were not in a state of "flow" were second most likely to be in a state of anxiety. This result supports the notion that having some prior leadership experience is important to creating "flow" experiences and that classroom learning can be an anxiety-filled time in one's life, especially with no prior background in

the topic of study (Everett and Raven, 2015). A potential strategy would be to use students with prior leadership experience to act as in-class mentors to those who did not have prior experience. This strategy might lead to decreasing the boredom of students with leadership experience while at the same time decreasing the anxiety of students without prior experience. This research also supports the results of Everett and Raven (2015) that engaging leadership activities can be a forum for creating a continuum for numerous optimal experiences.

Second, there was a significant relationship between "flow" channels and intrinsic motivation and engagement when comparing all undergraduate student respondents both with and without prior leadership experience. Overall, students in "flow" were also likely to be intrinsically motivated to learn for the sake of learning and not being interested in tangible aspects such as a grades or another type of reward. This result supports the work of Asakawa (2010) in that being intrinsically motivated to learn is critical to the educational process. Additionally, students in "flow" were also likely to be engaged in the learning process. This supports research conducted by Senge (1990) that engagement in learning is important to a students' intrinsic motivation to learn.

Finally, there were no direct relationships between "flow" and domains of learning among all respondents. However, students with prior leadership experience were more likely to be in "flow" than any other channel when participating in activities in the cognitive, psychomotor and affective domains of learning. These results suggest that students with prior leadership experience had "flow" experiences under a variety of learning environments. This supports the work of Newcomb et al. (2004) that providing instruction in a variety of domains will increase the overall efficacy of the learning experience as well as provide a broader range of opportunities for growth. More research is needed to determine if instruction in only one domain decreases "flow" experiences.

This study suggests that faculty teaching leadership courses in Colleges of Agriculture and Natural Resources (CANR) should consider employment of a variety of learning experiences within all domains of learning in an effort to provide "flow" experiences for all students. This study also suggests that faculty should be cognizant of student interest and knowledge levels with individuals who have no prior leadership experience in an undergraduate leadership course. These levels of boredom or anxiety may be due to having a limited understanding of leadership and consequently not being successful in a leadership course. Application of the ESM approach in this study has the potential to be applied in other classroom settings, however caution should be used. A limitation to this study was the number of respondents (n = 29). Larger and more diverse undergraduate courses would provide additional opportunities to apply this methodological approach.

In conclusion, results of this study suggest that important relationships exist between "flow," intrinsic motivation and engagement of undergraduates in a leadership course in the CANR at Michigan State University. This research sought to better understand if previous leadership experiences in FFA and 4-H make a difference in an undergraduate student's intrinsic motivation and engagement in a leadership course. This study differed from previous work by Everett and Raven (2015) by focusing on undergraduate leadership students and application of Flow Theory in the context of previous leadership learning experiences and application based on domains of learning (Newcomb et al., 2004). Results of this research provide CANR faculty with baseline information about classroom activities that provide "flow" or optimal experiences in the context of learning in an undergraduate leadership course. The results of this study indicate that instructors should be cognizant of students with previous leadership experiences as it impacts their engagement, intrinsic motivation and most importantly "flow" in leadership learning and development. This research also provides a framework for application in other agriculture and natural resource undergraduate programs and courses.

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Learning Through Collaborative and Interdisciplinary Teaching: A Case Study of Faculty Work as Learning in Sustainable Agriculture Education

Jennifer H. Culhane[1], Kim Niewolny[2], Susan Clark[3], Kate McConnell[4] and Curt Friedel[5]
Virginia Tech
Blacksburg, VA

Abstract

The National Academy of Sciences called for a dynamic approach to teaching and learning in colleges of agriculture. In response, faculty at colleges and universities are implementing innovative frameworks for undergraduate education in the agricultural sciences. This study explored the collaborative and interdisciplinary teaching and learning practices of faculty in sustainable agriculture education curricula at a land grant university as an illustration of this innovation. Drawing upon a sociocultural learning framework, this study specifically emphasizes faculty work as a social practice and the inherently relational learning that occurs with other faculty, their students and community partners. Using an in-depth, qualitative research approach, a single embedded case study design was implemented to illustrate the teaching and learning experiences of an interdisciplinary group of faculty collaborating within an undergraduate minor that fosters community engagement through service-learning and sustainable agriculture curricula. The collaborative teaching structure that is explored is comprised of an instructor of record, collaborating faculty, community-partner and graduate teaching assistant. Faculty teaching in this program of study experience learning in the areas of disciplinary knowledge and pedagogical practice and navigate organizational challenges and barriers to collaborative work.

Introduction

Background of the Case: Sustainable Agriculture Education

Sustainable agriculture education (SAE) represents an educational approach to agriculture education that addresses many complex social and environmental problems, where educators are blending theory and practice to develop experiential learning environments that view students as the focal point of the process (Parr et al., 2007). High-impact practices identified by Kuh (2010), such as first-year seminars, learning communities, service-learning, undergraduate research and capstone courses and projects, are frequently implemented in SAE programs (Clark et al., 2012; Parr et al., 2007; Parr and Van Horn, 2006). The of SAE programs has experienced remarkable growth in the past two decades (Jacobsen et al., 2012). Not surprisingly, SAE programs vary in content, structure and focus depending on regional needs, administrative support, financial resources and student interests. Educational stakeholders involved in the design of SAE curricula at land grant universities are increasingly seeking to promote community-based dialogue fostered through community-university partnerships (Niewolny et al., 2012). Understanding faculty learning while participating in collaborative and interdisciplinary teaching is critical if we are to understand how agriculture education is best positioned to meet the needs of a changing paradigm in higher education.

Faculty Work as Learning in Sustainable Agriculture Curricula

How faculty consider their teaching as learning is critical in regards to the changes occurring in the academy. For institutions of higher education to fully engage, understanding faculty's learning process as well as the factors and contexts that promote and sustain faculty learning is imperative. This involves the development of a framework in higher education for understanding the schol-

[1]Director of First Year Academic Initiatives, Virginia Tech, jculhane@vt.edu
[2]Associate Professor Agricultural, Leadership & Community Education, Virginia Tech, niewolny@vt.edu
[3]Associate Professor Horticulture, Virginia Tech, sfclark@vt.edu
[4]Director of Undergraduate Assessment, Virginia Tech, kmdrezek@vt.edu
[5]Assistant Professor, Agricultural, Leadership & Community Education, Virginia Tech, cfriedel@vt.edu

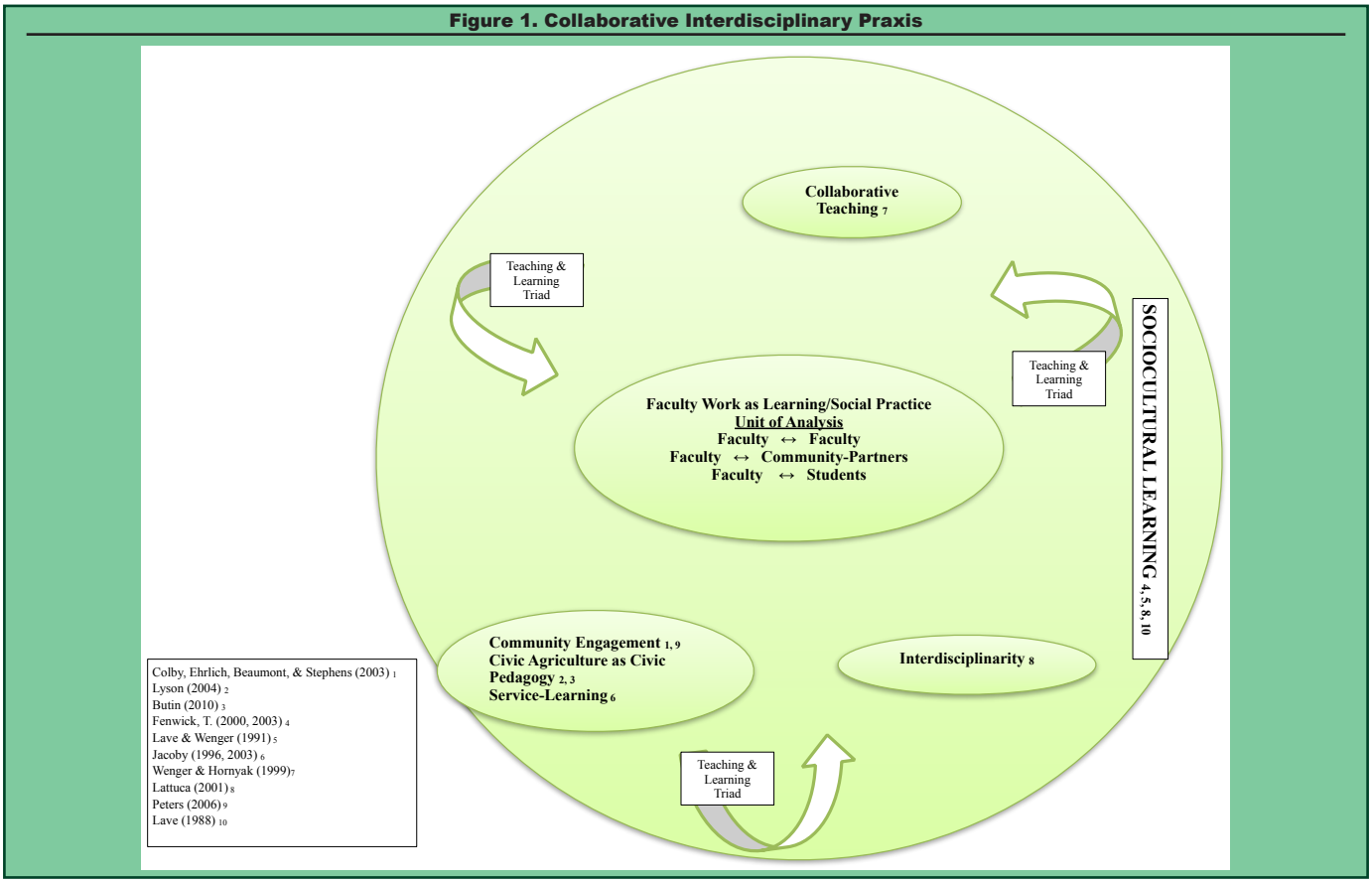
arship of teaching and learning as a learning process. This framework emphasizes a triad approach to teaching and learning that integrates experiential learning, interdisciplinarity and community engagement (Clark et al., 2013; Hammer, 2004; Niewolny et al., 2012; Parr and VanHorn, 2006; Parr et al., 2007). The first concept in the triad approach, experiential learning, is an overarching philosophy, epistemology and pedagogy that views experience as central to the process of teaching and learning; it considers experience as an embodied process of learning whereby the learner interacts in both the cognitive and physical sense through reflective practice (Fenwick, 2003). Interdisciplinarity, as the second component of the triad, is viewed as the blending of multiple disciplines inclusive of new knowledge structures and theoretical and methodological approaches (Godemann, 2006, p. 52).

Lattuca (2001) describes collaborative interdisciplinary teaching as a sociocultural practice where faculty gain new teaching strategies and insights, are intellectually stimulated and are more reflective on both their own learning and their students learning (Lattuca, 2001; Thorburn, 1985). Third is the phenomenon of community engagement in higher education. Drawing upon the National Academies of Science (2009), we see an emergence for increasing the scholarship of civic or community engagement, wherein academic knowledge and community service connect, thereby contributing to community well-being. Civic engagement, measures of civic embeddedness, relational ties among institutions, social capital and trust are qualities exemplified by engaged communities (Tolbert et al., 2002). In keeping with Colby et al. (2003), land grant universities (LGU) are to reengaging with their local communities in more meaningful ways by connecting the social with academic goals, knowledge competencies with personal commitment and the university with the larger world. Figure one illustrates the praxis of collaborative, interdisciplinary teaching and learning as embedded within community engaged framework (Figure 1).

The Case: Civic Agriculture and Food Systems Minor

This paper is part of a study on the Civic Agriculture and Food Systems (CAFS) minor within the College of Agriculture and Life Sciences at a southern land-grant university (Helms, 2014). The CAFS minor is an ideal case to observe collaborative and interdisciplinary teaching in practice. A combination of a values-based model of community development espoused by Heifer International (Aakers, 2008) and Lyson's (2004) framework for civic agriculture informed the development of the minor. Through collaborative agreement on the program's core values and philosophical goals, the CAFS taskforce—a decision-making body of faculty, community-partners, institution administration and graduate students—developed programmatic goals and student learning outcomes. Undergraduates intending to minor in CAFS are required to take four courses: 1) ALS 2204, Introduction to Civic Agriculture; 2) ALS 3404, Ecological Agriculture; 3) ALS 4204, Concepts in Community Food Systems; and 4) ALS 4214, Capstone in Civic Agricul-

Figure 1. Collaborative Interdisciplinary Praxis



ture and Food Systems. The core courses are taught by collaborative teaching teams comprised of faculty from multiple disciplines and include community-partner stakeholders (Clark et al., 2013). Wenger and Hornyak (1999) recommend a more integrated approach to teaching and learning where multiple perspectives, even competing viewpoints, can be shared and discussion can occur to address the complexity of issues. Grossman et al. (2012) suggest that the incorporation of community-based learning experiences can enhance student learning outcomes in the areas of social and environmental issues in tandem with reflection on those experiences while maintaining reciprocity with the local community. Specifically, the following community partners support the Civic Agriculture and Food Systems minor: University Dining Services; an international values-based community development organization, Heifer International; a small intensive urban farm; and a community garden. The student population enrolled in the minor is comprised of all 8 colleges at the university (Clark et al., 2013).

Methods

A qualitative research methodology was employed via a single embedded case study design informed by Yin (1997, 2012) to explore a minor at this LGU. The methods of data collection included semi-structured interviews, participant/observer field notes and secondary data analysis. Purposeful sampling was implemented for the selection of participants based on membership in the CAFS Taskforce and/or a collaborative teaching team (CTT) role in one of the four core courses in the minor. The Institutional Review Board approved the study protocol and all participants provided written informed consent prior to participation in the study. Faculty and a community-partner participated in semi-structured interviews. Participant identity was concealed by assigning pseudonyms. One of the researchers also acted as participant-observer throughout the Fall 2013 during the ALS 2204, Introduction to Civic Agriculture weekly classes and CTT meetings and the CAFS Curriculum Taskforce monthly meetings, to enhance data collection by observing practice. Secondary data collected through use of written documents created in the CAFS Curriculum Taskforce Assessment workshop and core course syllabi informed the overall process.

The primary researcher conducted field observations during the Fall 2013 semester— principally during (1) CAFS introductory core course sessions involving the collaborative teaching team, (2) weekly planning meetings and (3) CAFS Curriculum Taskforce monthly planning meetings. The observed collaborative teaching team was comprised of two faculty members in the College of Agriculture and Life Sciences, one community partner and one graduate teaching assistant (GTA)—namely the researcher for this study who acted as participant-observer. The CAFS Curriculum Taskforce meetings included faculty collaboratively teaching in one of the four core courses, community partners, institutional partners, college administration and graduate students. It should be noted that not every member attended each monthly meeting.

Constant comparative methodology (Charmaz, 2006) was implemented with the assistance of Atlas.ti (Dowling, 2008), the qualitative analysis software. Open coding of field notes, memos and interview transcripts were conducted simultaneously with data collection. Embedded memos (brief reflective memos) were included in the open coding process to inform future analytic memos (detailed memos that connect across embedded memos). Preliminary analytic notes in the form of memos serve as a level of analysis. Focused coding, the process of synthesizing initial open codes to the level of categories, was then conducted. These categories are included in an intensity matrix. Code matrix tables are utilized to show the frequency of code occurrence within each primary document. Primary documents are: interview transcripts, field notes and secondary data sources. Coding, using the constant comparative method, involved attaching labels to observations, interactions and collected materials that were sorted and synthesized forming tentative categories. Analytic memos synthesized data creating a logic trail that can be traced to the individual primary documents and field notes that informed the process through a labeling structure. Table 1 illustrates an example of a code matrix table that serves as an audit trail for the code Roles and Participation in Collaborative Teaching (Table 1).

Table 1. Code Matrix: Roles and Participation in Collaborative Teaching

Data Type	Interview (Primary Document # P1-P8)	CAFS Course Field Note (Primary Document # P9-P20)	CAFS Collaborative Teaching Team Meeting Field Note (Primary Document # (P21-34)	CAFS Curriculum Taskforce Field Note (Primary Document # P35-38)	CAFS Secondary Data (Primary Document # P39-P45)
Theme: Collaborative Teaching in Higher Education	* Number of Occurrences in Primary Document Shown in Parenthesis ex: P1(3)				
Category: Roles and Participation in Collaborative Teaching	P1(3)	P9(2)	P21(4)	P35(1)	P39(1)
	P2(2)	P11(2)	P22(1)	P37(2)	
	P4(6)	P12(6)	P31(5)		
	P5(1)	P13(4)	P32(1)		
	P6(6)	P14(6)	P23(2)		
	P7(4)	P15(3)	P34(2)		
	P8(4)	P16(2)	P24(1)		
		P17(5)	P25(4)		
		P18(2)	P26(2)		
		P19(2)	P27(2)		
			P28(3)		
			P29(2)		
			P30(2)		

This study was guided by an inquiry into the experience of faculty teaching and learning in sustainable agriculture education through a sociocultural lens. Following Fenwick's (2003) explanation of learning as a sociocultural experience and Lattuca's (2001; 2002) orientation to sociocultural learning theory, the primary researcher explored faculty work as learning to emphasize the importance of embedded social activity in diverse contexts, inclusive of interactions with other faculty, students and community partners and tools of various communities of practice (Lattuca, 2002). Specifically, the lead researcher drew upon Lattuca (2002) as a way to highlight how disciplinary positions frame faculty assumptions, practices, processes, values and relations to other disciplinary perspectives in their everyday work. Therefore, in this case of faculty teaching and learning, the unit of analysis was informed by faculty work as a sociocultural practice, drawing on the understanding of Lave (1988) that "the deep experience of whole-persons acting" (p.190) illustrates the nature of experience coupled with person, activity and setting as conditions for learning. The unit of analysis included faculty teaching and learning in the CAFS minor embedded with collaborative and interdisciplinary partnerships with CAFS faculty (faculty-faculty), community partners (faculty-community-partners) and student learners (faculty-student).

Results and Discussion

Faculty Learning: Designing and Implementing a Collaborative Teaching Team

This study found that faculty learn from working together; developing new ways of understanding disciplinary context and the environment. The collaborative teaching team structure for the CAFS minor has undergone modifications during the four iterations across its four core courses. The teaching teams implemented in the CAFS minor consisted of the following key members: instructor of record, collaborating faculty, community partner and graduate teaching assistant. The individual roles and responsibilities of the collaborative teaching team members enhanced the teaching and learning process and was communicated to university administration when requesting funding and time to work in this manner. Code mapping that revealed three iterations of analysis is illustrated in Table 2.

When explaining the minor's collaborative teaching team structure one faculty shared that some of the frustration experienced was working within the *"hierarchy of the education infrastructure...and how they assign credit to faculty for their teaching load."* The faculty member further explained that there was "no [organizational] model currently for doing what it is we are doing." As a partial solution, they stressed the importance of communicating with department heads for support, while at the same time cautioning the band-aid nature of this approach. Additional stated: *"Moving forward if we don't get more support mandating [collaborative interdisciplinary work] at the upper administration level, at our college and our department heads...it will not succeed."* Clear roles and outcomes for participation in collaborative teaching communicate the value/need for funding to administration. Establishment of a model for collaborative teaching that can be shared to navigate administrative structures can enhance the ability of the institution to learn outside of the existing structure. Also, clear structure for collaborative teaching based on programmatic goals and learning outcomes allows for seamless reporting to accreditation organizational structures.

The four C's were found to be essential for successful collaborative teaching: communication, continuity, clarity and capacity. One faculty spoke of communication: *"What made it work was that everybody communicated fairly well...but we were not in the same classroom at the same time at all times."* Another faculty noted the importance of the instructor of record in maintaining continuity: *"There's this connectivity and that would be the person that's the instructor of record maintaining that."* Clarity in the roles of teaching team members was mentioned: *"We're pretty clear about roles and responsibilities for the most part."* The size of a collaborative teaching team can also impact clarity and therefore performance as described by one faculty*: "[The collaborative teaching team has] definitely changed... [it's become] a smaller team since the beginning which I am personally happy with...it's better for a lot of reasons, it's tidier...the moving parts can be confusing."* The notion of capacity as a limiting factor to efficiency and successful collaboration was further questioned by another faculty member: "How many faculty can you have involved in three classes? And what is their role?"

While there is significant collaborative learning potential for faculty and students alike, the model is not without its challenges. Faculty in this study voiced concerns in the following themes: understanding clear roles and responsibilities of teaching team members; managing time commitments (which tend to be highly variable during a semester); communicating the model to students; maintaining equity; and understanding common pedagogical practice. Faculty described the potential hazards of not clearly understanding the role of each member of the teaching team. They indicated that "not fully understanding...the delineation of roles and responsibilities" affects participation and understanding of the collaborative teaching model. Also added was that time management is a challenge to collaborative teaching in the minor where it "seems like you're juggling a lot of balls...and if there's a better way of doing it I have yet to figure it out." A faculty member explained the challenge and difficulty in communicating the model to students, as follows:

I think one of the challenges is how do you best communicate this collaborative teaching concept to the students you're teaching...and we really need to continually remind the students that this is a collaborative team it's not just one individual... [it's] a different paradigm to what they are often exposed to on this

Table 2. Code Mapping: Three Iterations of Analysis

Code Mapping For Civic Agriculture and Food Systems Minor (Research Questions 1, 2, 3 and 4)			
RQ1. How do faculty understand and participate in collaborative teaching?	RQ2. How do faculty understand and participate in interdisciplinary teaching?	RQ3. How do faculty understand and participate in service-learning as a pedagogical practice?	RQ4. What sociocultural outcomes might result from faculty learning within this sustainable agriculture education program?
Third Iteration: Emergent Themes/Application to Data Set			
RQ1. Collaborative Teaching in Higher Education	RQ2. Interdisciplinary Teaching in Practice	RQ3. Service-Learning as Reflective/ Critical Practice	RQ4. Participation in Sustainable Agriculture Education Program
Second Iteration: Focused Coding/Constant Comparative Analysis			
RQ1. Roles and Participation in Collaborative Teaching ***Sub Categories-*** *Role of Instructor of Record* Role of Collaborating Faculty Role of Community Partner Liaison Understanding the Collaborative Teaching Model Feelings toward Collaborative Teaching	RQ1. Learning Pedagogical Practices Navigating Administrative Structure Navigating Collaborative Work Outcomes of Collaborative Work	RQ2. Learning Disciplinary Knowledge Recognizing Disciplinary Perspective Understanding Interdisciplinarity RQ3. Understanding Service-Learning as Pedagogical Practice Understanding the Community Partner as Educator	RQ4. Identifying Student Learning Learning Situated in Sustainable Agriculture Education Teaching in Sustainable Agriculture Education
First Iteration: Open Coding/Surface Content Analysis			
RQ1. Course Design and Structure	RQ1. Role: Instructor of Record		RQ2. Understanding Interdisciplinary Teaching
RQ1. Environment_Class size	RQ1. Model Adaptive		RQ3. Faculty Expectations
RQ1. Barriers	RQ1. Collaborative Scholarship		RQ3. Pedagogical Practice
RQ1. Faculty Personalities	RQ1. Benefits Pedagogical Knowledge		RQ3. Problem Solving
RQ1. Administrative Practice	RQ1. Challenges_Consensus		RQ3. Purpose
RQ1. Assessment	RQ1. Challenges_Content		RQ3. Reciprocity
RQ1. Benefits_ Enriching	RQ1. Challenges_Continutity		RQ3. Reflection
RQ1. Benefits_Each Iteration Becomes Easier	RQ1. Challenges_Faculty Reward System		RQ3. Rewarding_Personal Growth
RQ1. Benefits_Excitement	RQ1. Challenges_Justification		RQ3. Rewarding_Professional Growth
RQ1. Benefits_Learning	RQ1. Challenges_Time		RQ3. Social Impacts
RQ1. Benefits_Networking	RQ2. Access to Information		RQ3. Student Development/Success
RQ1. Understanding the Model	RQ2. Complex		RQ3. Understanding SL
RQ1. Professional Impacts: Funding	RQ2. Confidence in Interdisciplinary Practice_Doing what you Say you are Doing		RQ4. Participation
RQ1. Professional Impacts: Networking	RQ2. Defining Interdisciplinarity		RQ4. Transformation
RQ1. Professional Impacts: Pedagogical Practice	RQ2. Discipline		RQ4. Collaboration
RQ1. Role: Community Partner	RQ2. Knowledge Expertise		RQ4. Interdisciplinarity
RQ1. Role: Faculty	RQ2. Disciplinary Language Barrier		RQ4. Social Practice Promotes Learning
RQ1. Role: Graduate Teaching Assistant	RQ2. Learning from Others		RQ4. Understanding an Alternative Approach
			RQ4. Learning in SAE
DATA	DATA		DATA

campus...I think we need to be more intentional...this is a different way of learning about sustainable agriculture and food systems concepts.

Faculty describe equity among the collaborative faculty:

I think some of the burden seems like it is falling on the lead faculty just because everybody's busy and it's not clearly one person's job to do it...it needs to fall on somebody to get stuff out to the students. And I think that's the challenge in really trying to figure out how to equitably do all of that, given everybody's schedule and teaching obligations and you know because it [collaboratively taught course] is a relatively small chunk of your overall job.

As noted above, communication among faculty was an especially important concept to be successful in a collaboratively taught course, which emphasizes the concept of language as a cultural tool in the learning process (Lattuca, 2002). In this study faculty shared that they felt they had to almost translate to others their disciplinary understandings. Common understanding or consent, even if in disagreement with other disciplinary languages, is a starting point to clearly articulate across the institution a model for collaborative and interdisciplinary practice.

It was also observed that lack of structure around allocation of resources among faculty and their respective departments that support collaborative teaching efforts created barriers for participation. Complexity associated with navigating multiple departmental-level administrations were identified in ownership and use of the core courses taught in the minor, departmental teaching credit and misconceptions of allocated funding and allocated time for teaching in the minor included in the teaching load for each faculty. One faculty member spoke to the stated mission of both the college and the broader university, which calls for faculty "to be doing interdisciplinary work." Additionally, shared was the view about the disconnect between what the university supports and how faculty are pursuing this kind of work by referencing collaborative teaching in their home department: *"The way collaborative teaching is implemented is*

very different, it's not collaborative teaching it is co-teaching...where one person has half the semester and the other person has the other half." The challenges faced by faculty in pursuing a collaborative course model are very real, but can be ameliorated by changes in organizational procedures and policies that can empower faculty to pursue work that compliments both strategic growth plans and an enhanced student/faculty experience. One faculty member spoke to this issue from her perspective as a CAFS Taskforce member:

I think the conversation we had with the associate dean at the last taskforce meeting was really illustrative because...it seems like this minor is making these conversations happen at the administrative level, which maybe is a bigger scale than some of the other collaborative teaching that's happened on a piece meal basis. It just seems like [the CAFS minor is] facilitating those conversations and hopefully it will come out that there will be some decisions, some structure, some support at the administrative level for trying to make this happen. We are all seeing that it does work and it is rewarding so I think there's a lot of potential.

These findings further support the role of institutional culture and how faculty work with their own understandings and social practice in the larger community. Navigating these cultural differences is complex; collaborative teaching can serve as a gateway to collaboration across the institution further enhancing the university's mission and strategic plan.

Faculty Learning: Interdisciplinary and Collaborative Teaching

Within the framework of this study, interdisciplinarity was conceptualized according to Lattuca (2001) as enhanced through a "non-disciplinary" perspective by faculty and administration in higher education. Interdisciplinarity occurs on a continuum of activity. At one end is informal communication that includes insight gained from conversations between faculty across disciplines and departmental affiliation; with formal collaboration on the other end, including practices such as collaborative research agendas or teaching teams. A reconceptualization of interdisciplinarity that includes multiple knowledge perspectives and methods, as well as embodies civic-based activities, adds to the impact of interdisciplinary teaching practice.

When the practice of interdisciplinary teaching was discussed in participant interviews, faculty acknowledged the importance of having an expert within his/her discipline as part of the practice model. Faculty viewed the collaboration of faculty sharing their disciplinary knowledge and understanding of the course content as essential to addressing complex social issues within the context of SAE. A concept of significance in higher education is that of the specialization, often described as the silos approach to knowledge. One faculty member, for example, described their experience in one of the core courses: "We had a lot of different perspectives there that helped frame what should be presented." Also added was that it *"had been in a discipline [and] I knew really well where our discipline was related to community food systems, but then seeing how other disciplines were viewing it was really eye opening."* One faculty member stated that it is *"absolutely essential that everybody has some sense of the value of this other person's knowledge."* This approach to interdisciplinary teaching in the CAFS minor creates a model for teaching and learning in SAE as a collaborative process that incorporates multiple disciplinary understandings from a group of faculty to solve complex problems by creating and answering new questions the inquiry exposed.

As defined by Lattuca (2009), an academic discipline is more than just the subject matter and methodologies implemented in research and education; it is a culture of shared knowledge and understanding. Faculty teaching in the CAFS minor were highly motivated to teach in the core courses, which influenced reading literature outside of their own disciplines. Lattuca and Creamer argue that "discipline[s] [are] the dominant force and the central source of identity for faculty members" (p. 6). This view lends insight into the social and cultural implications of interdisciplinary work, whereby participating faculty bring disciplinary knowledge, practices and beliefs that affect the overall outcome of the experience. Faculty who took part in interdisciplinary teaching gained new teaching strategies and insights, were intellectually stimulated and were more reflective in terms of their own learning and their students' learning.

Summary

SAE is an emerging field of study that includes not only traditional agriculture and life sciences courses, but also a range of diverse fields that are impacting the way we view agriculture education. Thus, SAE is increasingly incorporating knowledge and skills from sociology, nutrition, agriculture, education, political science, architecture and planning and economics. Institutions of higher education—and particularly land grant universities—are responding to calls for a greater institutional commitment to revitalizing agriculture education programs. As evidence of this push, the National Academies of Science (2009) urged the enhancement of agricultural literacy and student recruitment in the field of agricultural sciences.

The CAFS Minor at this southern land-grant university is an interdisciplinary approach to experiential-based curricula that promotes agricultural literacy at an institutional level. Opportunities are increasing for creating experiential, interdisciplinary degree programs across departments and colleges of agriculture in higher education (Clark et al., 2012; Hammer, 2004). The incorporation of interdisciplinarity, collaborative teaching and research agendas and experiential-based learning into agriculture education are suggested to reach the goal of transformation in agriculture education to maintain pace with the changing global agrofood system and related opportunities for student career success (NAS, 2009). This study supports faculty participation in

collaborative and interdisciplinary work by illustrating the professional outcomes of engagement and the impact on the culture of the institution. The current shift toward a student-centered approach to teaching and learning is accompanied by alternative pedagogical practices that stretch the traditional perspective of the role of faculty and student both in and outside of the classroom. Faculty in this study learned new pedagogical practices from interactions with other faculty teaching and learning in the courses and developed an appreciation for other disciplinary knowledge and practices. This finding resonates with Lattuca's (2002) description of disciplinary positions which frame faculty assumptions, practices, processes, values and relations to other disciplinary perspectives in their everyday work.

Faculty work as learning incorporated into research agendas within the scholarship of teaching and learning is an opportunity for agriculture education to enhance understanding of social practice and disciplinary cultures as context that affects every day work experience. This involves the development of a framework in higher education for understanding faculty work as a learning process—one that also values the challenges and benefits of conducting interdisciplinary collaborative research, teaching and extension/service. Scholarship in the area of faculty work as learning illustrates the positive impacts on classroom engagement and effectiveness, as well as the larger scholarly community (Lattuca, 2005). Collaborative work, when viewed as a social learning experience, creates value for administration in supporting faculty who participate within the organizational structure with the realization that training and development are occurring at the same time. This study and ones like it, can illustrate the benefits of viewing collaborative work as faculty development, thus shifting the understanding of how faculty learn in the current academic workplace.

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Theory and Practice of an Interdisciplinary Food Systems Curriculum[1]

Kathleen Hilimire[2]
Fort Lewis College
Durango, CO

Abstract

Food production, consumption and trade are inextricably connected to health, livelihoods and the environment. In an increasingly globalized food system, commodity chains are complex and socio-cultural relations paramount. Conventional agriculture education programs and even non-traditional sustainable agriculture programs, do not always explicitly address food systems with global, structural and socio-cultural perspectives. As part of a three-year National Institute of Food and Agricultural postdoctoral research grant, I developed a curriculum for an undergraduate-level Sustainable Food Systems program. The program was comprised of six interdisciplinary courses that emphasize place-based learning, political ecology and agroecology. I created this curriculum through a case study at Fort Lewis College, a public liberal arts college in Durango, Colorado. Results from a survey of students at the college, interviews and surveys with food systems practitioners and literature review all combined to inform the direction of curriculum development. The developed courses are interdisciplinary, field-based, experiential and project-based. I piloted three of these courses and found that students established deep critical thinking skills around values-based controversial issues and were able to articulate solutions for complex place-based food systems problems.

Introduction

The study of food systems is inherently complex, including such varied topics as power dynamics along complex value chains (Alkon and Agyeman, 2011; Buck et al., 1997; Lind and Barham, 2004), health and the industrialized food system (Alston et al., 2008; Altieri, 2009), unequal institutional support for crops (Breggin and Myers, 2013; Spittler et al., 2011) and uneven impacts of food security (Sen, 1982; Trauger, 2014). Incorporation of these themes into a coherent food systems learning program is challenging. A crucial question for educators is how to structure coursework around food systems such that they are viewed as objects of study at the human-environment nexus and not placed wholly on either end of that spectrum. Historically, programs dealing with food systems emerged from agricultural programs and institutions seeking to adapt to cultural and market shifts towards sustainable agriculture (Karsten and Risius, 2004; Keating et al., 2010). These programs emerged from production-oriented departments and institutions, meaning that the new alternative curricula were often still farm-scale in nature (Keating et al., 2010). However, in recent years, the study of food systems themselves as the object of inquiry has resulted in the development of food systems curricula, as opposed to sustainable agriculture curricula (LaCharite in press).

This paper presents an interdisciplinary series of courses for post-secondary learning about food systems that emphasizes place-based learning, political ecology and agroecology. The program emphasizes approaches to food systems curricula development derived from a previous literature review (Hilimire et al., 2014) in which we identified interdisciplinarity, systems-thinking and the experience-theory-skill complement as core theoretical and pedagogical concepts for effective food systems learning (Table 1). Interdisciplinary thinking incorporates multiple perspectives and systems-thinking uses multi-scalar relationships as the object of inquiry (Francis et al., 2011; Karsten and O'Connor, 2002), both of which allow for a more accurate analysis of food systems than disconnected, disciplinary approaches (Schneider et al., 2005). The experience-theory-skill complement is a three-pronged approach to food systems curricula development that blends experience-based learning, theoretical study and skills acquisition.

From the same literature review (Hilimire et al., 2014) we identified exposure first, case study learning

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[2]Environmental Studies, Fort Lewis College, 1000 Rim Drive, Durango, Colorado, 81301, USA email: kehilimire@fortlewis.edu

Table 1. Concepts and goals for food systems curricula development, derived from Hilimire et al. (2014).

CONCEPT	EXPLANATION	GOALS
Core theoretical and pedagogical concepts		
Interdisciplinarity	Interdisciplinarity is a key concept for food systems curricula, both within individual courses and across an entire curriculum. Interdisciplinarity engages multiple perspectives, through both theory and method.	To effectively analyze food systems, which are inherently interdisciplinary.
Systems-thinking	Systems-thinking, in the context of food systems curricula, defines the object of inquiry as a system, allowing for engagement with the whole complexity of food systems.	To realistically define food systems as a series of complex, multi-scalar relationships.
Experience-theory-skill complement	The experience-theory-skill complement is an organizing principle for food systems curricula, suggesting that educators incorporate experience, theory, and skills acquisition into any curriculum. Experience-based learning can occur through events such as field trips, or participatory activities such as internships. Theoretical study can occur through engagement with the literature or debate. Skills refers to acquisition of accepted tools used for analysis and work in food systems.	To engage and delineate multiple modes for food systems learning. To foster civic engagement, critical thinking, and job-specific skills.
Techniques for building food systems curricula		
Exposure first	Exposure first, in the context of food systems, is a non-linear approach to learning that involves introducing learners to a food system early in a course or curriculum before tools of analysis or theoretical understanding are introduced, reinforced, or mastered.	To encourage curiosity and engagement among learners, as well as the ability to build contextual knowledge of food systems before theoretical concepts are mastered.
Case study learning	Case study learning connects students to real or imagined food systems scenarios, often asking learners to address or define problems. Case study learning can occur through many forms, such as written assignments, class discussion, and experience-based learning.	To link theoretical and practical concepts in the study of food systems, and to develop problem-solving skills.
Cooperative group learning	Cooperative learning includes team work and learning with practitioners.	To foster peer-to-peer learning and "communities of learners" (Ison 1990).

and cooperative learning as techniques for food systems curricula development (Table 1). Exposure first refers to the concept of immersing students in a complex food system scenario early in a course or curriculum. This represents a non-linear approach to learning whereby students gain investment in a topic and awareness of its complexities well before tools of analysis or theoretical understanding are introduced, reinforced or mastered (Ison, 1990; Lieblein and Francis, 2007; Lieblein et al., 2007). Case study learning involves presenting learners with real or simulated food systems situations and then defining the problems or envisioning solutions for each case. Written assignments, class discussion and experience-based learning all serve case study learning well and allow students to link theory and practice to hone critical thinking and problem-solving skills. Finally, we found that cooperative learning, in which teams of study are comprised of peers and/or practitioners, allows for a participatory experience in learning about others' personal experiences with food systems. This approach is particularly effective for a field such as food systems, where every learner is also a daily participant in the engagement with food.

After generating these food systems curricula development concepts and techniques, I sought to apply them in a postsecondary liberal arts context through development of a Sustainable Food Systems program, as presented in this paper. The presented program analyzes the social, political, economic, cultural and ecological domains of food and the associated pedagogy explicitly includes those fields that are sometimes left out of sustainable agriculture programs, such as human geography and political ecology. The objectives of this paper are to: (1) illustrate one approach for building a food systems program based on the above-described theoretical framework, (2) report on the piloted portions of this curriculum.

Methods

A National Institute of Food and Agriculture (NIFA) postdoctoral fellowship awarded in 2012 supported the development of pedagogy and curricula for what was originally titled an "Agroecology Certificate" at Fort Lewis College. Fort Lewis College is a public liberal arts postsecondary institution located in the rural southwestern region of Colorado in the city of Durango (population 17,500). In 2014, Fort Lewis College enrolled approximately 4,000 students in 30 majors. As a Native-American serving institution, Fort Lewis College enrolled students from 155 American Indian tribes and Native Alaskan villages in that time period (FLC n.d.). Historically, the school had a strong agricultural focus, with an agriculture program from 1925 to 2011 (FLC n.d.). In the 2000s, Fort Lewis left the land grant Colorado State University (CSU) system. While it had a liberal arts mission under land-grant CSU, following this shift, it became a stand-alone institution with a liberal arts focus. Eventually, formal agriculture science programs were removed from the college curriculum. Despite this departure, student interest in food systems studies remained high, with 87% of students in a 2013 survey indicating they were somewhat to very interested in more food systems coursework at Fort Lewis (Hilimire and McLaughlin in press). Under the NIFA grant, I proposed to create a curriculum for an Agroecology Certificate at Fort Lewis College. Throughout the course of this research, I retitled the curriculum as a "Sustainable Food Systems" program because the conceptual heft associated with the phrase sustainable food systems more accurately reflected the nature of the curriculum with its focus on political ecology, geography and ecological agriculture than did the term agroecology, which was often defined by students and colleagues as production-oriented.

To develop this series of courses, I completed a literature review (Hilimire et al., 2014), a survey of

Fort Lewis College students (Hilimire and McLaughlin in press), interviews and surveys with food systems practitioners, the preparation of the courses for the curriculum itself and piloting of courses. Key to the process of course creation was insight from practitioners (Niewolny et al., 2012). Through on-site visits, interviews and an online survey, I communicated with 18 food systems professionals in 2013 and 2014, found by contacting all farmers and ranchers listed as vendors at the Durango farmers market and in the Eat Local guide. I also networked with the local county extension agent and used word-of-mouth to identify additional food systems professionals. These food systems professionals represented the range of professions in food systems in the region of the college and included mixed vegetable farmers, orchard farmers, beef ranchers, food access and nutrition non-profit workers, policy advocates and the manager of a meat processing plant. These professionals offered insight for shaping the curriculum and became contacts for hosting field trips, giving guest lectures and offering internships. In this paper, I report on the results of developing and piloting the courses. Combining insight from the literature review, the student survey and practitioner interviews, I built six courses for the program, including course descriptions, teaching outlines and field-based program options. I piloted three of these courses. Following piloting, I evaluated courses through student feedback and refined them.

Results and Discussion

Six Food Systems Courses

Based on the pedagogical theory from the literature review; input from students given in the survey; and ideas from faculty, staff and food systems professionals, I built a series of six courses for a Sustainable Food Systems program (Table 2). Altogether, these courses form a cohesive, interdisciplinary food systems program with courses that can be taught by various faculty with related expertise. The goal in developing this curriculum was to create a program of courses, each one interdisciplinary, that cumulatively presented analytical tools for the assessment of the social, political, economic, cultural and ecological domains of food. This goal was informed by the need for learning programs tailored to systems-oriented scholars and professionals in the realm of food systems, as opposed to solely agriculture and was also driven by the need for curricula that fit well in a liberal arts context, as opposed to a land-grant context (Jacobsen et al., 2012; Parr et al., 2007). The presented Sustainable Food Systems program emphasizes the analysis of agricultural spaces as ecosystems, proficiency in food policy and politics and engagement with social issues surrounding food systems.

Sustainable Food Systems of the Four Corners

The first course in the series was called "Sustainable Food Systems of the Four Corners region." This interdisciplinary course aimed to engage students with food systems learning through the exposure first model, which entails engagement with complexity early in a food systems curriculum, rather than waiting until students master building block concepts, to involve them with complicated food systems analysis (Hilimire et al., 2014; Ison, 1990; Lieblein and Francis, 2007; Lieblein et al., 2007). Exposing students to complexity in food systems early in the curriculum can encourage investment in learning and synthesis.

I piloted this course during summer semester 2013. Learning modules for the class included a brief history of U.S. agriculture; defining key terms "food systems," "livelihoods," and "agroecology;" introduction to horticultural skills; meat and livestock; food security; and careers in food systems. These modules were particularly relevant to the region where the school was located for facilitation of experience-based learning. For the first module on the history of U.S. agriculture, students read and discussed the changes that have occurred primarily over the last 150 years in U.S. agriculture. We examined contemporary trends in U.S. food systems, focusing in-depth on the idea of "local foods." Students read and debated various view points on local foods (Born and Purcell, 2006; DuPuis and Goodman, 2005; Pilgeram, 2011; Pollan, 2006), using an explicitly geographic lens. Specifically, the analysis of the rhetorical strategy around local foods served to highlight the importance of scalar analysis, as students learned that local foods could accommodate positive or negative environmental impacts, depending on the scale of analysis (Born and Purcell, 2006). For the horticultural skills part of the class, we visited four different mixed vegetable farms, with students learning and practicing specific skills for

Table 2. Courses for a sample sustainable food systems college curriculum.

Course title	Key course concepts
Sustainable Food Systems of the Four Corners	Study the food system local to the college to promote early engagement with the complexity of food systems through an exposure first model.
Political Ecology of Food	Use written case study responses to develop deductive reasoning skills. Cultivate inductive reasoning with student-developed team research projects, which also emphasize cooperative group learning. Utilize literature from geography, political ecology, and other social sciences to explicitly analyze the structural context of food systems at multiple scales.
Ecological Agriculture	Develop practical farm and/or garden management skills, using the experience-theory-skill complement to balance field trips to farms, literature study, and the cultivation of a campus garden. Emphasize literature from agroecology, ecology, and other natural sciences to apply the ecosystem concept to agriculture and to study organic farming methods.
Interdisciplinary Field Training in Food Systems	Build skills proficiency for food systems analysis through learning and practicing field methods. Build critical thinking skills by applying methods in real world settings on a variety of farms, food policy agencies, and food systems organizations.
Community Development of Food Systems	Analyze a specific food sovereignty case using tools from participatory action research.
Independent Field Experience	Form specific expertise in an area of food systems inquiry through a student-centered learning experience with a food systems professional organization, farm, or ranch.

soil management, irrigation, crop culture and pest management. These field days, combined with lecture and readings on agroecology, altogether served to provide students with a complement of experience, theory and skills in regards to horticulture. This focus on horticulture was introductory to the third course in the series, "Ecological Agriculture."

In the meat and livestock portion of the class, we compared confined animal feeding operations to grass-fed cattle grazing and small-scale supplemental feeding operations. This unit was highly relatable for students in Colorado, many of whom were in-state residents. Cattle are a common sight in the agricultural landscape and the open curiosity of students about this subject strongly supported learning. In this vein, I recommend that for this course to be adopted in another region that it be crafted to focus on case studies relevant to the region. In the pilot course, we visited a slaughterhouse and two ranches with distinct management styles. Students then wrote reflective essays comparing observations from the site visits and their readings on the different management styles.

This course also emphasized civic engagement through a community partnership for service learning, a strategy utilized by other food systems programs (Clark et al., 2013). In the pilot version of this course, I partnered with an anti-hunger non-profit with an office in the region of the college. Students read reports on regional food security and a coordinator from the organization facilitated a lecture and discussion with students. The class then worked on a series of homework assignments. The first was titled "Shopping on a Budget." Students were instructed to report on field research to provide dinner for a family of four using $10 or less. After comparing costs and options at three different types of markets: a conventional grocery store, a convenience store and a farmer's market, students wrote reports detailing their findings. They compared meals on parameters of cost, total caloric intake per meal, nutritional and health values and environmental impact. For each parameter, students had to explain the values on which they based the comparisons. At the end of the paper, they described which meal they would serve and why.

In the second phase of the food security module of the course, I sought to connect the student research from the Shopping on a Budget activity with an activity designed to generate a useful product for the non-profit. Students were assigned the creation of recipes that could be used by clients of the non-profit to facilitate healthy, affordable cooking. The expectation for these recipes was that students would link concepts from the class to the assignment, proposing recipes with strong embedded environmental and social values, with ingredients totaling less than $10 for a dinner for a family of four. On nearly all assignments, students fell short of the expectations and I believe that the assignment was given too early. Exposure first is intended to immerse students in the complexity of food systems to promote early engagement and investment in learning. However, engagement and investment do not translate to proficiency, at least not without the analytical tools taught at later points in this curriculum. Instead of asking students to learn and implement new concepts so rapidly, this entry-level class should have focused on assignments in which students verbalized critical thinking, as opposed to demonstrating its results. In teaching this class again, I would instead emphasize work more like the Shopping on a Budget assignment. Such reflective assignments can support students to articulate questions, which may be more appropriate for an entry-level class.

Finally, this course included a lecture and discussion of careers in food systems. In evaluations of the course, students highlighted this as one of the most important units of the class. It was valuable to include this as a unit in the first course of a Sustainable Food Systems program such as this one, because future courses asked students to take a direct role in the choice of research topics and internships. Having an idea of what job-oriented direction they may pursue helped students to more carefully craft these student-centered options.

Political Ecology of Food

The second course in the series was called "Political Ecology of Food." In contrast to the regional concentration of the first course, this class emphasized the tension of the multiple scales of food systems, from local to global and highlighted analytical tools from the social sciences. The focus of this course was to apply theories from geography, political ecology and other social sciences to the multi-scalar analysis of food systems. I piloted this course in the spring semester of 2014, strongly emphasizing a combination of deductive and inductive case studies. Learning modules for the class included ethanol, food justice, commodity chain analysis, U.S. agricultural subsidies, free trade agreements, food and farm workers, pesticides, genetically modified organisms, food safety, fair trade and organic foods.

This course took a case study learning approach (Hilimire et al., 2014) by examining specific examples illustrative of larger themes in food systems studies. For these, I purposefully selected controversial topics for this course and provided students with readings that showed contrasting viewpoints. These encouraged students to enrich critical thinking skills and become comfortable with uncertainty in food systems research. For example, in a unit on quinoa, students read various articles, among which was a piece by (Jacobsen, 2011) and its response by Winkel et al. (2012). After reading these articles, students discussed the role that increased global quinoa consumption has played for food security and rural livelihoods in quinoa-producing regions. In another unit on genetically modified organisms, students read a book co-authored by a geneticist and an organic farmer (Ronald and Adamchak, 2008) about the potential benefits of genetically-modified organisms for organic-style agriculture. This book was intellectually challenging because it brought together two practices in

a complementary way that are often seen as competing. Students were surprised to learn the actual definition of genetic engineering and many struggled to separate the technical definition from the emotional associations with the term.

I incorporated case studies in several ways as homework assignments for this course. For several assignments, students responded to essay prompts for hypothetical situations. One essay prompt was:

The mayor of Our town is concerned about obesity. She puts forth a ban on all food products containing High Fructose Corn Syrup (HFCS) across the city. She is then taken to court by the Corn Refiners Association for targeting a specific agricultural commodity (corn). What is your take on the issue? How do you solve this problem?

Prompts like these served as deductive case studies (Hilimire et al., 2014). In these, students were given pre-identified problems and instructed to identify analytical tools and solutions. In this course, I also used an inductive case study learning approach, in which students were the ones to characterize the topic and problem. For an eight-week segment of the course, I assigned a student-selected, cooperative learning project. The prompt for the assignment instructed students to identify a food systems issue and study it, using a combination of literature and primary research. For the primary research, students were encouraged to use observation or interviews as their main tools. One group conducted a comparison of coffee at four local coffee shops. They conducted interviews and gathered evidence, comparing a small-sized coffee at each establishment on environmental parameters (organic, shade-grown, etc.), social parameters (Fair Trade or other direct sales channels) and economic parameters (cost per gram of ground coffee in the brew). Another group administered a two-minute interview in the downtown area, asking participants about values when food shopping. On student evaluations, this was one of the most successful tools for learning that emerged from this course, with students commenting on the value of teamwork and the importance of researching topics of personal interest to them. Similar to other research, students also commented on the social aspect of teamwork, indicating that working in small groups made the assignment more enjoyable (Trexler et al., 2003).

In addition to the controversial topics and case study learning, I sought to explicitly incorporate themes and analytical tools from geography and political ecology into this course. Geography, with its focus on the connection of humans and nature, is particularly well suited as a theoretical basis for the study of food systems (Duram and Oberholtzer, 2010). Furthermore, the emphasis on place and space at multiple scales, an important theme for geographers, helped students to parse the impacts of food systems change in a spatially meaningful way. One of the primary themes of this course was "beneficial in one place and time does not mean beneficial in all places and times." Through this lens, students analyzed topics such as international food trade, learning to identify winners and losers at multiple spatial and temporal scales.

Political ecology is a field that examines the environmental behavior of land-based actors, traditionally conceived of as peasants, in the context of political economy at multiple scales (Blaikie and Brookfield, 1987; Lawhon and Murphy, 2012; Walker, 2005). This course examined the land use decisions of agriculturalists in the contexts of local, regional, national and global political economies. Students used the multiples scales of political economy to distinguish land use behaviors of farmers. For example, students assessed private sector food safety regulations in California and their impacts on decisions to limit on-farm conservation practices (Beretti and Stuart, 2008; Stuart, 2009). They also examined the role of the "U.S. Farm Bill," past and present, on the American landscape and assessed the cascading effects of international free trade agreements on land use, particularly with regards to corn in Mexico. From this, students were asked to comment on the ways in which agriculturalists are constrained in their environmental decision-making by intersecting scales of political economic relations (Lawhon and Murphy, 2012). In this course, this line of questioning led to a post-structural political ecology analysis of decision-making and in the second half of the course students examined the role of the moral economy in further constraining or empowering agriculturalist actors, assessing social and market movements such as organics, fair trade and local. In this, students were exposed to actor-network-theory (Murdoch et al., 2000) and the importance of examining power shifts that derive from social movements around food systems.

Ecological Agriculture

The third course in the series was called "Ecological Agriculture." The goal of this course was to explore the ecosystem concept as it related to food. I piloted the course twice during the summer semesters of 2014 and 2015. The course immersed students in approaches to garden and farm management compatible with ecosystem function and environmental conservation. Ecological topics such as nutrient cycling, population dynamics, species interactions and adaptation were analyzed from an agroecological perspective. The course covered specific horticultural techniques for soil quality, irrigation management, crop rotations and integrated approaches to pest and weed management. Ecological Agriculture was a very skills-centric class. Students learned to assess soils in the field, interpret soil tests and build soil management plans. In another unit, students identified crops by botanical family and studied principles of crop rotation, intercropping and cover crops. Skills were tested throughout the semester in a series of in-class quizzes and take-home tests. Finally, for the capstone assignment of the course, students produced three-year cropping plans for a garden, including winter cover crops, summer season successions, intercrops and an articulated soil management plan.

The decision to include many hands-on skills in this course was informed by a student survey (Hilimire and McLaughlin in press) administered at Fort Lewis College that found a strong demand among students for acquisition of horticultural skills such as composting, gardening and sustainable farming techniques. In that survey, we also found that students sought experience-based learning opportunities, requesting that courses involve work on a farm or ranch. This course used the experience-theory-skill complement to integrate field trips to local farms, lectures and literature and work in the campus garden. One of the greatest strengths of the class was a cross-campus collaboration centered around the campus garden. The course was taught in the late spring (April-May) as an intensive and students tilled and amended the campus garden in preparation for the summer growing season. They also planted seeds and seedlings into the garden and built shade structures and trellises. At the conclusion of the course, two students assumed garden management as "Food Fellows," a program developed by the campus's student-run Environmental Center. The program offered a stipend to students for maintenance of several food-related campus projects. The collaboration with the Food Fellow program during the piloting of this course proved to be very successful; after the course concluded, the Fellows cared for and harvested the crops planted by the class. In addition, the Fellows worked closely with the cafeteria management to create a campus-grown model for using the garden crops as ingredients in the cafeteria.

Summary

The presented Sustainable Food Systems program incorporated multiple scales and perspectives through interdisciplinarity and systems thinking. The curriculum embodied the exposure first model with the first course in the sequence, in which students jumped into place-based case studies to build engagement and critical thinking skills even before analytical tools were mastered. It also included the experience-theory-skill complement at the level of the curriculum and in individual courses via field trips, inductive and deductive case studies, cooperative group learning, literature review, debate and job-specific skills learning. This program was designed to fit in a liberal arts context and emphasized political ecology, geography and agroecology. This Sustainable Food Systems program and others like it can support effective learning among undergraduates to address the complex problems of contemporary food systems.

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From the Field to the Classroom: The Experiences of County Agricultural Agents Delivering Undergraduate Instruction

Brian J. Schilling[1], Stephen Komar[2], Michelle Infante-Casella[3], William J. Bamka[4], Jack Rabin[5] and Daniel Kluchinski[6]
Rutgers, The State University of New Jersey
New Brunswick, NJ

Abstract

A team of county-based Extension faculty co-developed Direct Farm Marketing and Agritourism, a Rutgers University class for undergraduates enrolled in the Agriculture and Food Systems major. The class design emphasized the development of knowledge and skill sets applicable to real world issues using an interdisciplinary, experiential and student-centered learning model. Student assessments indicated that the course was well received as practical and pragmatic, with value placed on the experiential nature of class design (e.g., farm visits, farmer interactions and a capstone project centered on the development of a farm business plan). County-based faculty realized benefits from undergraduate instruction including professional fulfillment, departmental revenue enhancement and honing of materials and methods that can be used with traditional Extension clientele. However, the participation of county-based Extension personnel in undergraduate instruction also presents challenges. Most notable are the diversion of county agents' time from traditional client programming and uncertainty about how formal undergraduate teaching activities will be recognized or rewarded through university promotion and tenure review processes.

Introduction

The 1914 Smith-Lever Act established a national Cooperative Extension system ("Extension") to support the agricultural sector and improve rural life. Extension represents an enduring partnership between the federal government (USDA), state land grant universities and local governments. The mission and functions of Extension evolved over the past century in response to the needs of society, funding and university missions; however, educational outreach remains a core focus. Agricultural outreach traditionally occurs off campus, effectuated by county-based Extension faculty or staff responsible for disseminating research-based knowledge and programming directly to farm and agricultural service provider clientele. In contrast, formal undergraduate instruction within the land grant university setting has traditionally fallen under the purview of campus-based, disciplinarily-defined teaching faculty.

A strong contemporary argument regarding the value of bringing Extension's county-based agricultural agents' expertise to undergraduate instruction in the agricultural sciences can be made in terms of experience, networking and practical knowledge of real world issues. At the same time, formalized undergraduate teaching represents additional job responsibilities for county Extension professionals and invariably creates the need for tradeoffs in time allocation and reprioritization of job duties. It raises questions regarding allocation of financial resources. These realities may result in conflicts with the needs of traditional clientele and have implications for local funding allocations, yet some may argue that such tradeoffs are necessary in light of prevailing trends in the resourcing of Extension. Total funding for Extension

[1]Corresponding Author. Assistant Extension Specialist, Department of Agricultural, Food and Resource Economics. 108 Cook Office Building, 55 Dudley Road, New Brunswick, NJ USA 08901. Tel: 848-932-9127. E-mail: schilling@njaes.rutgers.edu

[2]County Agricultural Agent of Sussex County, Department of Agricultural and Resource Management Agents, Rutgers Cooperative Extension. 1 Spring Street, Newton, NJ USA 07860. Tel: 973-948-3040. E-mail: skomar@njaes.rutgers.edu

[3]County Agricultural Agent of Gloucester County, Department of Agricultural and Resource Management Agents, Rutgers Cooperative Extension. County Government Services Building A, 1200 N. Delsea Drive, Clayton, NJ USA 08312-1095. Tel: 856-307-6450. E-mail: minfante@njaes.rutgers.edu

[4]County Agricultural Agent of Burlington County, Department of Agricultural and Resource Management Agents, Rutgers Cooperative Extension. 2 Academy Drive, Westampton, NJ USA 08060-3826. Tel: 609-265-5050. E-mail: bamka@njaes.rutgers.edu

[5]Associate Director of Farm Programs, New Jersey Agricultural Experiment Station. 327 Martin Hall, Rutgers, The State University of New Jersey, 88 Lipman Drive, New Brunswick, NJ USA 08901-8525. Tel: 848-932-3610. E-mail: rabin@njaes.rutgers.edu

[6]Assistant Director, Rutgers Cooperative Extension and Department Chair, Department of Agricultural and Resource Management Agents. 326 Martin Hall, Rutgers, The State University of New Jersey, 88 Lipman Drive, New Brunswick, NJ USA 08901-8525. Tel: 848-932-3590. E-mail: kluchinski@njaes.rutgers.edu

programming has been declining since the 1980s, with increased reliance on state and county budget support (Wang, 2014a). Consequently, Extension professional staffing on a full-time equivalent (FTE) basis dropped across all ten USDA production regions. Between 1980 and 2010, the total number of Extension FTEs declined nationally by 22%. More specifically, the number of county agricultural agents fell by 30% (Wang, 2014b).

Examining the role of county-based Extension personnel in the classroom makes sense not only from an organizational standpoint, but also from an instruction perspective. Across the nation, there has been recent resurgence in undergraduate student interest in agricultural sciences and the broader food system as a field of study and in agriculture-related career paths (NSF, 2015). Job prospects in agriculture-related fields are also rising (Goecker et al., 2010), raising demand for well-trained students to fill these positions.

Naturally, equipping agricultural science students with the requisite knowledge, skill sets and experience to succeed in agricultural careers is of paramount importance in evolving and expanding agricultural sciences curricula. To paraphrase one New Jersey farmer and father of a college-age son hoping to return to the family farm: *"I can teach him to raise crops, I need you [the agricultural school] to teach him how to run a successful farm business."* Embodied in this imperative is the view that agricultural education must embrace a broader interdisciplinary approach that equips students with not only production know-how, but also the business and management acumen, leadership, communication and other skills needed for success. This is a tall order when considering the new demands our dynamic, globally-influenced food supply chain imposes on today's agriculturalists, shifting consumer food values and preferences, environmental concerns, potential climatic changes and myriad other factors. Further, unique pressures - opportunities and challenges alike - are borne by farmers operating in the expanding number of urban-influenced production areas such as New Jersey (see Berry (1978) for the early framing of these issues). Clark et al. (2013) observe that pursuing solutions to such complicated issues may be viewed as "imposing" or as opportunity to "affect change in how we educate the next generation of college students." The latter spirit is embodied in this paper.

There is lively discourse about the need to continually adapt and align the content and methods of undergraduate instruction in the agricultural sciences with the needs of students, employers and society (APLU, 2009). A 2009 National Research Council report asserts that many of the world's most pressing challenges - from human health, to energy security, to climate change - can be linked to the global agricultural system (NRC, 2009). The report argues*, "academic institutions with programs in agriculture are in a perfect position to foster the next generation of leaders and professionals needed to address these challenges."* The report specifically recommends increasing student opportunities to participate in Extension activities common to land grant universities. Niewolny et al. (2012) advocate a civic engagement model of instruction that effectuates real world, experiential student learning through university-community partnerships affording reciprocal advantages to students and those with whom they interact (e.g., farmers, community food system advocates, agency staff).

This paper offers a pilot case study of a new undergraduate class in the Agriculture and Food Systems major at Rutgers University that challenges the classic delineation of responsibilities between county agricultural agents and traditional teaching faculty. Direct Farm Marketing and Agritourism is an applied course developed and offered in 2013 by a team of county-based and campus-based Extension faculty. We detail the pedagogical motivation underlying course development and structure and discuss student feedback. We conclude with instructor perspectives on the implications of county agricultural agents re-balancing their time between the field and classroom.

Literature Review

The Kellogg Commission of the Future of State and Land Grant Universities (1999) recommended a series of changes to undergraduate education in an effort to make land grant institutions more engaged and better aligned with the changing needs of society. The report advanced numerous recommendations, including providing students with "hands-on" learning opportunities and a refocusing on university engagement, a central value embodied in the passage of the Morrill Act. The report notes that such engagement must extend beyond Extension's historic focus on outreach and recognize opportunities for students to experience and apply learned knowledge to real world issues and community needs. The earlier Boyer Commission (1996) similarly called for a change in pedagogy away from, in the words of Trexler and colleagues (2003), the delivery of "decontextualized knowledge to passive undergraduates" (p. 43). Rather, the report urged an inquiry-based system of learning offering reciprocal opportunities for learning to both student and professor, encouraging a shared "adventure of discovery" (Boyer Commission 1996, p.16).

Barr and Tagg (1995) reported movement away from a conventional instruction paradigm (professors teach and students listen) toward a learning paradigm wherein professors create a context within which students are able to construct knowledge for themselves and develop, discover and problem solve. In practice, a learning-centered format assumes different forms outside of traditional lecturing. These include experiential learning, internships, field trips and team projects, all with the goal of providing student-centric learning environments resulting in more prepared graduates. In some university settings, credit-conferring experiential learning is required for graduation. Agricultural education, by its nature, lends itself to experiential learning with a natural emphasis on applying learned skills to real-life situations (Cheek et al., 1990; Zilbert and Leske, 1989).

Sharing of information between academia and non-academic communities can help demonstrate the important role that academic institutions have in society. The dissemination of new research-based knowledge to society with the implicit goal to improve the lives of recipients is the backbone of the Cooperative Extension system. In fact, the phrase, Putting Knowledge to Work, a heading from the Kellogg report, has been used as a tag line for many Extension initiatives.

The Cooperative Extension system has traditionally consisted of county-based faculty and staff and extension specialists who are typically housed at the university or satellite research stations. The role of a county agricultural agent, for example, has historically been to provide research-based information generated by the Land Grant University system at the local or county level. While this County Delivery System, as it is known, has been successful in providing technical information to traditional Extension clientele (e.g., farmers, landowners and residential clientele), the model generally involves little interaction between the student population and county-based faculty or other community members. This disconnect often limits students' learning to theoretical applications with little exposure to "real world" applications and problem solving development that is a critical component of experiential learning.

In recent years, Extension personnel have been hired with appointments incorporating teaching and research functions, or tasked with additional responsibilities including undergraduate teaching. These changes are partially due to budgetary constraints (Acker, 2001; Loveridge, 2003; McDowell, 2001) and have resulted in a more blurred view of job functions and expectations. These blended appointments may pose certain challenges, including: difficulty balancing effort (Brittingham, 1999), the potential lack of focus on Extension program development (Loveridge, 2003), as well as a lack of understanding from faculty members without an Extension appointment when evaluating candidates for promotion and tenure. On the other hand, they also provide potential benefits, including the opportunity to test Extension programs in the classroom (Loveridge, 2003), the potential to bring practical experiences to the classroom by blending coursework with community engagement (Haines, 2002) and to incorporate real world problems often associated with Extension research into graduate education (Jones and Finley, 1997).

Methods

Pedagogical Approach to Course

The Agriculture and Food Systems (AFS) major, offered at Rutgers University's School of Environmental and Biological Sciences (SEBS), was launched in 2008 as a restructuring of a long-standing agricultural sciences curriculum. The curriculum is targeted to students interested in an "entrepreneurial and innovative" educational experience conducive to careers in production agriculture, agribusiness, Extension, agricultural education and related organizations. Rather than adopting a prescriptive format, the curriculum is adaptive to the needs and interests of students, allowing a high degree of coursework flexibility or specialization. A student may, for example, tailor a course of study to emphasize controlled-environment agriculture or agricultural policy.

Direct Farm Marketing and Agritourism was designed as a 300-level course within the AFS major by a team of five Extension faculty. The team comprised four county agricultural agents with expertise in crop production, crop physiology, weed science and agricultural management and a Specialist in agricultural economics and policy. With the exception of the Extension Specialist, who held a twenty percent teaching responsibility, the team consisted of faculty with one-hundred percent Extension appointments. The team has more than 100 years of collective Extension-related experience; 4 of the 5 instructors have direct experience in farming and/or providing commercial agricultural services. The interdisciplinary, collaborative and applied instructional approach was viewed as a unique strength of the course during the SEBS curriculum review and approval process.

The class premise was simple. Cooperative Extension agricultural agents and specialists have delivered training and educational resources to farmers, agricultural service providers, government officials and the general public for a century. Much of the same information taught in the field is applicable to undergraduate agricultural sciences students in search of technical, current, real-world knowledge on agricultural topics that will help them find success within a dynamic industry.

Course Design

The 14-week class was first offered in the Fall 2013 semester with an enrollment of 17 students. The course emphasized and encouraged experiential and self-directed learning opportunities through a combination of interactive lectures, farm visits, in-class activities, directed independent research and a capstone project. The class learning objectives were to provide students with the knowledge and skills needed to:

- develop and manage profitable agricultural enterprises in urbanizing areas where farming opportunities often involve direct sales to retail customers;
- analyze the costs and benefits of alternative direct marketing and agritourism enterprise opportunities; and,
- identify and mitigate the regulatory, policy, liability and other risk factors affecting direct marketing and agritourism operations.

The teaching modules were derived from a needs assessment of farmers in the Northeast U.S. region, conducted by the lead author as part of a USDA-Northeast Sustainable Agriculture Research and Education grant (award ENE11-121) supporting agritourism development and risk management. Topics were refined based on

the instruction team's professional and programming experiences in agricultural marketing, policy, production, farm safety and other aspects of agritourism and direct marketing. Course content was organized as follows:

- An introduction to agritourism and direct marketing- what it is, its growth and increasing incorporation into U.S. farm enterprises;
- Tools for assessing the suitability of agritourism from the perspective of a farm operator, farm resource availability and location;
- Marketing basics for direct marketing and agritourism;
- How to assess and manage external business risks (legal and regulatory issues, neighbor nuisance complaints);
- How to assess and manage internal business risks (farm safety, labor, hazard mitigation, legal liability);
- Financial analysis and partial enterprise budgeting; and,
- Hospitality and customer relations.

Student performance assessments were based on two written farm evaluations (20%), five independent research assignments (30%), a final capstone project (40%) and class participation (10%). Two farm visits provided students with opportunities to interact with farmers who have incorporated direct marketing and agritourism into their operations. Both farm visits were coordinated by a county agricultural agent familiar with the farms and the regional pressures influencing the marketing adaptations of the farms over recent decades. Students spent roughly one and a half hours with each farm's primary operators to tour the operation and learn about its history and evolution. Specific focus was placed on exposing students to the factors that encouraged farm diversification and related marketing changes and deepening their understanding of the benefits and challenges associated with inviting visitors to the farm. Each farm visit culminated with a student SWOT (strengths, weaknesses, opportunities, threats) analysis of the farm. During the following class, each student submitted and discussed a written farm evaluation and recommendations for operational improvement and risk mitigation. The instructors synthesized these assignments into reports provided to participating farm operators.

The independent research assignments and capstone project embraced the student-centered learning model, allowing students to explore, at differing levels, class content stimulating their interests. Each student prepared five business memos (i.e., simulating correspondence to a business owner, manager, financial lender, etc.) summarizing their research on a topic introduced in class (topics included agricultural policy, marketing, farm safety, types of agritourism and direct marketing offerings). One assignment was a "free-choice," allowing students to select a food or agriculture-related topic of their choosing. These memos challenged students to synthesize and present information in a concise, professional and impactful manner.

Each independent research exercise, teaching module and farm visit was designed to aid students with the preparation of a comprehensive agritourism or direct marketing business development plan. This exercise allowed students to explore and develop aspects of their plans in varying depths. For the capstone project, students individually prepared a written farm business and management plan based on farm scenarios (including farm size, financial position, family goals, geographic context, available resources, etc.) assigned early in the semester. Scenarios reflected alternative farm business challenges encountered by the Extension team (e.g., an adult child's inheritance of a family farm; establishment of a new, small-scale farm catering to a local niche market opportunity; a commercial farm preparing for the integration of a second generation into the business).

Each farm business plan outlined an agritourism/direct marketing business concept and contained a farm sketch (Figure 1), resource and staffing requirements, pro forma budget and cash flow projections, marketing strategies and farm safety risk and liability management practices. In addition to the submission of a written business plan, students verbally presented a 20-minute summary of their concepts to the instruction team and class in emulation of a "pitch" to a financial lender. A question and answer session moderated by the instructors followed each presentation.

Figure 1. A student's drawing of their project farm. Students were asked to explain their farm layout, identify risks to direct marketing/agritourism visitors and to explain their farm's 3 year budget plan. Image courtesy of Josef Corso.

Results and Discussion

Student Assessment and Feedback

A standard course evaluation was administered during the final day of class. Course evaluations validated the educational and experiential value of bringing county Extension professionals into the undergraduate classroom. Formal assessments of the curriculum and instructor effectiveness were positive. For example:

- Students (n=10) rated the "overall quality of the course" as 4.7/5.0 and the "teaching effectiveness of the instructor[s]" as 4.9/5.0 (scale: 1=poor to 5 = excellent);
- Each student was asked to agree or disagree with the statement "I learned a great deal in this course", resulting in a rating of 4.6/5.0 (scale: 1 = strongly disagree to 5 = strongly agree);
- Students tended to strongly agree that the "instructional methods encouraged student learning", 4.8/5.0 (scale: 1 = strongly disagree to 5 = strongly agree); and,
- Students also agreed that the "Instructor[s] generated interest in the course material", 4.8/5.0 (scale: 1 = strongly disagree to 5 = strongly agree).

A recurring theme in the open-ended student assessments was the value students placed on the "practical" nature of course content and an instructional delivery that brought multiple "real world" perspectives into the classroom. One student remarked that "[t]he practicality, real life experiences, practice "crunching numbers", touring successful farms and providing examples on how to achieve goals made this an *all-around great class."* Others noted:

- *"The expertise that each professor brought to the class made it very interesting."*
- *"I learned a great deal of information and the hands on approach to teaching was the best I have ever seen."*
- *"The professors all had a very engaging style, pragmatic approach to teaching and materials presented were extremely applicable to the course."*
- *"The final project for the class made students think about all aspects of a business and opened their eyes to what it would take to run a direct marketing or agritourism business from start to finish."*

Similar student responses to experiential learning methodologies have been reported by other educators. Curtis and Mahon (2010) find that agribusiness students reported higher valued learning experiences following in-person interactions with business professionals (in comparison to students who conducted Internet-based research or had only telephone interactions with business operators). Barlow (2012) affirms the value of service learning opportunities in forestry programming as a form of experiential-based instruction, finding that 97% of forestry and wildlife students completing a field-based service-learning project rated the usefulness of the experience more highly than other learning experiences.

Lessons Learned: A Critical Evaluation of County Agricultural Agents' Role in Undergraduate Instruction

The formative stages of class development were driven by a belief that many essential qualities of successful Extension programs are transferable to undergraduate instruction. Several core ideals motivated the structure and delivery of the course, including:

- Adopting a collaborative, interdisciplinary, team approach to instruction;
- Instilling in students' practical knowledge and skills applicable to real world issues;
- Providing opportunities for experiential and student-centered learning;
- Engagement and networking within the farming industry; and,
- Ensuring benefits to farmers and non-university partners that contribute to the class.

These ideals are central to recent proposals for transforming undergraduate education, particularly within agricultural curricula (Fields et al., 2003).

The instruction team held a class debriefing session at the conclusion of the 2013 semester. The consensus view among the instructors was that the process of organizing and delivering undergraduate instruction benefitted their Extension programs by keeping them abreast of the latest trends in educational delivery, methods and technologies. The process of synthesizing course materials, preparing lectures and responding to student inquiries resulted in both a broadening and deepening of content knowledge among instructors that will aid county-based program delivery. Participating county faculty also reported increased professional satisfaction from sharing their collective knowledge in an undergraduate curriculum setting and an increased sense of connection to the university system. An ancillary benefit identified by the instructors was the development of relationships with the students who may become industry leaders or potential clientele of/advocates for Extension educational programming (see Franz, 2011 for more on the "public value movement" aimed at promoting awareness of Extension).

Course Delivery-Related Challenges

While the overall class experience was positive, a number of issues requiring attention were identified by the instructors in order to maximize the learning experience for future students. The most significant challenge encountered by the team is the need to prepare course content and delivery in a manner that is appropriate for the intended audience. Undergraduate education differs significantly from traditional Extension program delivery which is typically geared toward changing participants' behavior through practice demonstrations and issue-

specific programming. For example, Extension agents rarely implement formal assessment or grading. Pre- and post-surveys are often used to gauge the effects of educational outreach, but formal "student" performance assessments or grading are uncommon. In sharp contrast, academic instruction requires communication of clear performance expectations, grading criteria and a transparent grade assignment process.

Retrospectively, the instruction team still embraces the student-centered learning opportunities as a pragmatic strategy for allowing students to explore specific interests; however, not all students excel under this approach. Observations drawn from the 2013 semester suggest that students exercise varying levels of initiative and respond differently to alternative learning methods. Some students required more structure and accountability to ensure that learning objectives were met. One notable lesson learned is the need to incorporate more grading opportunities (quizzes, exams) that encourage students to remain engaged and current with their work and to assess students' grasp of core materials and principles in real time. This preference was also expressed by students.

Despite two scheduled student-instructor meetings to discuss progress toward the completion of the capstone project (farm plan), allocating 40% of the final course grade to the project led to too much student uncertainty about course performance. This uncertainty may be attributed to students' unfamiliarity with experiential learning or student-centered learning methods (and, in this instance, a lack of historical course context - i.e., not having past students' feedback on coursework and grading). To mitigate these challenges, the instructors have implemented several changes to the course grading structure in the Fall 2015 semester. Changes include: (1) reducing the grade weights of the capstone project and independent research assignments (from 40% and 30%, respectively, to 30% and 10%), (2) requiring the submission of three discrete farm plan elements, or "milestone assignments," to ensure that students make steady progress throughout the semester and receive instructor feedback (15% of a student's final course grade) and (3) adding three quizzes based on lectures and course readings (15% contribution to final grade).

While many county agricultural agents--and other county-based Extension professionals--are excellent educators, making an effective transition to a formal classroom environment may require training to familiarize them with campus-based instructional resources, technologies and procedures. Our experience highlighted limited familiarity with formal academic course development (e.g., syllabus creation, grading protocols, refinement of learning objectives, etc.) and the approval processes required to establish the class as a component of the AFS curriculum. Establishing access to and working knowledge of university teaching tools (e.g., online class management software and roster/grade submission portals) and student assistance resources (e.g., student disability services, psychological and mental health counseling) also proved to be an unanticipated early barrier to overcome for the off-campus members of the instructional team.

A logistical challenge encountered during the semester was that instructors are not co-located. This impeded regular weekly interaction between the full instruction team and students and reduced the efficiency of class delivery (e.g., coordination of instructional content, grading). For a true synergistic team impact on students, it is important that instructors attend classes delivered by their colleagues; however, this further increases the time spent away from county duties. This avoids instruction pitfalls, including either discontinuity or overlap in course content and inconsistencies across instructors in terms of grading. It also builds trust and mutual respect among students and instructors necessary for effective course delivery.

A related concern raised among the team is the likelihood that changes in faculty availability may affect the consistency and continuity of course content over future semesters. For example, annual variability in workload, changes in job responsibilities (e.g., initiation of extramurally funded projects), promotion and tenure considerations and relocation within the state could change the personnel involved in the course. However, changes in participating faculty can also improve course delivery and enhance student learning by incorporating new content or instructor expertise.

Instructor-Related Challenges

The instructional team also recognized several instructor-related issues arising from county agricultural agents' involvement in formal undergraduate instruction. Most fundamentally, teaching campus-based classes diverts agents' time away from their primary county-based responsibilities. Exacerbating this challenge is the fact that some agents are assuming an increasingly regionalized set of responsibilities because of declines in Extension staffing. The course was organized as a weekly double period (rather than two 80-minute periods) to reduce time commitments away from county responsibilities. Nevertheless, agents spent a substantial amount of time on campus to prepare and deliver the course. Commuting from county offices to campus consumed additional time. Distance learning or potentially a hybrid course could reduce travel time and potentially increase the efficiency of instructional delivery for county-based faculty, but these benefits need to be balanced against the loss of "face time" with students and the costs of necessary technology and equipment.

All four county agents have committed to again teaching the course in 2015 and their continued involvement in the class is encouraged by administration as a means to diversify support for Extension programming and enrich student instruction. Participating in the 2013 class, however, increased the burden on county agents to carefully schedule and budget their time so that they can continue to meet the needs of their county clientele and the expectations of county administrators who

appropriate funding to Extension. Historically, Rutgers University's county agricultural agents have been hired exclusively on 100% Extension lines. In 2015, for example, 31 of Rutgers Cooperative Extension's 32 county agricultural agents were funded exclusively by Extension and Experiment Station dollars; one had a nominal amount of salary offset by teaching dollars. On average, 25-50% of funding for agricultural agents comes from county government and the balance derives from state and federal sources appropriated by the university. Continued engagement in teaching may necessitate reconsideration of county agricultural agents' line splits and hence funding streams. As a related financial matter, policies and funding sources (e.g., tuition dollars) need to be established to reimburse course-related expenses (e.g., mileage and incidental expenses such as the reproduction of materials) incurred by off-campus faculty.

Lastly, Rutgers county agricultural agents are tenure-track faculty. Fulfilling county Extension duties ("Extension Practice") is the primary evaluation criterion for agricultural agents undergoing review for tenure and promotion by the university. This includes the use of effective methods to share research-based information with clientele that leads to knowledge gain and change in behavior, as well as applied and evaluative research, grantmanship and impact on the profession. A principal concern among instructors was how--or even if--providing leadership in undergraduate instruction will be considered in promotion evaluations or rewarded in merit-based salary increases. In contrast to the team's Extension Specialist, who is formally evaluated in part by teaching effectiveness, considering participation in undergraduate instruction would be a paradigmatic shift in the review of county agricultural agents at Rutgers University.

Summary

Extension's 2014 Centennial warranted reflection on the organization's rich history and a future defined by declining resources and increasing client demands. Extension's future is intertwined with calls for transformative thinking to align agricultural education at land grant universities with the realities and needs of modern agricultural systems. Civic engagement, experiential learning and development of practical knowledge and skills sets to address real world issues are inherent elements of Extension programs and important parts of narratives calling for reforms to undergraduate agricultural education.

A multidisciplinary team of county- and campus-based Rutgers Cooperative Extension faculty developed a Direct Farm Marketing and Agritourism class within the university's Agriculture and Food Systems major. Course design embodied a practical, student-centered, experiential learning paradigm. Student feedback was overwhelmingly positive, highlighting a high value placed on "real world", "practical", "pragmatic" educational lessons and farm-based learning opportunities.

Undergraduate teaching by county-based Extension faculty may help bring needed revenue to Extension, particularly under a responsibility centered management budgetary model. It also can facilitate the development of curricula, training materials and methods that may be used with traditional Extension clientele. However, the participation of Extension personnel in undergraduate instruction presents potential challenges. Most intuitive is the additional strain on personnel time and diversion of county agents' time from traditional client programming. The time burdens of off-campus Extension personnel can be partially reduced through university investments in distance learning technology and other infrastructure needed to overcome time and geographic barriers that make it difficult or inefficient for county agents to teach or interact with campus-based undergraduates. A second important issue relates to an expansion of Extension personnel responsibilities beyond contractual obligations. For some county agents, undergraduate instruction may be tantamount to a form of professional "mission drift" that is not recognized or rewarded through university tenure and promotional reviews. If deeper engagement of Extension agents in formal classroom teaching is desired, universities may need to evaluate faculty line splits that define these expanded responsibilities.

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Evaluation of the Effects of Online Case Studies in an Equine Nutrition Course on Student Performance, Procrastination and Satisfaction[1]

N. Gilbert[2], J. Burns[3], G.D. Djira[4], K. Koch[5] and R.C. Bott[6]
South Dakota State University
Brookings, SD

Abstract

An on-line discussion board was used to foster interactive learning communities with discussion-based approach to solving case studies (CS) in an undergraduate equine nutrition course. Students (n=48 in 2011 and n=40 in 2013) were required to post pertinent discussion three or more times and then demonstrate comprehension of the case study topic through a group presentation in class. In 2011, students were given one week to complete the first two CS. In an attempt to curb procrastination, a split deadline approach was used in the third and final CS in 2011 and in both CS in 2013 where students were required to complete half of the CS posts within the first week of a two-week deadline. Student performance on CS was positively correlated with performance on homework ($P < 0.001$), quizzes ($P = 0.0001$) and examinations ($P = 0.0097$). Further, the incidence of early posts increased from 37.89% to 52.12% when moving from a single to a split deadline ($P = 0.0375$). Upon completion of these CS, students reported that information covered by CS was applicable to the real world and is essential for horse owners ($P < 0.0001$). Enhanced active learning was evident based on correlations of CS scores with other course assessments and favorable responses from students.

Introduction

Technology is advancing rapidly, infiltrating almost every aspect of our lives, especially education. There continues to be a rise in the number and popularity of college courses offered online across the country with 32% of United States' students are taking at least one online course (Allen and Seaman, 2013). This evolution of educational technology can also be seen in the increasing amount of online interaction in viewed in traditional lecture-based courses (Allen and Seaman, 2013). Universities are encouraging and often requiring professors to integrate technology in their teaching with the goal of enhancing learning and promoting student engagement within and outside of the classroom. Educational technology may allow more students to participate as classwork can be done on students' schedules (Xu and Jaggars, 2014), which may ultimately provide flexibility and opportunities for the student.

Contested Views on Technology in Education

The introduction of technology allows students to interact with course material by allowing them to expand topic searches, further discussion opportunities with both professors and peers and create an interactive atmosphere (Barnes et al., 1999). Students now can obtain additional information, complete online assignments and interact in expanded discussion with professors and peers with regards to the course. Educational technology might help students better engage in their courses with the anticipated outcome being better performance, reflected by grades and material comprehension.

The integration of technology in coursework offers the possibility of expanded group collaboration. Since most students have access to computer resources on and off campus, they can easily engage with their group members through online discussion areas (Xu and Jaggars, 2014). Some research indicates that students perform better in small group settings (Springer et al., 1999) educational technology may afford increased

[1]Acknowledgements: The authors thank Carrie Cox and Brittany Richardson for their dedication as teaching assistants in the AS 220 course in 2011 and 2013.
[2]Department of Teaching, Learning and Leadership; (817) 706-9436; Natalie.gilbert@jacks.sdstate.edu
[3]Department of Teaching, Learning and Leadership; (605) 688-4546; James.Burns@sdstate.edu
[4]Department of Mathematics and Statistics; (605) 688-5854; Gemechis.Djira@sdstate.edu
[5]Department of Animal Science; (605) 660-7223; kkoch703@gmail.com
[6]Corresponding author, Department of Animal Science; (605) 688-5412; Rebecca.Bott@sdstate.edu

student engagement with their groups beyond traditional face-to-face meetings, thus making group work more accessible.

Despite the push for an increase of online classes, they may not be suitable for every student. The expansion of educational technology in the classroom may actually contribute to student procrastination (Bork and Rucks-Ahidiana, 2013). Some research suggests that online assignments can increase procrastination as assignments can slip into the "out of sight out of mind" paradigm (Elvers et al., 2003; Allen and Seaman, 2013). This dilatory behavior might be attributed to the lack of assignment due date reminders and/or further explanation or discussion of assignments by the professor (Bork and Rucks-Ahidiana, 2013). The findings of Bork and Rucks-Ahidiana (2013) paradoxically suggest that procrastination may be due to the use of educational technology, particularly course management systems (CMS), that in fact propose to facilitate better communication and collaboration between instructors and students. The integration of technology in coursework, therefore, requires students to assume greater responsibility for and ownership of their work, especially through discussion-based assignments. While faculty should provide frameworks and expectations for online engagement, student engagement and self-direction are paramount.

In addition to the findings of Bork and Rucks-Ahidiana (2013) that technology may contribute to students' procrastination, the rapid introduction of technology at all levels of education is far from uncontroversial. Curriculum theorist William Pinar (2011, 2012), for example, sees a "hidden curriculum" in the use educational technology, which he argues has reconfigured education institutions into "cram schools, where so-called skills replace academic knowledge, decontextualized puzzles preparing for employment in jobs without meaning" (2011, p.11). Pinar's (2011, 2012) analysis elicits the question: to what are students really attending as teaching and learning become increasingly technologically mediated? This concern lies in the focus on skills associated with the technology itself and by extension the purpose(s) that truly underlie the integration of technology into education. Are students, for example, being trained through "educational" technology in the skills deemed of most value for workforce development rather than on their subjective positions and desires in education?

Bowers (2000) writes that the addiction to computers in education has helped accelerate the commodification, inherent in capitalism, of knowledge, teaching, learning, teachers and students and has reconfigured wisdom and knowledge as decontextualized information. Giroux (2012) critiques technology as complicit in reframing pedagogy as "narrowly defined skills and practices" that position teachers as a "subaltern class" and the purpose of education as the training of students purely to facilitate the global economic competitiveness of the U.S. (p.76). Finally, Lasch (1979) implicates the proliferation of technology in the emergence of a disconnected society characterized by anomie, hyper-individualism, narcissism and immersion purely in the present with little if any engagement with historical context. Pinar (2012), channeling Lasch (1979), concludes that those with a financial interest in addicting education institutions to technology claim that technology is a "boon to schooling, not a threat". But as curriculum theory appreciates, constructing academic knowledge as "information" erases remembrance as it converts contemplation into test-controlled attention (p.143).

Case Studies and Best Practices in Blended Education

Of relevance to this study, a large-scale meta-analysis conducted by the U.S. Department of Education (2010) found that:

- Effect sizes indicated greater benefit in which online instruction was collaborative or instructor-led than instruction in which students worked independently.
- Effect sizes were larger in cases where online and face-to-face conditions varied in terms of curriculum materials, instructional approach and instructional medium.
- Support mechanisms for groups, such as guiding questions, generally influence the way students interact, but not the amount they learn.

The meta-analysis (U.S. Department of Education, 2010) further concluded that the studies included did not demonstrate the superiority of online instruction as a medium. Rather, studies suggesting advantages associated with blended learning indicate that such advantages may be attributable to a combination of online and classroom conditions that differed in time spent in learning, curriculum and pedagogy. Finally, the report cautions against inferring causality in the context of reported effect sizes because of the dearth of large-scale randomized controlled studies available. Still, research has identified certain practices that should inform blended course design.

The importance of course planning and design is crucial to all teaching, including online and blended formats. For example, Fill (2010) notes the importance of the development of meaningful learning activities, which consist of three elements: a) establishing the learning context; b) learning and teaching approaches; and c) the specific learning tasks, which include pedagogical techniques, resources, learner and teacher roles and assessments. Likewise, McGee and Reis (2012) conclude that blended learning environments require a well-aligned instructional design; formal and informal course interactions; process-driven, product-oriented and project-based instructional approaches; use of technology directly related to established learning outcomes; a variety of assessment strategies; and clear communication. Particularly important to this study, Vaughn (2007) concludes that the element of communication is particularly important in online and blended formats because his findings indicate that although students perceive

greater time flexibility in hybrid courses, they initially experience difficulties related to time management and assuming greater responsibility for their learning.

Further salient to this study, research indicates that the use of peer learning (Boud, 2001) such as simulations and case studies can be effective in establishing the type of blended learning environment suggested by McGee and Reis (2012). Peer learning should be "mutually beneficial and involve the sharing of knowledge, ideas and experience between the participants," which moves "beyond independent to interdependent or mutual learning (Boud, 2001, p.3). Research in disciplines such as medicine (McGaghie et al., 2010; Wayne et al., 2008), Nursing (Cant and Cooper, 2009) and higher education (Boud, 2001; Tribe, 1994) indicates that peer learning deepens understanding and positively impacts learning outcomes through shared experience. Specific benefits include additional gains in knowledge, critical thinking ability, satisfaction and confidence (Cant and Cooper, 2009) as well as active engagement with learning processes and concepts (Boud, 2001; Tribe,1994).

This study was conducted over a two-year period in an undergraduate equine nutrition course. Study objectives were three-fold. The first objective was to determine if performance on online case studies (CS) was correlated with performance on clicker-quizzes, homework assignments and examinations. The second objective was to evaluate if a split deadline, where students were required to complete half of the CS posts within the first week of a two-week deadline, for case studies would reduce the amount of procrastination. The final objective was to gage class satisfaction and overall performance in relation to the case study assignments. We hypothesized that performance on case studies would translate into higher exam, quiz and homework grades. We also hypothesized that the split deadline would result in a higher frequency of early posts and that students would recognize the real-world application of CS material.

Procrastination Defined

For the purposes of this study, we use the psychological definition of procrastination (Kotler, 2009; Steel, 2007) as a gap between intention and action in which procrastinators delay performing an important task in favor of performing a less important, yet apparently more rewarding task. Procrastination actually represents a complex set of behaviors, as Steel (2007) found in a meta-analysis of over 550 studies related to procrastination. Rather than finding the propensity to procrastinate in any one source, Steel (2007) concludes that procrastination emerges from the interaction of four variables:

- A person's expectancy of success at a task;
- The perceived value of a task;
- A person's need for and sensitivity to the delay of immediate gratification; and
- A person's impulsiveness.

According to Vancouver (as cited in Kotler, 2009), Steel's (2007) findings provide significant insight into how the interrelated variables of time, expectancy of task success, task value and distractibility, relate with how deadlines impact the desire to achieve certain goals and complete certain tasks. Steel's (2007) findings are salient to this research because the factors he discerned from his meta-analysis could help educators and students understand procrastination and lead to interventions that might result in better student outcomes. This is particularly important in the context of the proliferation of technology, online and blended instruction in which students increasingly study, both individually and in groups, outside of a traditional classroom setting.

Methods

Course Background

Data were collected in 2011 (n = 48 students) and 2013 (n = 40 students) during an equine nutrition course designed for second or third year students as a required part of the curriculum for equine minors, yet open to all students. In addition to content-related course objectives, a further objective of the course was to use technology to enhance active learning in an undergraduate equine nutrition course. Specifically, technology was used to enhance the formative stages of learning through the creation of online discussion boards to foster interactive learning communities with a discussion-based approach to solving case studies and through the incorporation of student response system (SRS) clicker-quizzes with instant feedback.

Student Assessments

Equine Nutrition (AS 220) at South Dakota State University is composed of four major grading components: homework, quizzes, examinations and case studies. Homework assignments are designed to provide students with opportunities to evaluate diets or feed analyses and practice course material. Student response system (SRS) clicker quizzes assess student understanding of course materials such a readings and lecture notes. Examinations are comprised of a variety of selected response items, such as multiple choice and true/false questions, with a heavier emphasis on constructed response assessment items such as fill-in-the-blank, short answer and essay items. The goal of examinations was the assessment of student understanding of course curricular aims, which includes the ability to apply course material in addressing real-world scenarios. Case studies were designed to assess students through providing authentic opportunities to demonstrate their understanding of knowledge and concepts gained from coursework through application of course content to real-world scenarios. The case study component is completed online through South Dakota State's CMS Desire2Learn (D2L). The D2L portal is designed to promote online engagement and provides several benefits for managing the course. The discussion area allows students to correspond in

the privacy of their own groups, communicate with the instructor and share materials needed to complete the case study. The system allows the instructor to view what students wrote and to whom and what time they posted. The time indicator assists the instructor in deciphering which posts are or are not submitted by the prescribed deadline. D2L also allows the professor to see every individual's contribution to the project to ensure fair grading and to promote honesty in the classroom.

Case studies

Students were randomly assigned to groups of four or five students to complete the case studies. The groups were required to communicate and solve real world industry-applicable problems, or case studies, through the discussion area on D2L. Each case study posed a critical thinking problem that required the students to analyze limited information about a specific horse or feedstuff in order to find a solution. Case study topics included equine nutritional diseases, dental health, nutritional requirements and toxic plants. The students were required to utilize lecture material, class readings and additional resources to solve the assigned case study within two weeks. Grading was composed of two components: individual participation and group discussion and solution. Individual participation encompasses timeliness of posts, contribution to discussion and meeting minimum posting requirements. Group grading is based on correctly solving the problem and an in-class presentation.

Data were collected over two AS 220 sections: Fall 2011 and Fall 2013. The 2011 class was required to complete three case studies, two worth 10 points and one worth 30 points. The 2013 class was required to complete two case studies worth 30 points each. Deadlines for the two sections also differed. The first two case studies from 2011, worth 10 points each, had one deadline at the end of week two; one 30-point case study had a first deadline at the end of week one and another at the end of week two. Each of the two 30-point case studies in the 2013 class had two deadlines; the first deadline was at the end of week one and the second at the end of week two. The students were incentivized to complete at least half of the required 2-3 posts by the first deadline through placing a point value on doing so. In order to evaluate the effect of a split deadline on student procrastination, "early" posting was considered to be the first 120 hours or five days of the prescribed week, whereas "late" posting was considered to be the last 48 hours prior to the deadline. Both "early" and "late" posts were submitted on time. These terms are used here and throughout as temporal tendencies within the allotted assignment time; "later" posts reflecting a procrastination type behavior of completing work right before the deadline. Data were gathered through D2L for both 2011 and 2013.

Student Surveys

South Dakota State University Human Subjects Committee IRB approval was obtained (IRB-1402018-EXM) for the student survey. Construction of the survey questions focused on two themes related to the research questions: a) students' perspectives on the group work aspect of the course case studies; and b) students' perspectives on how well they perceived the case studies impacted their understanding of course material. Students responded to 20 questions based on a 1-10 Likert-type Scale in which "1" represented "no" or "disagree" and "10" represented "yes" or "strongly agree." In constructing the survey questions, the authors carefully considered instrumentation bias including the use of unstated criteria; inapplicable questions; use of examples in questions; overgeneralizations; over-demanding recall; over-specificity; the use of overemphasis; ambiguity; double-barreled questions; and leading and loaded questions (see Alreck and Settle, 2004, pp. 95-101). We further focused on the survey's content validity, which is indicated, "if the items in the tool sample the complete range of the attribute under study" (DeVon et al., 2007, p.157). Due to the small scale of the project, colleagues knowledgeable in survey design and the phenomenon under study reviewed the survey in the context of the research questions and provided feedback in order to ensure content validity associated with the constructs of group collaboration and learning through case studies.

At the end of each course, in addition to the university's standardized course evaluation, we administered our survey to each student to gather feedback on their enjoyment in completing the case studies, student reported effort on class activities, how students perceived the case studies prepared students for exams, their perceived relevance of case study information and their perceptions of the group aspect of completing the case studies. These survey responses were not factored into the final grade. Students' responses were recorded for each question in order to calculate correlation coefficients between survey responses.

Statistical Analysis

All statistical analyses were performed in SAS 9.3 (SAS Institute, Cary NC). Pearson correlation coefficients were used to determine case study associations in other assessment components. Multiple contrast tests comparing single versus split deadlines for 2011 and 2013 were performed using the contrast option in PROC GLM. Survey data association outcomes were determined by the use of correlation coefficients and x^2 tests.

Results and Discussion

The grade analysis from 2011 and 2013 combined data revealed that there were correlations between case studies and examinations ($P = 0.0097$), quizzes ($P = 0.0001$) and homework grades ($P < 0.0001$). However, the strongest correlation was between case study grades and homework grades. Table 1 illustrates the correlation matrix of grades for combined 2011 and 2013 sections

and average performance on CS, homework, quizzes and examinations are represented in Figure 1. These correlations provide evidence that the critical thinking based case studies are indicative of overall class performance. Presentation and assessment of content was provided through multiple modalities in the present study. Student performance on each method of assessment was correlated; thus, content repetition can be beneficial to the overall performance of students. These educational outcomes suggest that the course design comports with Fill's (2010) description of meaningful learning activities consisting of learning context, instructional approaches and well-defined learning tasks. The results further suggest a well-aligned instructional design as defined by McGee and Reis (2012). Finally, the results appear to support Boud's (2001) findings indicating the mutual benefits derived from well-structured peer learning, specifically the movement from independent to interdependent learning.

Table 1. Pearson correlation coefficients of student performance[1]

	CS		Exam		Quiz		HW	
	r	*P*-Value	r	*P*-Value	r	*P*-Value	r	*P*-Value
CS	-	-	0.2726	0.0010	0.3974	0.0001	0.6408	<0.001
Exam			-	-	0.3993	0.0001	0.5086	<0.001
Quiz					-	-	0.5940	<0.001
HW							-	-

Figure 1: Students performance is depicted as average grades (%) for students on case studies (CS), examinations (EXAM), quizzes (QUIZ) and homework assignments (HW).

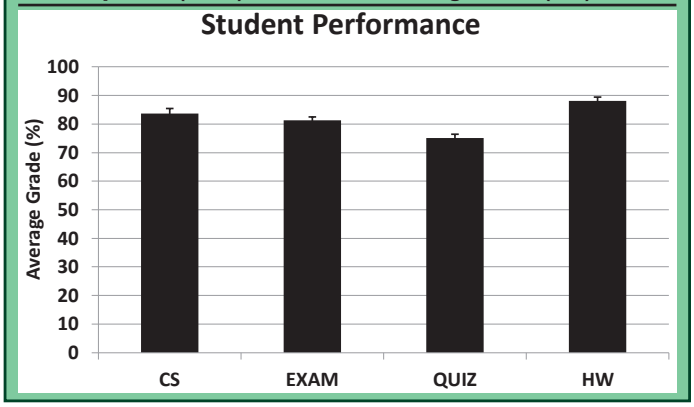
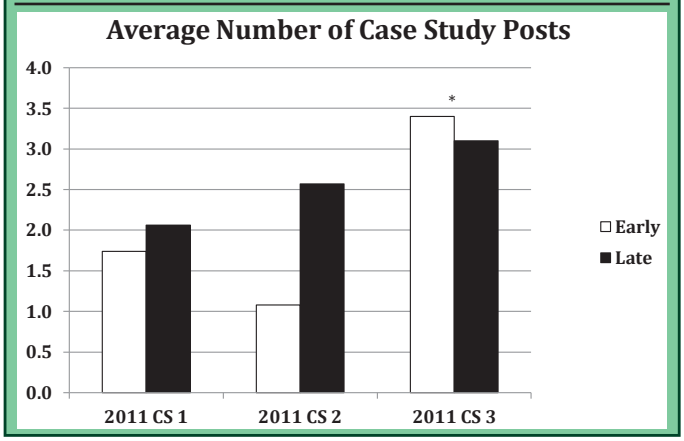


Figure 2: The average number of early and late posts for CS1, 2, and 3 in 2011are represented. *The proportion of early posts as a percent of overall posts was greater in the split deadline approach in CS3 compared to CS 1 and 2, P < 0.0001.



Students completed their assigned posting in a timelier manner when a split deadline was used (Table 2). Figure 2 shows the difference between the single deadline and split deadline approach for the case studies in 2011. The incidence of early posts increased from 37.89% of total posts in a single deadline requirement to 52.12% of total posts in the split deadline assignment ($P < 0.0375$). Of particular interest, the average number of posts per student in 2011 increased significantly from 3.7 to 6.5 ($P < 0.0001$) when the assignment transitioned from a single deadline to a double deadline format. The required posts remained the same for the deadlines however the split deadline CS was worth triple the points. The trend of early posting continued to an even greater extent in 2013 with the frequency of early posts in the 2013 CS being greater than in the final CS of 2011 ($P < 0.0493$; Figure 3). The split deadline format and the increase in number of points potentially both contributed to the increased in student effort on activities as indicated by early responses and overall number of responses. By requiring students to complete half of their assignment before the final deadline and by increasing point value, the assignment did not fall into the "out of sight, out of mind" paradox. This seems to be especially critical due to the fact this assignment could become as such, as it is completed not in the classroom but online.

Consistent with Steel's (2007) four variables in his construct of procrastination, the implementation of the split deadline and the point valuation may have increased the students' perceived value of the task. Such incentives may be serve as a type of intervention through which to increase timely participation in tasks, specifically in a blended instructional format. Further, Vaughn's (2007) findings about the importance of communication and well-aligned instructional design (McGee and Reis,

Table 2: Frequency of early posts in single and split deadline case studies.

	Case Study							
	2011			2013		Contrast[a]		
	1	2	3	1	2	I	II	III
Early	46%	30%	52%	61%	68%	0.0493	0.0132	0.1295

[a]P-values reported are of Contrast I (CS1 and CS2 vs CS3 of 2011), Contrast II (CS3 of 2011 vs CS1 and CS2 of 2013) and Contrast III (CS1 vs CS2 of 2013). CS1 and CS2 of 2011 reflect single deadlines, whereas CS3 of 2011 and CS1 and CS2 from 2013 reflect split deadlines.

Figure 3: The average number of early posts was increased in the 2013 case studies compared to 2011, *P < 0.02.

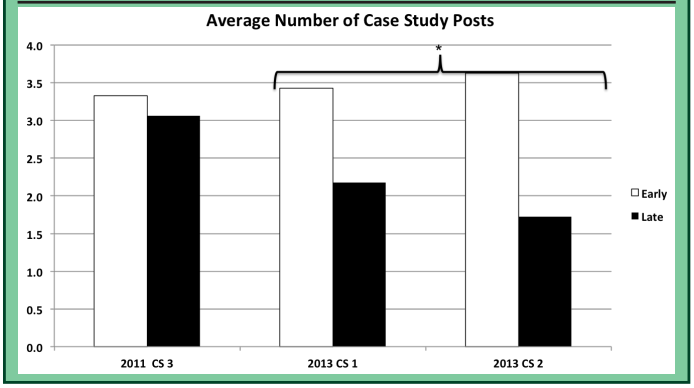
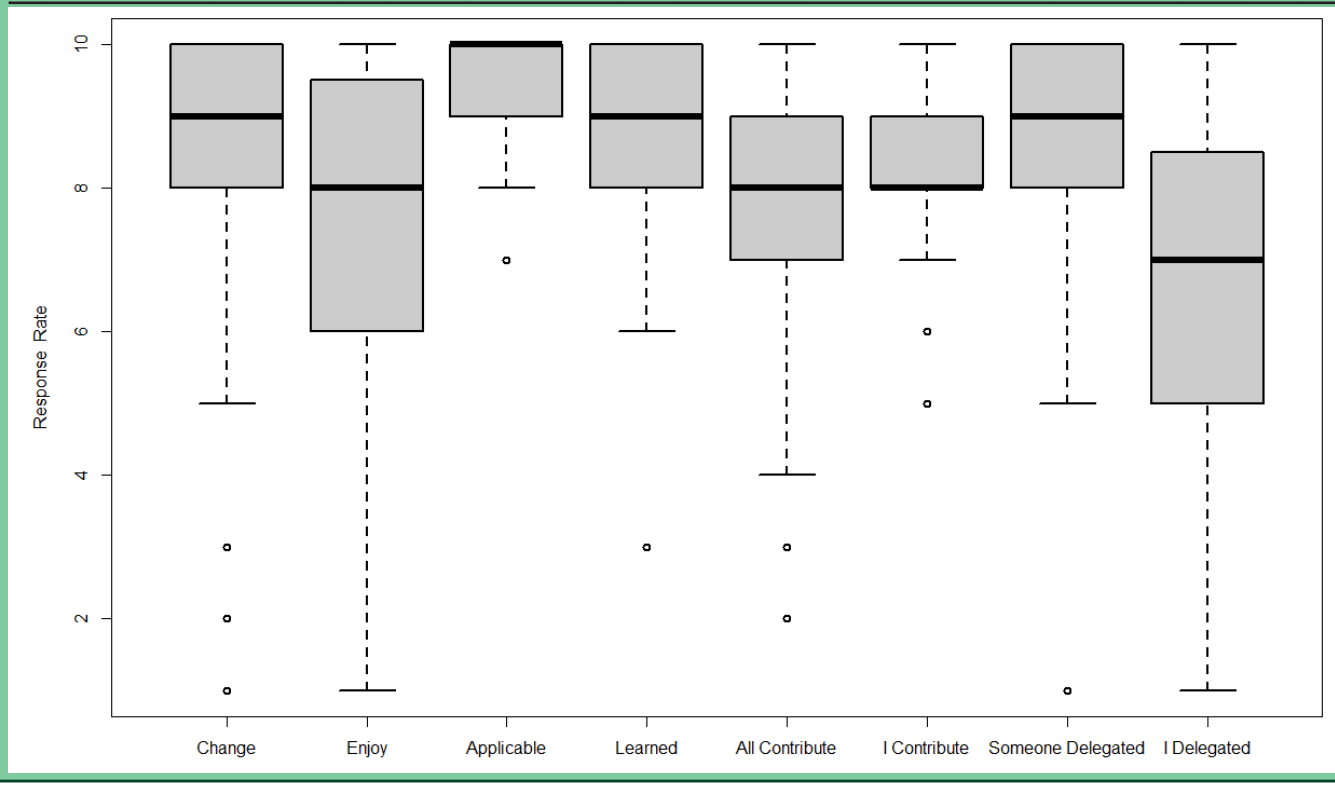


Figure 4: Students responded on a scale of 1-10 (1 strongly disagree, 10 strongly agree) as to the following statements: I realize that CS are worth enough to change my grade in the class by almost one letter grade (Change); I enjoyed solving CS (Enjoy); In general, the topics covered in the CS are applicable in the real world (Applicable); Regardless of whether or not I enjoyed the CS, I have learned relevant information that is essential for horse owners and nutritionists (Learned); My teammates all contributed to our discussion (All contribute); I contributed a lot of quality information and ideas to the group (I Contribute); Someone in my group has been good at delegating tasks (Someone Delegated); I personally was the one who delegated tasks (I Delegated).



2012) may also provide important interventions in cases where students experience difficulties in time management and taking responsibility for their learning and in online and blended formats. It may even be useful to discuss Steel's (2007) procrastination model with students in order to help develop their metacognition.

The final objective was to evaluate student satisfaction and self-assessment regarding the CS (Figure 4). Students reported having worked hard because the cases were worth one letter grade. Students, knowing how case study performance significantly affected their overall grade, believed that they worked harder and performed better in the class as a whole. Student reported enjoyment of solving CS, belief that case studies covered material applicable to the real world and belief that information learned was relevant and is essential for horse owners and nutritionists were significantly correlated ($P < 0.0001$). Over 94% of students ranked the information being relevant an eight, nine or ten and none of the students ranked the applicability of this information to the real world less than a seven. Most students enrolled in this class are interested in horses thus, this real world connection potentially makes the material more engaging, especially with the applicability of lecture knowledge to case study and real world situations. These results appear consistent with the findings of Cant and Cooper (2009) that peer learning through simulations and case studies benefit students through additional gains in knowledge, critical thinking ability, satisfaction and confidence and peer learning's fostering of active engagement with learning processes and concepts (Boud, 2001; Tribe, 1994).

Group dynamics and personal contributions were scored on a scale of 1-10 with 1 being yes or agree and 10 being no or disagree (Figure 4). Students reflected on whether all team members contributed to solving the CS and whether they believed that they personally contributed quality information and ideas to the group. Students were further asked to assess if someone in their group was good at delegating tasks and if they specifically were the one who delegated those tasks. Frequency of responses (1-10) to these group and personal reflections were varied as expected.

Summary

This research yielded several important findings. Utilizing case studies enhanced student reported enjoyment within an undergraduate equine nutrition course. Further, the split-deadline approach yielded an increase in student activity. The content repetition that case studies supplied allowed students to continually apply information from lecture as well as self- and group-guided topical research in order to gain content mastery that can be transferred to other assessment components of the class. Split deadlines positively impacted student performance and output in regards to online assignments, perhaps influencing the degree of student effort. Ultimately, student feedback confirmed

that the CS provided applicable and pertinent information relevant to their education in equine nutrition. As a result of this research, future research into issues of procrastination and engagement in peer learning through case studies in a hybrid course environment using the four variables identified by Steel (2007) could contribute to further understanding of student behavior, particularly in the context of course design, learning activities and assessment and student self-knowledge.

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Perspectives on Agricultural Education at the University of Idaho

J.M. Falk[1], C. Gerwig and K. Shaul
University of Idaho
Moscow, ID

P.T. White[2]
South Dakota State University
Brookings, SD

M.A. Baker[3]
Oklahoma State University
Stillwater, OK

Abstract

The purpose of this study was to examine the perspectives of faculty members at the University of Idaho held toward agricultural education curriculum. Improved communication is predicated upon better understanding of the perspectives of all team members involved in interdisciplinary studies. Q-methodology and purposeful sampling techniques were used to discover the perspectives of 21 participants from across the university. Four perspectives emerged, each differing on levels of agreement toward agricultural education programs. The perspectives added to the findings from similar studies conducted at other universities. The progressive idealist is a visionary who sees agricultural education as a rigorous academic content area capable of preparing students for any college major. Progressive realists see agricultural education as a program that creates better students, while most concerned with the positive impact it makes in the lives of students. Supportive idealists were not directly involved with agricultural education, but see it as an ideal model that should be aspired to by other sects of education. Skeptical academics are not convinced of the rigor and preparation agricultural education claims, but they acknowledge the overall benefit of the program while maintaining their skepticism. Trying to better understand these perspectives will improve communication in interdisciplinary projects involving agricultural educators.

Introduction

In today's educational environment change occurs at a rapid rate. In fact, it is commonly said that there is nothing as consistent as change. Agricultural education is not immune to the changes occurring around it. In Understanding Agriculture: New Directions for Education, agricultural education was asked to change, to become more relevant (National Research Council, 1988). Transforming Agricultural Education for a Changing World came out 20 years later and once again asked agricultural education to change (National Research Council, 2009). Recommendation 2 of that report asked for agriculture faculty to work with other faculty to improve education about agriculture.

Interdisciplinary projects are now required, or highly recommended in seeking grant funding from NIFA, NSF and many other funding organizations (Karsh and Fox, 2010). With ever increasing portions of the agricultural education budget being decided by granting organizations, agricultural education faculty must learn how to improve communications with faculty in other departments of their universities and with stakeholders at all levels. Blanchard (2007) indicated the key to being able to perform at a higher level is better communication with those with whom we work. Covey (2004), found that the key to communication was to first seek to understand and then seek to be understood. To move from low-level communication to higher-level communication Covey insists levels of trust must increase. Trust, Covey posits, is gained as we work toward understanding, or seeing things through the paradigm, or perspective, of the others in our new collaborative teams.

A study of the perceptions of stakeholders in agricultural education in Oklahoma found three distinct groups of perspectives relating to agricultural education and recommended follow-up studies be conducted to "foster conversations leading to a strengthened voice and concerted effort in ensuring that agricultural

[1]Assistant Professor in the Agricultural and Extension Education Department, 865 Perimeter Dr. MS 2040, Moscow ID 83843, (208) 885-6358, jfalk@uidaho.edu
[2]Assistant Professor in the Department of Teaching Learning and Leadership, Box 0507, Brookings, SD 57007, (605) 688-4546, peter.white@sdstate.edu
[3]Assistant Professor in the Agricultural Education, Communications & Leadership Department, 448 Agricultural Hall, Stillwater, OK 74078, (405) 744-8036, bakerma@okstate.edu

education remains viable" (Baker and Montgomery, 2012, p.911). Agricultural education in this context refers to the entire agricultural education community from the secondary level up through the university level, with admittedly more focus on the secondary level. University perspectives of agricultural education have not been conducted through the peer-review process in the past in Idaho. Informal communication with bench scientists collaborating on other interdisciplinary projects involving agricultural education have suggested a lack of knowledge as to what agricultural education does, the research they traditionally conduct, or the methods their research utilizes (P.T. White, personal communication, May, 3 2013). Perspectives of agricultural education at the University of Idaho need to be evaluated campus wide to enhance communication between faculty in all colleges and departments who engage with agricultural education students.

Theoretical Framework

The theoretical framework for this study was grounded in social constructionism, which, according to Watts and Stenner (2012, p.42) *"attempts to understand and map the currently predominant viewpoints or bodies of knowledge relative to a particular context, event, or object of enquiry."* More specifically, social constructivism in this study defines a reality that is defined socially by the interaction of groups of people. Social constructionism tells us that *"this lived world is a world of interpretation, a world in which meaning and the objects that are meaningful cannot be separated"* (Slife and Williams, 1995, p.91). Those in the agricultural education field, as well as those interacting with it continually construct and revise their views of what is agricultural education and what role does it play in the education of our youth. The identification of specific perspectives and utilizing commonalities with our own perspectives offers agricultural education faculty the ability to better communicate between themselves and with the larger university community. Defining and understanding the perspectives currently in use is critical in increasing trust and furthering this communication.

Purpose and Objectives

The purpose of this study was to examine the perspectives of agricultural education at the University of Idaho by faculty and staff across the university. Specific objectives were:

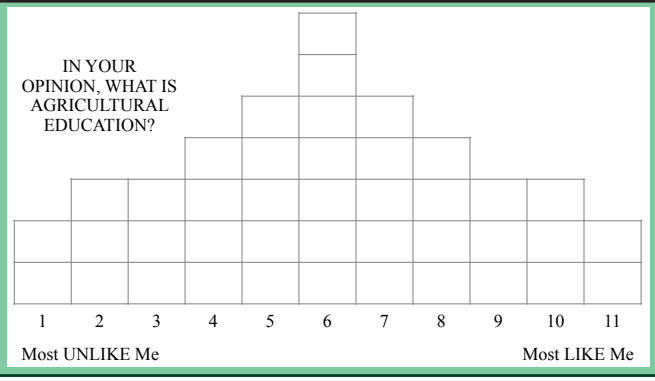
1. To identify the distinct groups (factors) of perspectives relating to agricultural education at the University of Idaho.
2. To identify the characteristics that most define a group (factor) of faculty perspectives of agricultural education.
3. To describe similarities and differences found between perceptions of University of Idaho faculty and faculty at Oklahoma State University based on a similar study.

Methods/Procedures

The methods used to conduct this study follow Q methodological design, also known as Q method or Q sorting. Q methodology, hereafter referred to as Q, is the opposite of R type studies in that respondents are correlated and not their responses (Watts and Stenner, 2012). This tenant of Q removes researcher bias by allowing for operant subjectivity. Definitions are not decided a priori, instead, definitions are defined as the participants sort the provided statements (McKeown and Thomas,1988). In Q, participants are correlated into factors (groups) and not their responses, allowing groups of similar minded people to be grouped and defining statements to emerge about the group (McKeown and Thomas, 1988; Watts and Stenner, 2012). Q was chosen as the method for this study for its ability to define groups based on factor analysis of the respondents and not to try and pigeon-hole them into stereotypical researcher defined groups. This study was modeled after Baker and Montgomery's study of faculty in Oklahoma (2012).

The participants in this study were purposefully chosen using snowball-sampling techniques to represent all four groups of perspectives Marshall and Montgomery (2012) identified as interacting with all levels of agricultural education in performance of their normal duties. The first groups of participants were chosen primarily from university faculty with direct associations with agricultural education faculty, graduate and undergraduate students and high school agricultural education students and instructors. These consisted primarily of career development event (CDE) superintendents and their assistants who conduct the skills based events for the state. These participants were chosen to better define the perspectives of those most involved with the agricultural education department and its students. The second group of participants chosen consisted of the administrative faculty who interact directly with agricultural education departmental faculty and staff. This consisted of deans, associate deans and their office staff members in both the College of Education and the College of Agricultural and Life Sciences, many of these had also interacted with secondary agricultural education. The third group of participants was selected from the agricultural education department itself. This group of faculty represents agricultural education in both the formal and informal settings of classrooms, 4-H and extension. The last group consisted of university faculty solicited from conversations with graduate and undergraduate students in the department. Students were asked to recommend faculty from the university who a majority of agricultural education students would take courses from who, in the students' minds, had strong opinions about them as a group. Faculty who were perceived as favorable or unfavorable were equally sought to try and include every possible perspective towards agricultural education. Several faculty members perceived as representing a unique group, or as enhancing a perceived group, refused to participate in the study, even when we

Figure 1. Form board for rank-sorting statements used in this study.



attempted to elicit responses during office hours. A total of 21 subjects participated in the study.

Q statements, also known as the concourse, for this study were taken directly from those statements used in the Baker and Montgomery (2012) study. A 41 statement Q sort board was utilized by participants to rank-sort the Q statements (Figure 1). Baker and Montgomery categorized these 41 statements as representing content, context, affective effects, social development and other. They were developed through both literature review as well as from statements made during interviews with stakeholders (Baker and Montgomery, 2012).

All 41 statements were used in their entirety. Following IRB exemption, prospective participants were contacted by email with a description of the project and asked to let the research group know when they would be available to participate in our study. After the second follow-up request research assistants solicited participation from non-respondents through face-to-face visits with faculty during their office hours. Snowball-sampling expanded the selection of participants to 21.

Participants initially grouped statements as like me or unlike me and were then instructed to start in one pile and place the two statements most like them on the board. Participants then proceeded to go back and forth between both their piles two statements at a time filling the board from the outside in. Alternating helped participants to both re-evaluate their choices and become more familiar with the remaining choices. Several participants decided to place the entirety of either their like or unlike piles and then proceeded to the other pile. It is of note that this variation in the procedure did not reduce the time required to complete the sort, nor did it appear to reduce the number of statements respondents moved around on the board following initial placing of all statements. Participants were asked questions relating to their unique placing of items as they progressed through the sort to help provide more depth into their perspective. Sorts were conducted by four researchers over the course of two months in the spring of 2013. Data was analyzed using the free PQ-Method software, which required a 32-bit MS Windows-based computer to be able to run all aspects of the data analysis.

Statistical analysis of data was utilized to delineate the number of arrays best representing the perspectives of the participants. Correlations between respondents suggested that there were three to five possible arrays, or groups of perspectives present. Eigenvalues suggested three factors (Watts and Stenner, 2012). Four factors were chosen for this study for two main reasons; first, one respondent represented more traditional faculty outside both the colleges the department primarily works with and second, any rotation with this perspective included always placed it alone. By including this factor, we were able to examine its perspective in relation to the other respondents while still being able to discriminate between the perspectives represented by those more involved with the department and its students. Measures for validity do not apply to Q-methodology since it relies on operant subjectivity with no outside criteria, or researcher imposed meanings as most other scalar methodologies (Brown, 1996; Nicholas, 2011).

Findings

Four distinct groups were found in this study. Of the 21 participants, six were represented by factor (group) one, one was by itself in factor two, three were represented in factor three and seven were represented by factor four. The remaining four participants were not represented in a factor. Interpretation of results focused on those statements each factor specified as most like them (+5, +4) or least like them (-5, -4) resulting in five statements in each of the four categories representing the statements with the strongest opinions both favorably and unfavorably. In addition to absolute ranking, distinguishing statements for each factor were given additional credence in describing the perspectives of each of the four factors. Seven of the 41 statements in the sort were not distinguishing for any of the four factors represented in this study, even though several of these statements' z-scores placed them in columns (+/-) four and (+/-) five. This indicates that there is a mixed, yet not distinctly unique, perspective on these statements. Combined, these statements suggest participants did not have distinct opinions on students being involved with agricultural education just to have fun. Likewise, agricultural education developing employability skills, students being more motivated or goal driven and students developing poor academic skills were not distinct.

Factor One: Progressive Enthusiasts

Progressive enthusiasts were defined by six of the participants and accounted for 25% of the explained variance in the study. Progressive enthusiasts felt agricultural education was an academic and leadership program. Progressive enthusiasts had only one distinguishing statement, number 12; "Involvement in agricultural education prepares students for any college degree program." In addition, statements 18, 20, 6 and 31 were reported as the most like this perspective (Table 1). Together these statements describe agricultural education as supporting intellectual growth and being able to prepare students for any college program.

In addition, progressive enthusiasts felt that, rural or not, agriculture is a science and all students can benefit from participation in agricultural education. Progressive enthusiasts felt that the agricultural education teacher is a role model for their students and agricultural education is really about teaching leadership. Progressive enthusiasts disagree that agricultural education is out of date, closed minded and lacks diversity in demographics and thought. Progressive enthusiasts disagreed that agricultural education should not include science, math and language arts, or that involvement in agricultural education caused students to develop poor academic and personal habits. Progressive enthusiasts like the direction agricultural education is taking and felt agricultural education is a beneficial program.

Factor 2: Skeptical Academic

Skeptical academics were defined by one participant and accounts for 6% of the explained variance in the study. Skeptical academics responses correlated less than .08 with all other factors. Presented in Table 2 include the statements that were selected by the Skeptical Academic as the most like and least like, them. Distinguishing statements (Table 3) show skeptical academics differ throughout the array from all three other factors.

Skeptical academics believe funding agricultural education is a good use of money, naturally includes science, math, reading and writing, develops employment skills, makes confusing math and science easier to understand and supports the intellectual growth of students (Table 3). However, skeptical academics do not believe that agricultural education enables students to perform better on standardized tests, makes students any more prepared for any college degree program, or develops citizenship skills. Skeptical academics also don't believe agricultural education causes students to develop poor academic skills or is most beneficial for high achieving students. Skeptical academics were notably neutral on the inclusion of science math and language arts in the agricultural education curriculum.

Factor 3: Supportive Idealists

Supportive idealists were defined by three participants and account for 16% of the explained variance in the study. Type three perspectives are

Table 1. Factor Scores of the Five Most Like and Least Like Statements for Progressive Enthusiasts

No.	Progressive Enthusiasts—*Most Like* Statements	Array Position	Z Score
18	Agricultural education supports the intellectual growth of students.	5	1.67
12*	Involvement in agricultural education prepares students for any college degree program.	5	1.57
20	The agricultural education teacher is an important mentor and role model for high school students in and outside of the classroom.	4	1.51
6	Agriculture was the first science and any student, whether rural or not, can benefit from learning about agriculture broadly defined.	4	1.20
31	Agricultural education is really about teaching leadership and citizenship to students.	4	1.10
	Progressive Enthusiasts—*Least Like* Statements		
28	The culture is close-minded and lacks diversity in demographics and thought.	-4	-1.52
4	Agricultural education is only viable in rural communities where production agriculture is practiced.	-4	-1.56
35	Students involved actually develop poor academic and personal habits.	-4	-1.57
41	Keep the science, math, and language arts out of agriculture.	-5	-1.59
9	Agricultural education is out of date and impractical in today's high schools.	-5	-1.76

Note. Statements marked by * are significant (p < .01)

Table 2. Factor Scores of the Five Most Like and Least Like Statements for Skeptical Academics

No.	Skeptical Academic—*Most Like* Statements	Array Position	Z Score
17*	Studying agriculture naturally includes the study of math, science, reading and writing – it doesn't require special attention to integration.	5	1.85
27	Investment of state funds in agricultural education is a good use of money.	5	1.85
5	agricultural education courses develop necessary skills for employment in business and industry.	4	1.48
13	agricultural education makes confusing math and science concepts easier to understand by putting the concepts in a real-world context.	4	1.48
18	agricultural education supports the intellectual growth of students.	4	1.48
	Skeptical Academic—*Least Like* Statements		
23	agricultural education is most beneficial for high achieving students.	-4	-1.48
35	Students involved actually develop poor academic and personal habits.	-4	-1.48
33	agricultural education is an elective that helps students develop citizenship skills.	-4	-1.48
12*	Involvement in agricultural education prepares students for any college degree program.	-5	-1.85
11*	agricultural education enables students to perform better on standardized exams.	-5	-1.85

Note. Statements marked by * are significant (p < .01)

Table 3. Distinguishing Statements of the Skeptical Academic

No.	Statement	Array Position	Z Score
17	Studying agriculture naturally includes the study of math, science, reading and writing – it doesn't require special attention to integration.	5	1.85
15	Agricultural education has no business teaching students core subjects like science, math, and language arts.	3	1.11
9	Agricultural education is out of date and impractical in today's high schools.	2	0.74
8	High school agricultural teachers know a lot about agriculture, but are not qualified to teach core concepts such as science, math, and reading.	2	0.74
41	Keep the science, math, and language arts out of agriculture.	0	0.00
32	Agricultural education is a vital bridge between the community and public education.	-2	-0.74
12	Involvement in agricultural education prepares students for any college degree program.	-5	-1.85
11	Agricultural education enables students to perform better on standardized exams.	-5	-1.85

Note. Significant Z-scores (p < .01)

significantly ($p < .01$) defined by the statement "agricultural education is a rigorous science or math class in the context of agriculture" (Table 4). Overall, supportive idealists see agricultural education as rigorous, making confusing math and science easier to understand and felt agricultural education takes a "refreshing, hands on, approach to learning." Supportive idealists do not agree that agricultural education is out of date, impractical, or causes students to develop poor academic skills. Supportive idealists felt livestock exhibitions, FFA contests and student projects have educational value and agree agricultural education should be teaching core content. Supportive idealists and progressive enthusiasts show a very strong association ($r = 0.73$), therefore it is important to note the statements exhibiting the greatest difference in Z-scores. The greatest difference ($\Delta z = 1.84$) occurs with their perspective relating to the rigor of agricultural education compared to science or mathematics. While supportive idealists rank it as the statement most like them, progressive enthusiasts respondent were nearly neutral ($z = 0.19$). The next highest difference score comes in relation to agricultural education's importance as a bridge to the community ($\Delta z = 1.31$).

Factor 4: Progressive Realists

Progressive realists were defined by seven participants and accounts for 30% of the explained variance in the study. Progressive realists felt agricultural education is a good use of state funds, the agricultural education instructor is an important role model, but agricultural education teachers need to collaborate with core content instructors to increase awareness of agriculture (Table 4). Progressive realists believe agricultural education is valuable outside rural communities, science math and language arts belong in agricultural education and agricultural education should be teaching core subject concepts. Progressive realists are similar to the progressive realist identified by Baker & Montgomery (2012). Progressive realists know there is value in agricultural education programs but felt there is work to be done still to achieve its potential. Progressive realists were also very strongly associated with progressive enthusiasts ($r = 0.86$). The largest difference occurs between their perspective on agriculture as the first science ($\Delta z = 1.10$), agriculture naturally including science, reading and writing ($\Delta z = 1.02$) and agricultural education really being about teaching leadership and citizenship ($\Delta z = 1.01$). Progressive enthusiasts felt they were more like these statements than progressive realists. Progressive realists were less likely to disagree agricultural education is the best place for lower achieving students ($\Delta z = 1.20$).

Differences in Perspectives between Studies

Baker and Montgomery (2012) found three factors, as opposed to four factors, in their study of Oklahoma State University faculty. They named their perspectives the supportive idealist, the critical academic and the progressive agricultural educator. Comparisons between this initial use of the statements and our use of them a year later provide some additional insight into how academic faculty at both institutions view agricultural education, as well as an additional perspective.

The one perspective that appears to be consistent between both studies is the supportive idealist. Results from both studies suggest supportive idealists see agricultural education through rose-colored glasses. Baker and Montgomery (2012) found this perspective indicative of those mostly outside agricultural education. We, too, found this to be true. All three of the participants were from outside agricultural education, but were instead from our sibling organizations; one was from 4-H, one from the family and consumer sciences and one from career and technology education. Their exposure to agricultural education was through high school experiences, growing up on farms and through their interaction with both collegiate and secondary agriculture students.

Similar in title, the critical academic (Baker and Montgomery, 2012) and the skeptical academic show some level of similarity. Both are outside the Colleges of Agriculture, both represent hard sciences and both feel agricultural education students do not perform any better on standardized exams. However, on the issue of academic rigor, Baker and Montgomery found critical academics more critical (statement 10, z-score -2.28, array position -5) of the academic rigor as opposed to our skeptical academic who was more neutral (10, -0.74, -2). Additionally, Baker and Montgomery's critical academic viewed agricultural education as close-minded (28, 2.18, +5) but teaching in a refreshing experiential

Table 4. Factor Scores of the Five Most Like and Least Like Statements for Supportive Idealists

No.	Supportive Idealists—*Most Like* Statements	Array Position	Z Score
10	Agricultural education is a rigorous science or math class in the context of agriculture.	5	2.02
13	Agricultural education makes confusing math and science concepts easier to understand by putting the concepts in a real-world context.	5	1.80
14	It is important that agricultural educators and core content educators collaborate in order to be aware of connections between the agricultural classes and core classes.	4	1.52
31	Agricultural education is really about teaching leadership and citizenship to students.	4	1.39
40	Agricultural education takes a refreshing, hands-on, approach to learning.	4	1.33
	Supportive Idealists—*Least Like* Statements		
9	Agricultural education is out of date and impractical in today's high schools.	-4	-.94
35	Students involved actually develop poor academic and personal habits.	-4	-1.49
39	There is little educational value to the livestock exhibitions, FFA contests, and extracurricular student projects. It is just that extracurricular.	-4	-1.73
15	Agricultural education has no business teaching students core subjects like science, math, and language arts.	-5	-1.97
41	Keep the science, math, and language arts out of agriculture.	-5	-2.11

manner (40, 1.22, +4). Our skeptical academic felt more that agricultural education was not close-minded (28, 0.37, +1), but was not conducting hands-on learning (40, -0.37, -1).

Baker and Montgomery's final category, the progressive agricultural educator, was represented by two faculty members in the agricultural education department at Oklahoma State. They viewed agricultural education through the lens of what is and compared it to what could be. As such, they see the potential but lamented the gap that needs to close. We specifically looked for this category in our study among the agricultural education faculty. However, upon statistical analysis it became evident that we had two distinct separate categories emerge. The progressive enthusiast was represented by a group possibly more visionary or forward thinking. This group was composed of department heads and higher level administrative faculty in the College of Agricultural and Life Sciences, most with direct involvement in agricultural education for many years. The progressive enthusiast is someone who imagines a more academic agricultural education (18, 1.67, +5) that prepares students for any college degree program (12, 1.57, +5) and leadership (31, 1.10, +4).

Our final category, the progressive realist (Table 5) sees a more limited agricultural education. Progressive realists (20, 1.49, +5) like Baker and Montgomery's progressive agricultural educator (20, 1.41, +4) see the importance of the mentoring of students both inside and outside the classroom. Our progressive realist does not see agricultural education as merely a fun place (19, -0.56, -1) as the progressive agricultural educator is more likely to do (19, 1.51, +4). However, progressive realists agree with the progressive agricultural educator (4, -1.84, -5) that agricultural education is too important for just rural students (4, -1.74, -5).

Conclusions/Recommendations/Implications

Increasing trust between individuals will increase understanding and the quality of communication (Covey, 2004). At the onset of this study, we felt that there would be a shared perspective from the agricultural education faculty. This was not to be the case as the faculty who completed the Q-sort were divided between three of the four found perspectives. Understanding that even those with similar backgrounds can espouse a different point of view is crucial in learning to communicate with them. This task becomes even more important as agricultural education faculty increase the number of interdisciplinary projects they are collaborating on with investigators who may not be from their same background or share their philosophical epistemologies.

Skeptical academics may make up a large portion of the faculty in colleges of agriculture. Communicating with these individuals requires careful consideration of their perception of agricultural education. Skeptical academics hold the potential to become more supportive of agricultural education with increasing knowledge about agricultural education. We will consider communicating the ideals of personal benefits of agricultural education to begin conversations with skeptical academics, while also acknowledging that there is room to grow in weaker programs to increase academic rigor. Likewise, it became apparent that array positions of zero in areas of science and math integration (41, 0.00, 0) suggest there is room for increased understanding and acceptance of agricultural education in those areas. Not all hard scientists, or non-social scientists, are skeptical academics and in fact, many of the hard scientists participating in this study were progressive realists. The skeptical academics agree that secondary agricultural education has value and that it also needs improvement. Progressive idealists see a future for agricultural education that espouses science, language arts and mathematics as rigorous integral components of agricultural education. Understanding and communicating with them requires us to see agricultural education as it could or arguably should be. Progressive idealists look to a future where agricultural education is a vibrant thriving component of the education system. Progressive idealists look to agricultural education as they think it should be and you should communicate with them considering the best of agricultural education. Starting conversations with what has been done in the past is not a recommended strategy.

The progressive realist may be the most understanding of the perspectives. Progressive realists see the value in agricultural education as they see it today. Communication with progressive realists requires complete honesty about what is and why it is important to agricultural education. They see a program that is all about making students better (25, 1.10, +3; 26, -1.30, -3). They have no grand illusions about agricultural

Table 5. Factor Scores of the Five Most Like and Least Like Statements for Progressive Realists

	Progressive Realists—*Most Like* Statements		
27	Investment of state funds in agricultural education is a good use of money.	5	1.56
20	The agricultural education teacher is an important mentor and role model for high school students in and outside of the classroom.	5	1.49
14	It is important that agricultural educators and core content educators collaborate in order to be aware of connections between the agricultural classes and core classes.	4	1.39
13	Agricultural education makes confusing math and science concepts easier to understand by putting the concepts in a real-world context.	4	1.32
18	Agricultural education supports the intellectual growth of students.	4	1.24
	Progressive Realists—*Least Like* Statements		
39	There is little educational value to the livestock exhibitions, FFA contests, and extracurricular student projects. It is just that extracurricular.	-4	-1.52
15	Agricultural education has no business teaching students core subjects like science, math, and language arts.	-4	-1.68
35	Students involved actually develop poor academic and personal habits.	-4	-1.70
41	Keep the science, math, and language arts out of agriculture.	-5	-1.72
4	Agricultural education is only viable in rural communities where production agriculture is practiced.	-5	-1.74

education being the academic solution for gifted or struggling students and may be the most dependable of supporters and collaborators. Recognizing the truths and celebrating successes is a strategy that we recommend in order to keep these progressive realists informed of the current status of agricultural education.

This study illustrates key differences in the varying perspective held by groups defined as progressive enthusiasts, skeptical academics, supportive idealists and progressive realists among the faculty at the University of Idaho with regard to secondary agricultural education. The results provide information that may be helpful in enhancing, trust and communicate with faculty both within the agricultural education community, as well as without. This study focused primarily on the outcomes of agricultural education, students and teachers. Further research needs to be conducted with university faculty concerning epistemological perspectives held by hard and social scientists. Research needs to be directed toward ways to better understand the methodological similarities and differences, as well as the strengths of interdisciplinary projects once trust, communication and understanding are established.

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N. Omri Rawlings, Editor
Middle Tennessee State Univ.
Murfreesboro, TN 37130

Agricultural Missions Play an Important Role

Wilbur P. Ball

Abstract

There is a growing need for qualified agriculturalists to fill numerous positions available with church-related and humanitarian organizations in many of the developing countries. The primary emphasis of agricultural missions is to help small subsistence farmers improve their agricultural production and standard of living through practical extension programs. There is no greater challenge today than to become actively involved in helping to solve present world food problems.

Introduction

Members of NACTA have an excellent opportunity to play an important role in agricultural missions by helping to prepare agriculturalists with skills and abilities needed by small farmers in Nigeria as well as many other developing countries. Hundreds of dedicated agriculturalists are needed to fill positions available under various private and church-related mission boards. To cite an example, one church-related organization recruits and supports approximately 140 agriculturalists for two-year assignments in nearly 40 countries around the world. In most cases these agriculturalists must be college or university graduates, preferably with a plant or animal science background and some practical farm experience. Assignments may be of an advisory nature, but most often include full-time extension work with local farmers. Proficiency in a local language may be necessary to communicate effectively with the people.

Several agricultural majors currently enrolled in international agricultural classes at California State University, Fresno, are preparing for future assignments with private and church-related organizations. One recent graduate accepted a career position as the agricultural development specialist assigned to work with a four-man team in West Africa.

Dr. Ball is Professor of International Agriculture and Education at California State University, Fresno, and a member of NACTA's International Affairs Committee. He served as an Agricultural Consultant for the Sudan Interior Mission in Nigeria during the summer of 1975.

The Agricultural Situation

Nigeria is a rapidly developing country, rich with natural resources, where an estimated 85 percent of the people are directly dependent upon the land for their livelihood. In the past, agriculture has often been a symbol of poverty and a backward life style offering only a subsistence standard of living. During recent years vast numbers of people have migrated from the rural areas to cities in search of jobs and a better life. The youth especially have left the farms to escape the drudgery of manual labor and a subsistence level of income. The resulting growth of cities has caused congested transportation systems, scarcity of basic food supplies, and rising inflation. Concerned government officials are presently trying to convince the people that farming, if done properly, is a respectable and profitable occupation. This renewed interest and emphasis on improved farming and food production holds many far-reaching implications for the agricultural missionary in Nigeria.

The economic welfare of most developing countries still depends greatly on the pace of improvement in agriculture. Industrial advance and the employment of surplus labor from rural areas is likewise dependent upon an efficient and productive agriculture. How to slow the population migration to cities and increase agricultural production in rural areas remain two serious problems for national development planners.

As the work of agricultural missions expands in a country, efforts are made to interest farmers in local cooperative associations. Farmers, young and old, need

to be conditioned through the schools and adult extension programs to accept innovation in agriculture. When higher yielding strains of grains, proper application of fertilizers, better breeds of poultry, and good management practices are successfully adapted to local conditions, the small farmer begins to understand the meaning of this new system of agriculture. The agricultural missionary strives to increase agricultural production and improve standards of living. And he also hopes to see growth in terms of common concern for one another, the bearing of each other's burdens, and a cooperative effort of the people for the welfare of the total community.

Simple, practical projects that help meet the basic needs of the small farmer are the key to acceptance of outside expertise and technology. People must be helped in ways they can appreciate, understand, and participate in. Well prepared agriculturalists with practical farm backgrounds and experience are needed to work with community improvement projects as well as to advise farmers about farming problems.

Agricultural Mission Projects

Some extension projects that challenge agricultural missionaries today include introducing better strains of crops, planting fruit trees, applying fertilizers and insecticides, rotating crops, storing grain, marketing crops, constructing earth dams, conserving water, digging wells, improving farm tools, building fish ponds, raising poultry, improving animal husbandry, introducing new management practices, and organizing farmer cooperatives.

Under the leadership of Louis Haveman, a Michigan State University agricultural graduate working in Eastern Nigeria, over 1000 day-old chicks were delivered to the mission agricultural center every month for distribution to individual small farmers. Now improved poultry breeds may be found in nearly every village, and local community volunteer agents continue to be an important way of serving the people. These agents are provided with a limited supply of agricultural chemicals that may be reordered from the central storehouse as needed. Each agent operates on a cash basis and is allowed a 15 percent sales commission on all agricultural chemicals. The number of volunteer agents increased from 52 in 1973 to approximately 65 in 1975 and is expected to level off somewhere around 100 by 1980.

Agricultural missionary Harvey Ratzlaff recently reported his experiences with the use of fertilizers in Northern Nigeria. One farmer planted 5 acres of peanuts using 250 pounds of seed and one 100-pound bag of super phosphate per acre. He harvested 117 bags of peanuts in the shell. A neighbor planted 6½ acres using 335 pounds of seed without any application of fertilizer. He harvested only 57 bags of peanuts. The advantage of the proper use of fertilizers was clearly demonstrated; however, many farmers have difficulty securing needed fertilizer at the proper time.

German-born agriculturalist Gottfied Scholm was instrumental in improving the community where he was assigned in Central Nigeria. With the cooperation of the people a small concrete dam was constructed just below a spring at a cost of approximately $1500. With the water supply securely fenced, village women no longer compete with the pigs and cows for their domestic water.

To help alleviate the effects of past drought and to improve and expand food production in Nigeria, a community development department was recently established by the Sudan Interior Mission. This new church-oriented ministry, under the supervision of Ken Kastner, has emphasized agricultural extension work with small farmers.

A number of British agriculturalist with the Sudan United Missions have developed agricultural programs allowing students to live at the school with their wives and families. Two acres are assigned each student for growing vegetable and other food crops for their domestic use. Both husband and wife receive instruction which includes improved farming methods, nutrition, sanitation, and village improvement.

Another interesting agricultural project located in East Central State is operated by Norwegian Chuch Relief, an organization supported by Christian churches in Norway and the Norwegian government. The purpose of this project is to educate and train young school dropouts to become better farmers and leaders of the rural communities. The project building complex consists of classrooms, farm structures, tractors and machinery, rice mill, water system, health clinic, student farmer housing, and staff homes. Several hundred young men have successfully completed training programs at the center with a majority now engaged in farming or agricultural related work. This church-related project differs from most agricultural mission programs due to the extensive amount of capital outlay in land, buildings, equipment, and technician salaries needed to operate a large demonstrational training farm.

Peter Bachelor, a British rural development consultant for Christian churches in Africa, has emphasized that the primary effort in agricultural missions must be to reach people by extension methods rather than expect farmers to come to an elaborate research center for highly technical instruction. He believes that a meaningful rural development program can be operated effectively through a centrally located facility such as a house with an office and storeroom. The agricultural missionary simply acts as a catalyst in bringing useful information to the local agent or to the people he is training.

According to Bruce Bond of New Zealand, the agricultural missionary must not undermine the local system of agriculture, but rather build on existing foundations. The local farmer generally has a wealth of knowledge of his area. The agriculturalist, therefore, must work directly with the local farmer and act as a liaison between governmental agencies and research centers. He must be willing to listen to and learn from local people. Bond believes that the primary need is practical, well-prepared agriculturalists willing to do very "humble" jobs with the small farmer, helping improve his standard of living.

Dr. Raymond Davis, former general director of the Sudan Interior Mission states that the world food shortage is a fact of life which will affect all phases of church and mission activity far into the future. He believes that agricultural missions are as appropriate a Christian service to mankind as medicine or education and may well be number one in a list of priorities for today.

Conclusion

Certainly the question of how to assist the small subsistence farmer increase food production and raise his standard of living will continue to be the number one challenge facing the agricultural missionary. Professional agriculturalists in North American colleges and universities have an opportunity to play an increasing role in preparing young agriculturalists for private and church-sponsored positions to increase food production in Nigeria and many other developing countries.

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Anonymous Grading: A Win/Win for Faculty and Students

An anonymous grading policy is one most law schools have strategically employed for decades. This Paper will briefly address the major advantages of employing such a policy as well as some of the criticism; ultimately I will argue that anonymous grading is beneficial, even desirable, at the collegiate level in a variety of disciplines as it has been of significant pedagogical benefit in my undergraduate and graduate courses over the past twenty-five years.

At the core of the anonymous grading system is the elimination of bias. In academics, the potential for biased grading is at the heart of student assessment reliability.[1] Bias in essay grading may come in the form of a "conscious decision to boost the grades of students to whom instructors are favorably disposed, whether because of past academic performance, effort, or personality."[2] For students who do not have the past performance to enhance their credibility, bias may deny those students the "benefit of the doubt" when on the borderline between grades.[3] Bias may also be more generally placed on a group of students defined by immutable characteristics like race, gender, sexual orientation, age, and religion. [4] Thus, "if an instructor knows the identity of the student whose essay he or she are grading, that instructor may use past performance as a 'shortcut' to assigning an easy grade."[5] Clearly, anonymous grading benefits students in a variety of ways, and as educators, our role is to provide to the student an assurance of objectivity. In addition to guarding against bias by withholding the student's identity until after grading is complete, anonymous grading also "[p]rotect[s] teachers from accusations of bias" and "gives teachers (and students) more credibility when teachers want to endorse or support students who have done well in a class for admission to higher levels of education or for jobs."[6] Some criticism to anonymous grading include "making it harder for a teacher to reward classroom participation," inapplicability in settings where student projects are unique, and chilling student-faculty interaction;[7] however, a teacher can simply adjust the overall grade in light of classroom participation after anonymous grading is complete and, as such, students can still effectively interact with faculty.

Beyond those assertions, there are no major drawbacks to anonymous grading. A study at the United States Military Academy at West Point found that bias did exist in the context of non-anonymous grading.[8] Given the clear benefits, it makes sense for undergraduate and graduate instructors to continue with anonymous grading policies and for a variety of academic disciplines to adopt such policies. As a win/win, I have found that it provides for more open class discussions as students feel free to openly express their opinions and it instills in the instructor a sense of objectivity which is clearly understood and appreciated by the students.

Notes

[1]Robert Person, *Blind Truth: An Examination of Grading Bias*, United States Military Academy, 1, 1 (2013), http://www.usma.edu/cfe/Literature/Person_13.pdf.

[2] *Id.* at 2.

[3]*Id.*

[4]Vikram David Amar, *Why "Blind" Grading Makes Good Sense, and Should Be Used More Extensively Outside of the Context of Law School Exams*, Verdict, Jan. 17, 2014 https://verdict.justia.com/2014/01/17/blind-grading-makes-good-sense-used-extensively-outside-context-law-school-exams.

[5]Person, *supra* note 1, at 2.

[6]Amar, *supra* note 4.

[7]*Id.*

[8]Person, *supra* note 1, at 10.

Submitted by:
Michael T. Olexa
Food and Resource Economics Department
University of Florida, Gainesville
olexa@ufl.edu

Pump in a Bucket: A Method for Teaching Teachers and Students Solar Energy Concepts

Introduction

Solar energy can be infused in many agriculture science courses at all levels. Pumping water with solar energy can be included in both plant science and animal science courses. Solar energy projects fit readily into a STEM career path curriculum. Topics include electricity, chemistry, physics, math and project design (engineering). Components for assembling and

demonstrating a solar-powered water pumping system are available online or from local DIY building centers. Curriculum (lesson plans, projects) for teaching solar energy are available online. The simplest system to assemble is called "PV-direct". The load (12 volt DC pump) is matched to the source (a 17 volt DC module). The voltage of the load and source need to be the same (12 volts).

Procedure

Materials for the project include a 20-watt solar module (designed for charging 12 volt batteries), a 12 volt DC bilge pump (300 gph), a five gallon bucket, and various pieces of ½ inch diameter PVC pipe and pipe fittings. Use no glue. Let your audience pick and choose fittings to assemble their project. The key is to assemble a structure which connects to the submersible pump, and moves water up and out of the bucket, and letting it return. A two-inch piece of 5/8-inch clear poly tubing is used to connect the barbed pump fitting to a poly barb x male pipe fitting (mpt) that screws into a PVC female pipe adapter.

When teaching the subject, introduce the audience to an operating system. The leads of the module are connected to the leads of the pump outside of the bucket of wire with wire nuts. When the module is exposed to the sun, DC current is sent to the pump. Adjusting the tilt angle of the module toward the sun affects the performance of the pump. Teachers and students are drawn to the sight and sound of the flowing water. Working in small groups, have several sets of PVC components on tables with pumps and buckets. Some audiences will go back to the working model and attempt to copy or replicate. Others attempt to create their own model. Demonstrate how to safely connect the ends of the pump leads to the bare ends of the pump leads. Wire nuts can be used to secure the ends. Be sure the leads are outside of the bucket and not submerged in the water.

Any hands-on activity involving electricity needs to include a discussion of personal safety. A solar module exposed to the sun can produce electrical current. Use a digital meter to measure power output (voltage and current). Make sure modules are positioned face down when making connections to the ends of the leads. Have your audience ask what the expected level of voltage or current is before taking the measurement. Follow this with the taking of the measurements. Is your meter functioning correctly? Be familiar with functioning of the meter. Solar energy produces Direct Current (DC) electricity. A clamp on meter can measure electrical current by clamping around the leads.

Assessment

Several opportunities to assess student learning exist. A pre-activity survey can measure student knowledge and skill set working with solar energy systems. Compare the findings with a post-activity survey. Another method is to have a prepared worksheet with questions. Have your audience illustrate the flow of electrical current, and/or draw a pictorial diagram. Expand on the activity. Wire multiple modules in series (+ to -) or in parallel (+ to + and – to -) to see the effect of altering the flow of electrical current. What happens when the module is shaded? Develop a student solar fair competition. Have groups of students demonstrate methods of using solar modules to move water for various projects such irrigation, hydroponics, aquaponics and livestock watering.

Submitted by
Edward Franklin
University of Arizona
eafrank@ag.arizona.edu

Bringing the world to your classroom: Using WebEx™ conferencing to bring experts to your course

Introduction

When we, as educators, step into the classroom, we are the experts for the day, but each of us also knows that there are others that usually know at least part of that day's topic better than we do. When I was asked to develop a Nutritional Genomics course for students in our Agriculture and Life Sciences College, I had taught basic Animal Genetics for 10 years at another university, and certainly used many genetic and genomic assays and approaches in my own research. However, I also appreciated the fact that there were other experts in the areas I was going to cover, and so I thought about ways to bring these experts to my students. However, the cost of bringing experts to my classroom from all over the world, each with speaking fees, hotel and airfare expenses and per diems was not feasible to propose to my department. So, I started thinking of other ways that we could bring experts to the classroom using online conferencing technologies.

There are several different conferencing platforms that can be used, each with strengths and weaknesses. Several online sites provide a ranking of online conferencing tools, including G2 Crowd [1], Online Meeting Software Review [2], and Capterra [3] among many others. PC Magazine recently reviewed 10 of the top web-based conferencing tools for price, ease of use and meeting features [4]. Our university contracts with Adobe Connect™, Skype, Google Hangouts™, and WebEx™ Conferencing. For this course, I decided to use WebEx™ Conferencing because I was already familiar with using it during my summer online course, it had tech support from both our university and the company, and it allowed me to have multiple users join the conference and share audio, video and file sharing from anywhere in the world. Also, once I had created an account, I had my own private meeting room which allowed for immediate set up of meetings.

Procedure

Once I had decided on the topics for my course, I started looking for guest speakers for the Friday interactive sessions. My course is at 8 AM in the Eastern time zone, so this limited me to those in the Eastern, Central, and European time zones, as I was quite sure scientists in California would not want to give a 5 AM lecture. I was able to find scientists from the University of North Carolina, University College, London, University of Madrid, Spain, University of Cambridge, London, University of Pisa, Italy, and a company-AFB International in St. Louis Missouri, as well as several speakers who were at my home institution of Virginia Tech and gave the traditional in-class seminars. For all speakers using WebEx™, I sent a WebEx™ "quick start" document, and the link to my personal WebEx™ meeting room at least one week in advance. We then set up a 15-30 minute time prior to their class session to test the system. Speakers did not have to load any software, but simply copied the web address into their browser window and virtually entered my meeting room. They then connected the audio and video, which was easily done through a series of clicks on graphics within the meeting room, and we were ready to go. To share a PowerPoint file, another interactive graphic allowed them to click and either share their desktop, which was showing the PowerPoint presentation, or share their file, which would show their PowerPoint in the meeting room window. Most of my speakers had never used WebEx™ conferencing prior to our meeting and all of them were able to quickly set up in my meeting room within about 15 minutes during our test session. During this time I also asked speakers if I could record their presentation, using the WebEx™ record feature, and most agreed. Students likewise used the link I provided and entered the meeting room during class time, setting up their audio and video for use during the session.

The WebEx™ class sessions were run as follows: The speaker and I usually met in the room at least 10 minutes prior to class start time, and students entered within 2-5 minutes of class start time. Note that students did not come to our regular classroom, but logged in from home, the library or the coffee shop. Once I saw that everyone was in the meeting room, I would start the recording (if the speaker had previously agreed to it) and would introduce the speaker. I would then ask the students to answer a question related to the day's topic as they introduced themselves—for example, on a day were the topic was the genetics of lactose intolerance, I asked the students to tell everyone whether they were lactose tolerant, or intolerant. This question got the conversation going between the speaker and the students, and sometimes, short discussions around that question arose during this introduction time. The speaker then started their 20-25 minute presentation. During the presentation and any time that students were not talking or asking a question, I had everyone but the speaker turn off their mics. This reduced the background noise in the meeting room. To preserve bandwidth, I also had everyone turn off their videos, except the speaker so that we could see him or her doing the presentation. The class ended with a question/answer period, which usually went over class time as most of the speakers were able to generate a lot of interest in their topics. I posted the recorded sessions on our learning management system for students to review.

Results

Most of the speakers have agreed to speak again next year, even though I did not offer any pay or compensation for their time. Following each WebEx presentations I did have the students write a brief thank-you note on VT/Hokie Bird paper, and sent the student notes, my own personal thank-you note, and a VT/Hokie Bird pen to each speaker (even those at Virginia Tech). In the end of the year course reviews, students commented that "it's been one of my favorite classes over my entire college career so far" and that "The weekly guest lectures were awesome - I learned so much from these professional researchers in diverse fields and, importantly, I gained new perspective on some very relevant issues by listening to their talks". In summary, using WebEx™ or any other web conferencing software can allow professors to bring experts directly to the classroom with little to no cost, very little time commitment, and very few problems. As an aside, I've also run my class from home or during a business trip using WebEx, and I've used WebEx conferencing to virtually meet with students who had questions about course materials, and graduate students who wanted to talk on a weekend about a new finding. I highly recommend using web conferencing in the classroom or other facets of academic work, and can envision this technology used in many different disciplines in Agricultural Sciences.

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Submitted by:
Deborah J. Good
Department of Human Nutrition, Foods and Exercise
Virginia Tech
goodd@vt.edu

The Student-Developed Quiz (or Exam): Scaffolding Higher-Order Thinking

Introduction

Active learning can facilitate students' absorption and integration of classroom material (See, for example, Myers & Jones, 1993; Prince, 2004). Active learning can include problem-solving exercises, group work, case studies, and roleplaying, among other activities. In these strategies, however, the assessment of such learning typically remains the domain of the instructor. The dynamic is clear: students learn, teachers assess. In employment situations, however, students must regularly assess their own competencies and performance. For example, employees must continually assess their on-the-job performance and, when given new projects, must assess the extent to which their current knowledge is sufficient. Teaching students how to assess their own knowledge and learning, therefore, is a valuable skill.

One way to teach student how to assess is to invite students to build their own quiz or exam. The act of creating a quiz is both a fun in-class activity and, also, a valuable pedagogical practice. Including students in the process of developing a quiz or exam invites students to higher-order thinking: Rather than just memorize or apply the material, they must think about how to evaluate the material (For more information, see Bloom, 1956). This activity provides what Hogan and Pressley (1997) describe as scaffolding: instructional support that encourages students to function at their highest cognitive capacity.

Procedure

This Teaching Tip outlines one procedure for having students build their own quiz. This procedure was designed for a large undergraduate classroom. The steps are as follows:

Step 1: Approximately two class periods before the quiz or exam, instructors should provide a brief in-class review of the material to be covered on the quiz or exam. Then, give each student an index card, preferably a card that is at least four inches by six inches. Instruct students to create one potential quiz question each, and to write that question on the notecard. The question may be of any format (i.e., multiple choice, true/false, essay, etc.). Students must also write the answer. Students may work alone or in pairs, but must write their name on the card. When finished, students turn in the index cards to the instructor. The cards can be used to note attendance and/or award participation points.

Step 2: During the next class period, the instructor can use the students' suggested questions to help students prepare for the quiz or exam. This can be done by displaying the best questions on a PowerPoint and discussing the answers as a class. The instructor should take care to praise the students' questions and to note any patterns the instructor observed when reviewing the students' questions. For example, the instructor might note that many of the questions revolved around a particular topic or theme, or that none of the questions addressed a particular topic or theme.

Step 3: Develop and administer the quiz. In developing the quiz, the instructor will want to use as many of the students' suggested questions on the quiz as possible. Of course, the instructor may edit, adapt, and/or combine the students' suggestions as needed.

Step 4: During the class period immediately following the quiz, ask students about their experience developing and, then, taking the quiz. Some students will appreciate the learning challenge and will feel a sense of accomplishment. Some students will appreciate the shift in dynamic from teacher-driven assessment to student-driven assessment. Other students will be uncomfortable with this process and the ambiguity inherent in such a shift in roles. Take care to encourage both positive and negative responses, and to validate all students' experiences.

This procedure may be modified as appropriate. For example, students could work in small groups of three to four students to develop a number of quiz questions (e.g., 10 questions per group).

Assessment

This teaching exercise is effective on three levels. First, it is engaging. Students enjoy the challenge of thinking up quiz questions and the pride of seeing their questions on the actual quiz. They often find that it is harder than they would have imagined. Second, the process is itself a form of assessment. The type and difficulty of the questions generated by students give instructors another opportunity assess students' comprehension. For example, instructors may see areas where students are still confused or, alternatively areas where students may be encouraged to think more critically. This information can be used to review material or update teaching methods. Finally, this exercise improves students' analytical skills. In thinking about potential quiz questions, students must approach the course material from a fundamentally different perspective—that of the evaluator or assessor.

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Submitted by:
Jennifer A. Jones
Nonprofit Leadership and Management
University of Florida
jenniferajones@ufl.edu

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