Southern Region Conference
of the

American Association for Agricultural Education

2013 PROGRAM

Held in conjunction with the meeting of the
SOUTHERN ASSOCIATION OF AGRICULTURAL SCIENTISTS (SAAS)

Hosted by:
Department of Agricultural Education and Communication
University of Florida

February 3 – 5, 2013 – Orlando, Florida
Wyndham Orlando Resort

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Recognizing the Factors Influencing Faculty Decisions to Lead the Land Grant System into the Future

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Abstract

Many outside influences are altering higher education including a decline in financial and human resources, changes in student demographics, the impacts of technology, and the shift from an industrial age to an information age. The need for faculty members to step up as leaders that can handle swift changes to the culture and climate of Colleges of Agriculture within the land-grant system are needed now more than ever. Recognizing the need for future leaders, colleges and universities have devoted valuable resources to developing future leaders through leadership training. While participants of leadership programs are often nominated by administrators who see their leadership potential, little is known about why certain individuals choose to volunteer for leadership roles or emerge as leaders. Using the theory of planned behavior, this research explored how attitudes towards leadership training, subjective norm surrounding leadership, and perceived behavioral control over engaging in leadership related to and predicted a faculty member's intent to volunteer for a leadership role within the land grant system. Control, especially over one's perceived amount of time to develop leadership skills, was the only significant predictor of intent. Recommendations included organizational assistance in the creation of capacity that will allow the faculty member to focus on developing their leadership skills as well as the creation of a support network for the faculty member once they have completed training.

Introduction

In the current academic climate, "challenges and opportunities exist simultaneously in the administrative and leadership ranks of our colleges and universities" (Eddy & VanDerLinden, 2006, p. 5). Many outside influences are altering higher education including a decline in financial and human resources (Johnstone, 1999), changes in student demographics (Hurtado & Dey, 1997), the impacts of technology (Baldwin, 1998), and the shift from an industrial age to an information age (Dolence & Norris, 1995). Fehlis (2005, p. 6) stated "leadership is unquestionably the key factor in determining if [the land grant system] will be capable of synthesizing future changes in demographics, science, technology, educational model, and human needs, and then developing a very clear and specific vision for our system."

One would expect to be able to find a clear and concise definition of leadership given conversations surrounding leadership date back to discussions identified in the Greek classics and the writings of ancient Chinese philosophers (Davies, Hides, & Casey, 2001). However, multiple definitions of leadership can be found throughout the literature. While different in description, the definitions of leadership offered by Montgomery (1961), Tannenbaum and Schmidt (1973), Kotter (1990) and Drouillard and Kleiner (1996) all offer a consistent theme. They all indicate that a leader has the ability to influence a group of individuals towards the achievement of a specific goal. This common theme delineates leadership from management. The role of management focuses on coping with complexity while leadership is about coping with change (Khaleelee & Woolf, 1996). Zaleznik (1977) described the differences between management and leadership when he stated:

> leadership inevitably requires using power to influence the thought and actions of other people . . . a managerial culture emphasizes rationality and control. Whether his/her energies are directed toward goals, resources, organization structures, or people, a manager is a problem solver (p. 67).

Many individuals believe leaders are born rather than made, however previous research has shown that while there are some innate leadership skills, others can be developed (Kotter, 1996). Recognizing the need for future leaders, colleges and universities have devoted valuable resources to developing future leaders through leadership training (Eddy & VanDerLinden, 2006). The LEAD21 program, a national leadership development program, was established as an effort to assist colleges of agricultural, environmental, and human sciences, the National Institute of Food and Agriculture (NIFA), and their strategic partners within the land-grant system, in developing leaders who link research, academics, and extension in order to lead more effectively in an increasingly changing environment (Strickland, 2012). The LEAD21 Board of Directors consists of representatives from the Association of Public and Land-grant Universities Committees on Policy (COPS) and other sponsoring organizations and has primary ownership of LEAD21.

A positive future for the land-grant system, like any large organization, is "dependent upon the building and strengthening of leadership and decision making skills" (Nistler, Lamm, & Stedman, 2011, p. 110), and long-term sustainability of any organization is dependent upon emergent new leaders (Collins, 2001). While participants of leadership programs, such as LEAD21, are often nominated by administrators who see their leadership potential, little is known about why certain individuals choose to volunteer for leadership roles or emerge as leaders.

One of the priority areas of the National Research Agenda for Agricultural Education (Doerfert, 2011) is to develop a sufficient scientific and professional workforce that addresses the challenges of the 21st Century, with a focus on "developing the models, strategies, and tactics that best prepare, promote, and retain new professionals who demonstrate content knowledge, technical competence, moral boundaries, and cultural awareness coupled with communication and interpersonal skills" (p. 9). Therefore, a study examining what influences faculty members' choices to volunteer for leadership roles provides vital information and insight that will assist in developing leadership development programs that can ensure the future success of the land-grant system.

Theoretical Framework

The theoretical framework for this study was based on Ajzen's (1991) theory of planned behavior (TPB). TPB identifies three beliefs that guide human behavior: behavioral beliefs, normative beliefs, and control beliefs. Behavioral beliefs represent the attributes of the behavior which include the likely outcomes and the assessment of these outcomes (Ajzen, 2002). Behavioral beliefs produce a favorable or unfavorable attitude toward the behavior. Normative beliefs represent an individual's beliefs about the normative expectations of other people. Normative beliefs result in the perception of social pressure, also known as a subjective norm

(Ajzen, 2002). Control beliefs represent the presence of factors that may assist or hurt an individual's ability to perform a specific behavior. Control beliefs also represent the individual's perceived power over the factors they identify (Ajzen, 2002). Control beliefs drive an individual's perception of the ease or difficulty they associate with a specific behavior, otherwise known as perceived behavioral control. Manipulation of any, or all, of these beliefs is expected to alter the chances a person will intend to perform a specific behavior (Francis et al., 2004). Intention is identified as the immediate antecedent to behavior, therefore, by altering intention it is expected behavior can be manipulated. This study focused on how behavioral, normative and control beliefs influence faculty members intent to volunteer for leadership roles within the land-grant system.

Behavioral beliefs, or attitudes, have been shown to have a strong predictive value as it relates to training effectiveness (Noe, 1986; Noe & Schmitt, 1986; Sahinidis & Bouris, 2008). Noe and Schmitt (1986) found participants' attitudes about training prior to a training event had a direct influence on the eventual training effectiveness (as measured by pre and post behavior and performance criteria). Kovacic (2003) found leadership development programs such as LEAD21 provide valuable training opportunities to participants and are an effective means of developing individual leadership capacity. Consequently, leadership development programs do share common characteristics with more general training interventions; therefore, findings related to attitude and general training are appropriate to apply to leadership development programs. Prislin (1993) determined that attitude was the strongest predictor of intention when an individual had previous experience with a behavior; however, when an individual did not have previous experience, both attitude and normative belief were predictive of a behavior.

Of the three TPB beliefs (behavioral, normative, and control), normative beliefs have been identified as the weakest predictor of intention (Armitage & Connor, 2001). However, there is strong evidence to suggest that some of these findings may have been due to incomplete or inaccurate measures. Armitage and Connor (2001) identified studies where single item measures were employed to measure normative beliefs, versus multi-item instruments. This distinction is consistent with Nunnally's (1978) work identifying the potential for erroneous results when single item measures are employed. When analyzed, the multi-item measures of normative beliefs had more significant correlations with intention than did single item measures (Armitage & Connor, 2001). Nonetheless, there are numerous empirical studies which have demonstrated a direct linkage between normative beliefs and behavioral intention. Specifically, normative beliefs have been correlated with an agricultural group's intention to lead the adoption of conservation technology (Lynne, Casey, Hodges, & Rahmani, 1995), as well as with agricultural teachers' intentions to serve as leaders in the integration of science into their curriculum (Myers & Washburn, 2009). It has also been shown to be predictive of knowledge scores after youth completed an agricultural education program (Lautenschlager-Beckman & Smith, 2008). Finally, normative belief when represented as organizational support has been shown to act as a significant predictor of behavior change (Facteau, Facteau, Schoel, Russell, & Poteet, 1998; Santos & Stuart, 2003).

While attitude and normative belief are critical components to TPB, the third fundamental element is perceived behavioral control. The addition of perceived behavioral control represents a departure from the TPB predecessor, the theory of reasoned action. It is the magnitude of all three facets collectively that has the best predictive characteristics regarding the behavior

(Armitage & Connor, 2001). Consequently, the relative influence of each facet will vary depending on specific circumstances. Previous studies have empirically shown that perceived behavioral control, especially when related to developmental programs, such as leadership development programs, can have a significant influence on effectiveness and the actual change in behavior being sought (McCarthy & Garavan, 2006). Organizational support and/or lack of support has been found, on numerous occasions, to be a critical antecedent to training program effectiveness and individual behavioral change (Chiaburu & Tekleab, 2005; Mathieu & Martineau,1997; Tracey, Hinkin, Tannenbaum, & Mathieu, 2001).

Purpose and Objectives

The purpose of this study was to determine why faculty members choose to step into leadership roles within the land-grant system by completing a quantitative study analyzing a sample population of leadership program participants. The study is guided by the following objectives:

1. Identify faculty members' attitude towards leadership training, subjective norm surrounding leadership, perceived behavioral control over gaining leadership skills and intent to volunteer for leadership roles.
2. Identify if relationships exist between faculty members' attitude towards leadership training, subjective norm surrounding leadership, and perceived behavioral control over gaining leadership skills and their intent to volunteer for leadership roles.
3. Determine if faculty members' attitude towards leadership training, subjective norm surrounding leadership, and perceived behavioral control over gaining leadership skills predicts their intent to volunteer for leadership roles.

Methods

A census of the 83 faculty participating in the LEAD21 leadership development program during the 2012-13 calendar year was conducted. The study was limited to participants of the LEAD21 program because of the selection process used for participation. Participants in LEAD21 are identified as "emerging leaders" and nominated by administrators at their home institutions. LEAD21 participants also represent a balance of faculty from across the land-grant system (1862 institutions, 1890 institutions, 1994 institutions and NIFA).

The target population's access to the Internet enabled the use of an online instrument (Dillman, Smyth, & Christian, 2008). The researcher-designed instrument was reviewed by an expert panel from the University of Florida, Chief Dull Knife College, Michigan State University, and the University of Georgia for content and face validity.

Participants were asked to rate their attitude towards leadership and their perceived behavioral control of gaining leadership skills on a bipolar scale between specific adjectives with a score of one indicating a negative response, and a score of five indicating a positive response. An overall score for attitude and perceived behavioral control was obtained by taking the average of the individual item scores. Participants were also asked to rate their level of agreement with statements signifying a subjective norm surrounding leadership on a five point scale (1 = *Strongly Disagree*, 2 = *Disagree*, 3 = *Neutral*, 4 = *Agree*, 5 = *Strongly Agree*). All item development was based on the structure of questions used in Ajzen's (2002) handbook identifying how to construct a TPB questionnaire.

Participants were contacted through e-mail using Dillman et al.'s (2008) Tailored Design Method. Eighty-one of the 83 participants responded for a final response rate of 97.6% (*N* = 81). Descriptive analysis of the demographic data showed that there were 28 female (33%) and 53 male (67%) respondents. Eighty percent (*n* = 65) of the participants represented 1862 institutions, 16% (*n* = 13) represented minority serving institutions (including 1890, 1994, 2008, and U.S. territory institutions) and 4% (*n* = 3) were from other organizations (USDA, NIFA, APLU, AASCAR).

Descriptive statistics were calculated for the first two objectives. Responses were coded for computer analysis using SPSS. Relationships between attitude, subjective norm, perceived behavioral control, and intent to volunteer for a leadership role were described by calculating Pearson's product-moment correlation coefficient using Davis' (1971) convention. The last objective was calculated using logistic regression with the participants' intent to volunteer as the dependent variable and their perceptions of their attitude, subjective norm, and perceived behavioral control over leadership as the independent variables. A level of significance of .05 was established *a priori*.

Results

Attitude, Subjective Norm, Perceived Behavioral Control and Intent to Volunteer for Leadership Roles

Participants were asked to rate their attitude towards participation in leadership training on a bipolar scale between specific adjectives with a score of one indicating a negative attitude, and a score of five indicating a positive attitude. An overall score was obtaining by taking the average of the individual item scores. Participants reported a very positive attitude towards participating in leadership training (Table 1).

Table 1
Attitude towards Leadership Training (n = 81)

	M	*SD*
Overall Attitude towards Leadership Training	**4.80**	**.44**
Bad/Good	4.82	.45
Negative/Positive	4.81	.46
Unfavorable/Favorable	4.77	.51
Not Very Beneficial/Beneficial	4.76	.48

Note: Scale is 1 = *Left Adjective*, 5 = *Right Adjective*

Participants were asked to rate their level of agreement with five statements signifying a subjective norm surrounding leadership on a five point Likert-type scale with 1 = *Strongly*

Disagree, 2 = *Disagree*, 3 = *Neither Agree nor Disagree*, 4 = *Agree*, 5 = *Strongly Agree*. An overall score was obtained by taking the average of the five item scores for each individual. Participants generally agreed others encourage them to take on a leadership role (Table 2). However, the participants' average level of agreement with the subjective norm items was not as high as their average personal attitudes towards leadership.

Table 2
Subjective Norm Surrounding Leadership (n = 81)

	M	*SD*
Overall Subjective Norm Surrounding Leadership	**3.92**	**.58**
The people I work with whose opinions I value would want me to improve my abilities related to leadership	4.32	.75
The people I work with whose opinions I value work to improve their own abilities related to leadership	3.91	.78
It is expected that I will improve my ability to be a leader this year	3.87	.84
The people I work with who are important to me think I should improve my ability to be a leader	3.78	.78
The people I work with who are important to me work to improve their own abilities related to leadership	3.74	.81

Note: Scale is 1 = *Strongly Disagree*, 2 = *Disagree*, 3 = *Neither Agree nor Disagree*, 4 = *Agree*, 5 = *Strongly Agree*.

Participants were asked to rate their level of control over gaining leadership skills on a bipolar scale between specific adjectives with a score of one indicating a negative reaction, and a score of five indicating a positive reaction. An overall score was obtained by taking the average of the individual item scores. Overall, participants believed they had control over gaining leadership skills (Table 3). It is interesting to note, however, that the items associated with time were lower, indicating many of the participants feel their time is limited and developing leadership skills takes time they may not have control over.

Table 3
Perceived Behavioral Control of Gaining Leadership Skills (n = 81)

	M	*SD*
Overall Perceived Behavioral Control	**4.13**	**.44**
If I want to, I can improve my ability to be a leader this coming year:		

Definitely false/Definitely True	4.71	.53
Improving my ability to be a leader this coming year is:		
Impossible/Possible	4.68	.52
Not up to me/Up to me	4.59	.69
How much control do you have over improving your ability to be a leader this coming year:		
No control/Complete control	4.21	.59
Finding time to improve my ability to be a leader this coming year is:		
Not in my control/In my control	3.93	.85
Impossible/Possible	3.90	.89
Difficult/Easy	2.94	.97

Note: Scale is 1 = *Left Adjective*, 5 = *Right Adjective*

Seventy-nine percent ($n = 63$) of participants reported they planned to volunteer for leadership roles. The type of leadership roles they indicated being interested in volunteering for included department, college and campus-wide committee leadership, roles in professional associations, and climbing the professional ladder (department chair, center director, associate dean, and dean positions).

Relationships between Attitude, Subjective Norm, Perceived Behavioral Control and Intent to Volunteer for Leadership Roles

There were significant moderate correlations between participants' perceived behavioral control of gaining leadership skills and their intent to volunteer for leadership roles ($r = -.36$, $p = .00$) (see Table 4). There was also a significant low correlation between attitude towards leadership training and intent to volunteer for leadership roles ($r = .22$, $p = .05$). The subjective norm surrounding leadership ($r = .06$, $p = .64$), had a non-significant, negligible correlation with intent to volunteer for leadership roles.

Table 4
Correlations between Attitude, Subjective Norm, Perceived Behavioral Control and Intent to Volunteer for Leadership Roles

	Intent to Volunteer for Leadership Roles		
	r	*p*	Magnitude
Perceived Behavioral Control of Gaining Leadership Skills	.36	.00**	Moderate

Attitude towards Leadership Training	.22	.05*	Low
Subjective Norm Surrounding Leadership	.06	.64	Negligible

Note. Magnitude: $.01 \geq r \geq .09$ = Negligible, $.10 \geq r \geq .29$ = Low, $.30 \geq r \geq .49$ = Moderate, $.50 \geq r \geq .69$ = Substantial, $r \geq .70$ = Very Strong.
*$p < .05$, **$p < .01$.

Understanding the Impact of Attitude, Subjective Norm, Perceived Behavioral Control on Intent to Volunteer for Leadership Roles

Logistic regression was used to develop a predictive model. Attitude, subjective norm, and perceived behavioral control were used as the independent variables and intent to volunteer for leadership roles the dependent variable. The model explained 15% of the variance in participants' intent to volunteer for leadership roles. The only significant predictor of intent to volunteer for leadership roles was the participants' perceived behavioral control of gaining leadership skills (Table 5).

Table 5
Predicted Impact of Attitude, Subjective Norm, Perceived Behavioral Control on Intent to Volunteer for Leadership Roles (n = 81)

Constant	β	p-value
Perceived Behavioral Control of Gaining Leadership Skills	1.99	.03*
Attitude towards Leadership Training	1.24	.14
Subjective Norm Surrounding Leadership	-.94	.24

Note. *$p < .05$, $R^2 = .15$

Conclusions and Implications

This research illuminated some of the antecedents and motivations that precede emergent leadership behaviors in a population of land-grant system faculty. Using TPB (Ajzen, 2002) it is possible to establish a framework against which intended behaviors can be predicted. The participants strongly agreed to measurements of all three facets of the theory. Specifically the participants reported a high degree of behavioral belief (represented as a positive attitude toward leadership training), high degree of normative beliefs (believing they and the opinions of those they value would support their leadership development), and a high overall level of perceived behavioral control (having the ability and capacity to work on developing their leadership capabilities).

These descriptive results are somewhat intuitive based on the selection criteria and nomination process used in LEAD21. Participants were expected to demonstrate leadership ability and a desire to take on leadership roles in order to have been selected for participation. However, an examination of how attitude, subjective norm, and perceived behavioral controls are correlated to, and predictive of, an individual's intent to volunteer for leadership roles within the land-grant system was of interest.

Based on the existing literature, attitude should have strong positive correlation with behavioral intention, this being volunteering for leadership roles (Noe, 1986; Noe & Schmitt, 1986; Sahinidis & Bouris, 2008). The results from this study were consistent with the prediction showing attitude and intent to volunteer for a leadership role were positively correlated. However, with any correlational study one must interpret the results with caution as correlations do not denote directionality. Consequently, individuals may have a positive attitude regarding the leadership development program because they had a pre-existing intention to volunteer for leadership roles. The selection process for this program in particular may also lend credence to this scenario.

Previous research has had mixed results regarding the importance of normative beliefs as they relate to behavioral intention (Armitage & Connor, 2001). The results of this study indicated that normative beliefs surrounding leadership do not have a significant correlation to intent and do not predict intent to take on a leadership role. This result confirmed Prislin's (1993) findings that normative beliefs were unrelated to intentions in situations where individuals had pre-existing experience with the behavior. Again, based on the audience and selection criteria, it is highly likely that the participants of this study had exposure to some manner of leadership role previously (for example advising student organizations or leading teams of researchers on grants). Perhaps the absence of correlation or predictive value would be greater in an audience less familiar with the types of leadership roles expected as an outcome of program participation.

Finally, perceived behavioral control is expected to have a significant influence on intentions based on past research (McCarthy & Garavan, 2006). In this study, perceived behavioral control was found to not only be moderately correlated with intent to volunteer for a leadership role but also predictive of this intention. Perceived behavioral control was the only variable which predicted behavior (given an audience of qualified and prepared individuals). These findings are consistent with previous research that predicts control to be strongly associated with intention (Chiaburu & Tekleab, 2005; Mathieu & Martineau, 1997; Tracey et al., 2001); however, this is one of the first studies that has empirically shown it is also predictive under developmental conditions. This study also found that the lowest mean score in the overall measure of perceived behavioral control was related to time; specifically individuals believed that it would be difficult to find the time to develop their leadership skills in the next year.

Recommendations

As a result of this study there are a number of recommendations for practice and future research. With an audience of qualified and prepared individuals, the only facet that had a direct predictive quality on intent to volunteer for a leadership role was perceived behavioral control. The results indicated that when an individual has the necessary attitude and support from their sponsoring organization they are more likely to engage in a leadership role and leadership training. What these results indicated is that the supporting organization needs to become involved in the development of the individual, by specifically assisting the individual in the creation of capacity and finding time to focus on developing their leadership skills. It is reasonable to predict that the majority of individuals that are selected for participation in such prestigious development programs are likely demonstrating a high degree of competence and participation within their respective organization. With time a finite resource, if organizations intentionally support the transition from existing responsibilities to new leadership focused endeavors there should be an increase in observed leadership volunteering behavior. Future research that examines leadership development in a general population versus a nominated group of emergent leaders may help to better illuminate additional correlations. Additional studies from a random sample of representative faculty members tracked in a longitudinal manner would add significant insights to the findings of this particular study. Specifically, if the TPB findings from this study are a predictive antecedent of leadership volunteer behavior as an objective performance outcome.

A second associated recommendation is on the organizational side. Before nominating individuals to participate in such programs it may be advisable to develop an ongoing support plan for when they return, such as a mentoring program. Minimizing obstacles, and thus increasing individual's perceived behavioral control, should have a direct impact on the behavior change (this assumes an individual has the appropriate attitude and normative belief regarding the development program). In the future, research that examines how such pre-emptive preparations influence both the individual's perception of support (perceived behavioral control) as well as actual performance (volunteering for roles) will continue to clarify interactions and influences on anticipated outcomes.

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Discussant Remarks: Dr. Amy Harder, Associate Professor, University of Florida

Recognizing the Factors Influencing Faculty Decisions to Lead the Land Grant System into the Future

This study examines potential factors influencing a select group of faculty members' intent to volunteer for leadership roles in the future. The development of future leaders within the land-grant system is certainly a topic worthy of investigation and consistent with the priorities outlined in the current National Research Agenda for Agricultural Education (Doerfert, 2011). The development of leadership skills is a key consideration in the preparation of agricultural scientists and professionals.

The authors present a well-written theoretical framework outlining the Theory of Planned Behavior. However, it would be beneficial to present a review of relevant literature related to developing leadership behaviors in faculty members to understand if/how this study advances our understanding of the topic.

The authors used appropriate research procedures that support the objectives of the study. An exceptional response rate was achieved, negating the needs to address non-response error. While validity was addressed, the methods section would be strengthened by providing information on the reliability of the three constructs used in the logistic regression. The authors were intentional about their population selection, but it would also be appropriate to note this as a limitation of the study given that the results are not generalizable to the majority of land-grant faculty members who will never participate in LEAD21. Additional research using a more representative sample would magnify the value of this study by providing greater insight about factors influencing faculty leadership behaviors.

A through job is done connecting the conclusions and implications to the theoretical framework, and this study helps to advance our understanding of the Theory of Planned Behavior. The key finding of the study was that overall perceived behavioral control was predictive of intent to volunteer for leadership roles. The authors noted the relatively negative views held by the participants related to the ease of finding time to improve their abilities to be a leader and recommended universities better support faculty in their efforts to manage time in order to improve behavioral intention. It is also possible that the highly positive views held by participants with respect to being able to improve their own abilities as a leader may account for the predictive relationship observed, which if true would require additional organizational changes designed to foster self-confidence in faculty.

The authors are commended for examining a relevant topic, as the value of land-grant universities is increasingly scrutinized under tough budgetary times. The emergence of future leaders will be necessary to advance land-grant universities well into the new century.

Evaluation of Perceptions of Sustainable Agriculture Topics Among Kentucky Agricultural Educators

Bethany Pratt; Graduate Assistant, The University of Kentucky
Rebekah B. Epps, PhD; The University of Kentucky

Abstract

In the agricultural community, sustainable agriculture has become a prominent topic because it approaches the world through the combined lenses of environment, economics and community. Educators across many disciplines are picking up on this and using sustainable agriculture's philosophy and processes in their classrooms. This study was designed as a part of a larger study examining the presence of sustainable agricultural education within the Kentucky agricultural classroom. In this study, the researcher sought to describe the perceptions of sustainable agriculture held by Kentucky secondary agricultural educators and then describe the level of presence sustainable agriculture topics have in the agricultural classroom. Results indicated that secondary educators had a high frequency of agreement with statements that had a sustainable agriculture theme, but their positive perception is not always present in the range of topics covered in the classroom.

Introduction

Sustainability is a word that has recently emerged in the forefront of the American Social context. This term can be seen everywhere from how your toilet paper is produced to the nature of educational material. In the agricultural community, sustainability is also becoming a new buzz word when referring to agricultural practices. For many agriculturalists, sustainability means:

> "A system of agriculture that meets our needs now and for future generations—and that means producing food in a way that can work indefinitely without degrading our health or the natural 'life support systems' we depend on" (Union of Concerned Scientists, 2008).

In the agricultural classroom, the idea of sustainability has been largely deemed, "a philosophy advocating economic, environmental, and social benefits, [rather] than a knowledge base featuring approved farming practices" (Williams, 2000, pg. 22). The interdisciplinary nature of sustainable agriculture could provide educators with the unique opportunity to include a variety of content material into their classroom (Williams & Dollisso, 1998).

Between 1997 and 2009 three separate studies examined some aspect of sustainable agriculture within the high school classroom (Williams & Wise, 1997; Agbage, Martin & Williams, 2001; Williams, 2000). In 1997, Williams & Wise evaluated Iowa agricultural educators and students on their perceived knowledge and impact of sustainable agriculture. Their results indicated that both populations need to learn more about sustainable agriculture practices. This led the researchers to conclude that sustainable agriculture topics need to be incorporated into the curriculum (Williams & Wise, 1997). A follow-up of this study in 2000, sought to determine student knowledge of sustainable agriculture practices and the impact expected from implementation. Overall, the student responses indicated disconnect between knowledge of sustainable practices and perceived impact (Williams, 2000). Since then, there has been one additional study assessing the perception secondary agricultural educators have about sustainable agriculture and the extent to which sustainable agriculture is included in their curriculum. In this study, educators indicated that sustainable agriculture was “moderately” incorporated into their curriculum and that teachers were “unsure” of their beliefs on sustainable agriculture (Agbaje, Martin, & Williams, 2001). The trends that emerged from these studies indicated that both educators and students have a limited knowledge of sustainable agriculture practices. Additionally, all of these studies were geographically based in the north-central region of the United States of America and have not been further researched.

Since 2001, the education system in the United States of America has changed. New national requirements have caused an outcry of concern that students are missing out on natural interactions (Louv, 2005). Educators across the country have begun to bring children back outdoors in a meaningful and agricultural context (Sobel, 2004). Schools such as Martin Luther King, Jr. Middle School in Berkeley, California and the Hampstead Hill Academy in Baltimore, Maryland have begun using school gardens as an integral part of their curriculum (Edible Schoolyard, 2012; Food for life, 2012). In these school gardens and many others, sustainable or organic agriculture practices are most frequently used (Williams & Brown, 2012). Based on national trends, sustainable agriculture is becoming a part of the educational world for teachers of all subjects. However, previous studies or publications on the topics of sustainable agriculture in schools have focused geographically on the Midwest, West, or Northeast. To date, there is no data to indicate the presence of sustainable agriculture within the southern classroom.

This study was designed as the first part of a larger study examining the presence of sustainable agricultural education within the Kentucky agricultural classroom. The larger question researchers are hoping to address over several studies is: Does the current agricultural education in Kentucky adequately reflect the national change in agricultural practices? The first part of this study is an exploration of current Kentucky agricultural educators. This information will provide a baseline of data that can be used to describe the presence of sustainable agriculture within the Kentucky agricultural classroom. Furthermore, this study aligns with Priority One of the National Research Agenda of the American Association of Agricultural Education (AAAE) by exploring Kentucky agricultural educators’ understanding and opinions of sustainable agriculture through their perceptions of the topic (AAAE, 2011).

Theoretical Framework

For the purposes of this study, Sustainable Agriculture/farming is being broadly defined as:

> “meeting environmental, economic, and social objectives simultaneously. Environmentally sound agriculture is nature-based rather than factory-based. Economic sustainability depends on profitable enterprises, sound financial planning, proactive marketing, and risk management. Social sustainability results from

> making decisions with the farm families and the larger community's quality of life as a value and a goal" (Sullivan, 2003).

This definition was chosen because it most clearly defines and identifies the major components of the system of thinking in sustainable agriculture. The US Farm Bill collaborates this definition and defines sustainable agriculture as an

> "integrated system of plant and animal production practices having site-specific application that will over the long term: satisfy human food and fiber needs; enhance environmental quality and the natural resource base upon which the agricultural economy depends… [and] enhance the quality of life for farmer and society as a whole" (112^{th} U.S. Congress, 2008).

In addition, other institutions and organizations surrounding sustainable agriculture have also adopted similar definitions all of which focus on the central themes of environment, economic and social practices which improve quality of life for all.

In contrast to the synergy of sustainable agriculture, industrial agriculture relies on primarily on economies of scale to maximize production and profit with little regard for the environment being used (Union of Concerned Scientists, 2007). Cultural anthropologists view industrial agriculture as the agrarian equivalent of the industrial revolution (Barlett, 1987). In this context, industrial agriculture can be seen as production in the most efficient manner, primarily through mechanization and homogenization of product and process (Katzman, 1974; Horrigan, Lawrence & Walker, 2002). The contrasting concepts of sustainable agriculture and industrial agriculture provide the theoretical framework for the research.

Purpose/Objectives

The purpose of this exploratory study is to examine two facets of the inclusion of sustainable agriculture into the high school classroom:

1. Describe the perception of sustainable agriculture among Kentucky high school agricultural educators.
2. Describe the level of presence sustainable agriculture has in the agricultural classrooms of Kentucky.
3. Describe the demographics of Kentucky high school agricultural educators.

Methods

Instrumentation

To address the research questions, the researcher created a survey instrument to gather data. The instrument is a five part Likert-type survey. The survey was sent with the working title, "Perceptions of Agricultural Topics among Kentucky Agricultural Educators". The researchers intentionally omitted the word "sustainable" from the title. This choice was made in an effort to avoid reactionary responses based on preconceived ideas of sustainable agriculture. Both the researchers and a Panel of Agricultural Experts at a Land Grant University agreed that this was the best way to obtain a true response. In the survey, part one of the survey is, “Topics in Agriculture” and participants were asked to respond to each statement based on their personal reaction. Part two is “Agricultural Topics in your Curriculum” and respondents were asked to indicate the extent to which each topic was included in their classroom curriculum.

For both part one and part two, each statement was categorized either “sustainable agriculture” or “industrial agriculture”. The categorization was tested and approved by a panel of experts. The survey was then piloted on twenty-seven undergraduate agricultural education students in the Department of Social Sciences at the University of Kentucky. The reliability of part one of the surveys was tested using the Chronbach’s Alpha. Reliability was calculated to be a 0.944 indicating that the statements fit reliably into the parameters of the study. The instrument and research objectives were all submitted and approved by the University of Kentucky Institutional Review Board prior to participant recruitment.

Participants

Participants were recruited for the study using the complete list of Kentucky Agricultural Educators (attained from the Kentucky Department of Education). A random number generator was used to randomly select 155 of the 256 educators for the survey. This sample size was determined using the formula developed by Krejcie & Morgan (1970). The participant’s position as an agricultural educator qualified them for the survey. Any active agricultural educator who completed a survey instrument was included in the data regardless of gender, age, or ethnic background.

These educators were then solicited for voluntary participation through a series of mailings following the Dillman tailored design method (Dillman, 2000). The first mailing was a postcard introducing the study. One week later, the survey packet was mailed out. This packet included a participant cover letter, survey instrument, and self-addressed and stamped envelope for returning the survey. Two weeks after that, a follow-up postcard was mailed to all non-respondents. Five days after that, all non-respondents received a second survey packet in the mail. Two weeks after that, a final postcard was mailed to all non-respondents requesting the return of the survey instrument. A total of 65 participants responded for a total response rate of 41.9%.

To address error due to non-response, Ary, Jacobs & Sorensen (2010), recommend comparing early to late respondents based on specific characteristics, which aligns with Miller & Smith’s report from 1983. This was done using four different characteristics asked in part three of the instrument. The characteristics evaluated were: years teaching agriculture; personal farm history; interest or prior participation in professional development in sustainable agriculture, and membership in a professional organization. Test results determined there was no statistically significant difference between early and late respondents, so all the data was collapsed for further evaluation. All responses were entered into the SPSS Statistical Analysis program for evaluation.

Findings

In objective one, the researchers described the perceptions of sustainable agriculture among Kentucky agricultural educators. When evaluating the frequency results of the sustainable agriculture statements, several patterns emerged. Statements with a frequency agreement of 60% and greater reflected the broad theme of environment. These statements addressed topics such as protecting farmland or wildlife, stream buffer zones and air quality. At the bottom of the spectrum (40% and below), statements about social issues were most common. Knowledge of authors and philosophers such as Wendell Berry and John Muir were the least frequently occurring. For each response, a higher percentage frequency indicates the participant more strongly agreed with the statement compared to the group. Complete frequency results from the sustainable agriculture statements can be found below in Table 1.

Table 1
Frequency of Agreement for Sustainable Agriculture Statements

Statement	Percent Frequency	N
Farm land is worth caring for and protecting.	93.8%	61
The protection of wildlife is important to me.	75.4%	49
Protecting natural resources should be a priority.	69.2%	45
Diversification of land use improves farm production.	66.2%	43
I would support government farm programs that encourage the use of sustainable agriculture practices.	66.2%	43
Sustainable agriculture generates revenue for local governments and communities.	64.6%	42
Farming practices should improve the quality of the land.	64.6%	42
It is important to preserve biological diversity of agricultural livestock and crops.	64.6%	42
Micro-and macro-invertebrates are	63.1%	41

important to farming.		
The impact of farming on air quality is important to me.	61.5%	40
Stream buffer zones are an important component of healthy farms and streams.	60.0%	39
Farming practices should maintain the quality of the land.	60.0%	39
It is important to protect forest lands from conversion to non-forest use.	60.0%	39
Livestock is an essential part of integrated farming.	56.9%	37
Profitability is essential for sustainability.	52.3%	34
Heirloom produce and Heritage breed animals are the best way to improve production yield.	52.3%	34
Restoring and/or preserving native grasslands is important to me.	50.8%	33
Organic agricultural practices are the most sustainable farming practices.	49.2%	32
The most important factor in purchasing food is the health value.	44.6%	29
Farm subsidies should be linked proportionally to production.	43.1%	28
I am familiar with the philosophies of Aldo Leopold.	40.0%	26
Organic agriculture practices should be used whenever possible.	36.9%	24

The government should subsidize vegetable production.	35.4%	23
I am familiar with the philosophies of John Muir.	35.4%	23
I am familiar with the philosophies of Wendell Berry.	30.8%	20

Note: Responses were assessed on a 1-5 Likert-type scale where 1=strongly disagree, 2=disagree, 3=undecided, 4=agree, 5=strongly agree.

For statements that fell into the industrial agriculture category, response frequency was also calculated and examined for themes. The same themes of environmental, social and economic were used to group statements. The two statements with the highest frequency percentages (64.6% and 76.9%, respectively), were both statements that referenced economies of scale, which fits with the definition of industrial agriculture used in this study (Union of Concerned Scientists, 2007). When reading results, a higher percent frequency indicates stronger agreement with the statement when compared to the group. The complete frequency results for industrial agriculture statements can be found below in Table 2.

Table 2
Frequency of Agreement for Industrial Agriculture Statements

Statement	Percent Frequency	N
Commodity futures play an important role in the agricultural economy.	76.9%	50
Organic agriculture can be produced commercially.	64.6%	42
Job creation is not a role of sustainable agriculture.	58.5%	38
Farmers should, "Get big or get out." (Earl Butz, US Secretary of Agriculture, 1972).	49.2%	32
US farmers have a responsibility to produce enough food for other countries.	47.7%	31

Profit is the most important result of agriculture.	47.7%	31
The most important factor in purchasing food is the cost.	46.2%	30
Yield is the most important outcome of agriculture.	46.2%	30
Conventional fertilizers are the best way to improve production yield.	44.6%	29
The government should subsidize growers of selected commodity crops.	44.6%	29
Conventional pesticides are the best way to reduce crop loss.	44.6%	29
Genetically modified plant varieties are the best way to improve production yield.	43.1%	28
Most sustainable agriculture practices are not practical for the average farmer.	40.0%	26
Government has no business telling farmers how to use their land.	38.5%	25

Note: Responses were assessed on a 1-5 Likert-type scale where 1=strongly disagree, 2=disagree, 3=undecided, 4=agree, 5=strongly agree.

The second objective was to describe the level of presence of sustainable agriculture in the Kentucky High School Agricultural Education Classroom. This was addressed in part two of the survey where participants indicated the extent to which each subject area was included within their curriculum. Each subject was approved by Faculty in Sustainable Agriculture at a Land Grant University to be an essential topic in Sustainable Agriculture. Individual responses to each statement were entered into SPSS Statistical Analysis for evaluation. The response frequency was calculated and reported below.

Sullivan's definition of sustainable agriculture, with its three themes: environment, economy and society, present a systems-based approach to agriculture (Sullivan, 2003). Researchers used this to determine that each agricultural topic in Part II of the survey could be considered a part of the larger agricultural community. Sustainable agriculture systems thinking promotes exposure and understanding of the varied agricultural practices and philosophies that exist within Kentucky and the United States so that agricultural students will have a comprehensive agricultural education and will be able to make informed decisions about their own agricultural practices.

Part II of the survey was used to identify and describe the topics present in the Kentucky agricultural classroom. Results from analysis of this section of the survey show the two most frequently occurring topics are Agricultural Economics (53.8%) and Genetically Modified Organisms (52.3%). All other topics were present in less than 50% of the curriculum used by surveyed educators. The complete results can be found below in Table 3.

Table 3
Agricultural Topic Presence in the Participant's Classroom

Topic	Percent Frequency	N
Agricultural Economics	53.8%	35
Genetically Modified Organisms	52.3%	34
Sustainable agriculture practices	47.7%	31
Current environmental issues related to farming	47.7%	31
Micro- and macro-invertebrates	46.2%	30
The variety of farming practices used in the United States	46.2%	30
The Community Supported Agriculture (CSA) model	43.1%	28
The impact of agriculture on the planet	43.1%	28
Land conservation strategies	43.1%	28
Organic farming methods	41.5%	27
Animal nutrition	41.5%	27
Agricultural Policy	40.0%	26
Water conservation strategies	40.0%	26
Integrated farm systems	38.5%	25
Genetic diversity	38.5%	25
Animal management	38.5%	25
Agroecology	36.9%	24

Production farming methods	36.9%	24
Integrated pest management	35.4%	23
The relationship between food and health	33.8%	22

Note: Responses were assessed on a 1-5 Likert-type scale where 1=none, 2=low, 3=moderate, 4=high, 5=very high.

In objective three, researchers described the demographics of the sample population. 65 of the 155 Kentucky agricultural educators randomly selected to participate responded. Of the respondents, 61% identified with the male sex and 34% with the female sex and 2% chose not to respond. The average age of the educators was 34.5 years and ages ranged from 23-59 years of age. They had a mean of 9.38 years teaching experience and a range of 1-34 years teaching. Educators were asked if they had a farming history; 93.8% responded positively. Additionally, educators were asked if they considered themselves practicing farmers and 61.5% indicated they were.

Using the County Continuum Code from the Economic Research Service (ERS), participants were asked to self-identify their county of personal residence as well as the location of their work place. In both cases, the majority of educators lived and worked in *urban* communities with a population range of 2,500-249,999 people (ERS, 2012). The complete results of this section of the survey can be found below in Tables 4 and 5.

Table 4
Place of Educator Residence by County Population

Continuum Code Classification	Population	Percent Frequency	N
Rural	< 2,500	23.1%	15
Urban	2,500-249,999	72.3%	47
Metropolitan	>250,000	3%	2

Note: Continuum Code Classification can be found online at http://www.ers.usda.gov/data-products/rural-urban-continuum-codes/documentation.aspx.

Table 5
Location of School by County Population

Continuum Code Classification	Population	Percent Frequency	N
Rural	< 2,500	26.2%	15
Urban	2,500-249,999	64.6%	47

Metropolitan	>250,000	6.1%	3

Note: Continuum Code Classification can be found online at http://www.ers.usda.gov/data-products/rural-urban-continuum-codes/documentation.aspx.

Finally, participants were asked if they had previously participated in a sustainable agriculture professional development program. 27.7% of the respondents confirmed they had participated and 72.3% indicated that they had not. The follow-up question to this was, *Are you interested in professional development for sustainable agriculture?*. 90.8% of respondents indicated positive interest while 9.2% responded negatively.

Conclusion

The purpose of this exploratory study was to describe the presence of sustainable agriculture within the Kentucky high school agricultural classroom. Results of objective one showed that educators overall had high frequencies of agreement with statements that contained a sustainable agriculture theme. However, the statements with the highest overall frequency contained a social and economic theme respectively. The statement with the highest over-all frequency was, *Farm land is worth caring for and protecting* (93.8%). The statement with the second highest overall frequency and economic theme was: *Commodity futures play an important role in the agricultural economy* (75.4%). For objective two, agricultural economics and genetically modified organisms were the two topics with the most frequent occurrence within the educators' curriculum with a percent frequency occurrence of 53.8% and 52.3%, respectively. The results from this study have provided the researchers with a baseline for future study. However, the small sample size of the respondents prevents the preliminary findings of this study to be generalized to populations larger than the immediate sample size.

Implications & Recommendations

From this exploratory study, the researchers have learned that many Kentucky agricultural educators have a common personal interest in preserving farmland as well as a broad range of sustainable agriculture topics. However, results from objective two indicate that those perceptions are not always present within their curriculum. This may relate back to the statement by Williams that sustainable agriculture may still be considered "a philosophy advocating economic, environmental, and social benefits, [rather] than a knowledge base featuring approved farming practices" (Williams, 2000, pg. 22). Results in Table 3 indicate that only 47.7% of educators teach sustainable farming practices. In conjunction with the small percentage of educators who teach sustainable farming practices, 90.8% of respondents cited an interest in attending a professional development on sustainable agriculture. The small classroom presence of sustainable agriculture practice combined with educators' interest in professional development indicates that agricultural educators may want additional training in order to develop comfort with sustainable practices. Further research is recommended in order to determine which sustainable agriculture topics Kentucky secondary agricultural educators want to become more familiar with. After that, it is the recommendation of the researchers the University of Kentucky Agricultural Education Program work to develop a sustainable agriculture training program for pre-service agricultural educators and a professional development program for in-service agricultural educators.

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Discussant Remarks: Dr. Amy Harder, Associate Professor, University of Florida

Evaluation of Perceptions of Sustainable Agriculture Topics Among Kentucky Agricultural Educators

The perceptions of sustainable agriculture topics among agricultural educators in Kentucky form the focus of this study. The authors are commended for selecting a topic of recognized importance, which has a direct tie to not only the National Research Agenda (Doerfert, 2011), but also is a recognized program within the National Institute of Food and Agriculture (NIFA). Preparation of tomorrow's agricultural workforce through agricultural education will require teachers who are prepared to knowledgeably address sustainable agriculture.

The authors provide an overview of the existing literature and appropriately build a case for the need for the study largely based on the lack of research about the topic. The paper would be strengthened by more clearly articulating a theoretical framework and the purpose of the study. A responsible effort was taken to establish the validity and reliability of the survey instrument including the use of an expert panel, report of Cronbach's alpha, and pilot testing using a similar audience. I particularly found the authors' explanation and adherence to Dillman's Tailored Design Method to be worthy of mention.

The authors might consider explaining the Likert-scale responses and how they were interpreted, as well as additional information about how the instrument was developed and data analysis, in the methods section rather than in the findings. Additionally, the tables and narrative may benefit from the increased clarity that would come from showing the frequency responses for each response option rather than just displaying "agreement" or "presence." It was interesting to note the level of interest held by the participants in receiving professional development on sustainable agriculture but the remaining demographics add limited value to the paper when presented as findings.

Connecting the conclusions to the literature and theoretical framework would help readers to better understand the significance of this study. The authors are encouraged to move beyond a summary of the findings to really explore what those findings mean and what their implications are for agricultural education; in other words, dedicate more of the manuscript to answering the question of "so what?" It is recognized that this is a baseline study and the authors are encouraged to continue this line of research to more fully understand how agricultural education teachers can embrace teaching about sustainable agriculture.

The Impact of Problem Solving Style on Team Dynamics while Consensus Building around Agricultural and Natural Resource Issues

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Abstract

Agricultural leadership programs develop agricultural practitioners' ability to serve as opinion leaders when addressing the issues facing the agricultural and natural resource (ANR) sector. As opinion leaders, program participants should be developing problem solving and critical thinking skills to enable their ability to diffuse information about the most current issues. However, little is known about how opinion leaders work together to serve in this role, impacting their ability to disseminate information and teach others about critical ANR issues. This study used a qualitative focus group research method to explore how problem solving style influenced team dynamics while ANR opinion leaders built consensus around critical agricultural and natural resource issues. The findings and resulting recommendations can assist educators in being selective when assigning groups, resulting in more effective teaching and learning processes that will prepare participants to lead diverse teams when building consensus around critical ANR issues.

Introduction

Agricultural leadership programs develop agricultural practitioners' ability to serve as opinion leaders when addressing the issues facing the agricultural and natural resource (ANR) sector. As opinion leaders, program participants should be developing problem solving and critical thinking skills to enable their ability to diffuse information about the most current issues (Valente & Davis, 1999). However, little is known about how opinion leaders work together to serve in this role, impacting their ability to disseminate information and teach others about critical ANR issues.

In agricultural leadership programming the introduction of dynamic group problem solving strategies allows participants to grapple with a variety of perspectives, interpretations, and solutions brought forth by diverse group members. The use of problem solving strategies in agricultural education is common due to the numerous benefits, including an enhancement of problem solving ability, critical thinking skills, and the ability to relate when working in groups (Boone, 1990; Cano & Martinez, 1991; Gokhale, 1995; Phipps, Osborne, Dyer, & Ball, 2008).

Agricultural leadership educators are often put in charge of arranging participant placement in small groups when facilitating group learning experiences. Research has shown a variety of factors influence the experience of a group (Lamm et al., 2012). Well-structured groups should allow participants to "share their conceptual and procedural knowledge . . . so that all [participants] are actively engaged in the problem-solving process and differences of opinion are resolved in a reasonable manner" (Heller & Hollabaugh, 1992, p. 637). However, the influence of group makeup has been minimally studied and never within the context of agricultural leadership programming. Developing various learning interventions and delivery technologies to increase problem solving, transfer of learning, and higher order thinking is part of the National Research Agenda for Agricultural Education (Doerfert, 2011). Therefore, a study exploring how problem solving style influences team dynamics can assist educators in being selective when assigning groups, resulting in more effective teaching and learning processes that will prepare participants to lead diverse teams when building consensus around critical ANR issues.

Theoretical Framework

The theoretical framework for this study is based on both Consensus Building Theory (Susskind, 1999) and Adaption-Innovation Theory (Kirton, 2003).

Consensus Building Theory

Consensus building requires clear communication, for which it then has a number of structural and practical applications. Consensus building suggests that a set of activities can lead a group to a shared result. These activities include (a) establishing overarching shared principles, (b) setting ground rules, and (c) using joint fact finding to resolve factual disputes (Susskind & Field, 1996).

Susskind (1999) identified steps in the process of consensus building for different audiences. The four steps include (a) convening, (b) clarifying responsibilities and strategies, (c) deliberation of issues and barriers to address issues, and (d) decision and implementation. The convening step is initiated by an individual placed in a position to bring key stakeholders together and often referred to as opinion leaders (Rogers, 2003). They convene a group to discuss an issue. During the second step, clarifying responsibilities and strategies, formal roles and responsibilities of group participants, ground rules, and the agenda of the work are established (Susskind, 1999).

The third step, deliberation, is crucial to consensus building as it "pursues deliberations in a constructive fashion" (Susskind, 1999, p. 44). Deliberation is accomplished by expressing concerns in an unconditionally constructive manner to maintain a problem solving approach (Susskind, 1999). Other aspects of the deliberation step include not trading interests for relationships, engaging in active listening, brainstorming, and seeking ways to bridge differences. It is during the deliberation step that participants formally identify the issue and share their experiences with the chosen issue. Feedback, discussion, and action planning occur during the deliberation step (Marshall, Soloman, & Steber, 2001).

The fourth step, decision and implementation, occurs when the group assesses the agreement they have reached (Susskind, 1999). Action items, such as PowerPoint presentations and handouts, are formalized during this phase. It is important to note that consensus building is adaptive and evolving, and it has no real boundaries regarding time, subject matter, and space (Innes & Booher, 1999). A downside to consensus building theory is it often focuses too much on the process while ignoring the impacts of diverse values, cultures, and identities on group dynamics (Schön & Rein, 1994). These differences may "distort communication and thus lead to either poor agreements or no agreement at all" (Fuller, 2009, p. 3).

Adaption-Innovation Theory

Adaption-Innovation Theory (A-I Theory; Kirton, 2003) measures individual problem solving style: how individuals prefer to solve problems. Disparities in individual style results in problem solving and decision making differences between individuals. Cognitive style variations identified when individuals are engaged in specific situations are critical to success and are easily identified by placing individuals in problem solving situations (Kirton, 1976).

A-I Theory (Kirton, 2003) divides individuals into cognitive styles that fall on a continuum between adaption and innovation. Individuals exhibiting an adaptive tendency when problem solving prefer more structure while those exhibiting an innovative tendency appreciate less structure (Kirton, 2003). Adaptors tend to seek to develop "better" solutions by suggesting more technically efficient ideas. Innovators tend to be original and seek to develop "unique" solutions. Innovators will push the boundaries of the environment and often require the realignment of objectives or strategies to ensure success (Foxall, 1986). Innovators believe adaptors play it safe, are willing to conform, appear predictable, are not flexible, and are uncomfortable with ambiguity (Kirton, 1999, 2003). To adaptors, an innovator will appear risky, impractical, exciting, and a threat to the established system (Kirton, 1999, 2003).

There are benefits and challenges to identifying and utilizing problem solving style in the realm of group work. Homogeneous groups, consisting of all adaptors or all innovators, are expected to collaborate easily and will most likely experience success in narrow projects (Kirton, 2003; Lamm et al., 2012). However, success with larger, more ambiguous projects will become difficult for homogeneous groups to handle (Kirton, 2003; Lamm et al., 2012). When too little structure is present, homogenous adaptor groups will become inefficient and stuck because of the breadth of ambiguity. On the opposing side, when too much structure is enforced on a homogenous group of innovators they become frustrated. Team members find themselves trapped in an "inappropriate paradigm or one in dire need of reform" (Kirton, 2003, p. 24) without the ability to make the perceived necessary changes. When heterogeneous groups (i.e., a mixture of adaptors and innovators) are put together to solve a small problem, they can experience communication difficulties as a result of differences in cognitive style (Kirton, 2003). Heterogeneous groups become more efficient when presented with a broad range of problems and asked to work together. Individuals exhibiting cognitive differences approach the aspects of problem solving from unique perspectives offering a variety of resources when approaching a problem. Therefore, heterogeneous groups are expected to be more successful at large-scale problem solving (Gokhale, 1995; Kirton, 2003).

Purpose & Research Question

The purpose of this study was to examine how grouping by problem solving style influenced opinion leaders' ability to work collaboratively when consensus building around an ANR issue. The purpose was guided by the following research questions:

1. How do groups progress through the consensus building process?
2. How do adaptor and innovator characteristics influence team dynamics of homogenous and heterogeneous problem solving style groups when consensus building?

Methods

The qualitative research method of focus groups was used to address the research questions. "Focus groups are carefully planned group meetings designed to collect perceptions and information on a defined area of interest" (Chalofsky, 1999, p. 1). The unit of analysis for this study was focus groups conducted with 30 agricultural leadership program participants. The overall agricultural leadership program included two years of educational sessions that combined lectures and fieldwork on ANR topics designed to develop individual, group, organizational, and industry leadership skills. An agenda building project was included as part of the overall program. The project began with the participants completing an online questionnaire requesting they identify the five ANR issues they believed were most important in their state, how involved they were in the issues, and how they believed the public perceived the issue. The participants indicated water, immigration, and agricultural regulations were the most important issues. The three identified issues served as the issues of interest used for the rest of the project.

The results from the initial questionnaire were compiled and disseminated to the participants during a four-day seminar at the University of Florida a month after taking the survey. Speakers with expertise were recruited to discuss the latest trends and topics associated with water, immigration, and agricultural regulations during the first seminar. One month after the first seminar, the participants took the KAI (Kirton, 2003; Taylor, 1989), an inventory that measures problem solving style. Two months after the first seminar, the participants were brought together for a second four-day seminar. During a two-hour session, the participants were taught what an agenda is, how to build an agenda, how to discuss political topics with internal and external stakeholders, and the importance of communicating properly with decision makers. The participants were then divided into six small homogeneous problem solving style groups based on their KAI scores (three adaptor groups each assigned water, immigration, or agricultural regulation, and three innovator groups each assigned water, immigration, or agricultural regulation) and given two hours to come to consensus while building an agenda based on the pre-assigned issue. The groups were given a worksheet to lead their consensus building efforts requesting they develop answers to eight questions focused on agenda building around their specific issue. At the conclusion of the first two hours, the homogeneous groups were paired with the opposing homogeneous groups to build an agenda on the same topic to form three larger heterogeneous groups, each focused on a separate issue. Participants were told to come to consensus on their issue specific agenda in a two-hour time period. Each team was required to have a PowerPoint presentation at the conclusion of the session to present to the entire group. The educators gave minimal guidance during the group project time.

Data Collection

Three focus groups were conducted, one with each of the heterogeneous groups, at the conclusion of the project. Each focus group lasted approximately one hour. All respondents were coded for confidentiality with a pre-assigned letter designating their problem solving style (A = adaptor group and I = innovator group), letter designating the issue they were addressing (W = water, I = immigration, and R = agricultural regulation), and number based on the order that they first spoke. Three facilitators conducted the focus groups simultaneously. The facilitators assured the participants the information shared would not be associated with them individually prior to the start of each session. The facilitators provided minimal input and allowed the conversation to flow naturally. Effort was made to gain input from all participants. The focus groups were audio recorded, transcribed in detail, and compared with the recordings for verification and elaboration. Observations made by the facilitators, interviews with the leadership program educator, and participant open-ended reflective statements collected at the conclusion of each seminar provided different sources and methods to triangulate the data.

Data Analysis

Once the focus groups were conducted and transcribed, content analysis was used to identify themes related to consensus building in the statements made during the focus groups to answer the first research question and themes related to problem solving style to answer the second research question. Content analysis is defined by Holsti (1969) as a process that is "carried out on the basis of explicitly formulated rules and procedures" (p. 3). The purpose of content analysis is to divide data into categories *a priori* based on a theoretical model, in this case Consensus Building Theory and A-I Theory (Lincoln & Guba, 1985; Neuendorf, 2002).

In order to address observer bias, two coders were used for the content analysis (Lincoln & Guba, 1985). The coders did not have any contact with the focus group participants and were not familiar with the programmatic content. The coders were aware the groups were manipulated based on problem solving style and the intent for the groups to come to consensus on an agenda around a specific topic. The coders reviewed generalities about Consensus Building Theory and A-I Theory together to gain a joint perspective on the identified themes prior to reviewing the focus group transcriptions, (Lincoln & Guba, 1985). The coders then identified patterns, themes, and relationships within the data. At the conclusion of reviewing each of the three groups' reflections, the coders discussed the group's process. The two coders discussed their personal perceptions and generalizations as a peer review and then came together to reach agreement on consistent patterns, themes, and relationships existing within the data. The coders kept an audit trail throughout the process to ensure trustworthiness and used faculty mentors to discuss their coding process for peer debriefing (Lincoln & Guba, 1985).

To ensure transferability of the data, background information on the participants was collected (Lincoln & Guba, 1985). The 30 participants for this study were all engaged in the Wedgworth Leadership Program at the University of Florida. 40% of the participants were female and 60% were male, ranging in age from 27 to 55 years of age. Twenty-seven of the participants were White, two were Hispanic, and one was Asian. The participants represented diverse industry backgrounds including specializations in horticulture, citrus, cattle, vegetable production, and related ANR industry roles.

Results

RQ1: How Did the Groups Progress through the Consensus Building Process?

The results for the first research question are broken down into three themes based on the last steps for consensus building (Susskind, 1999). The first of the steps suggested by Susskind was not included as a theme because the convening step occurred as a part of the program.

Clarifying responsibilities and strategies.

There were five subthemes for how the participants dealt with the clarifications theme: *using resources, being affected by time constraints, dealing with the uncertainty of the activity, merging of personalities,* and *the development of team member roles*.

There were two aspects of the *using resources* subtheme. The first was participants making use of information they learned as a part of their leadership program. IW1 said

> The other part was too rushed, too difficult to start with this, to start with the large amount of research collection that was needed and then to meld the other group's same consideration material into a presentation to give immediately after. . . . But having [program presenter]'s theory, tips, and tactics that should be incorporated into a persuasive presentation, I found that very helpful.

Another aspect of the subtheme was seeking outside information. IW2 said "[IW1] wanted to pull from two or three websites that she knew of, [AW5] and her group got a hold of Farm Bureau . . ., [IW8] brought great pictures. You have to use all sources of information." The Immigration group indicated they had trouble using resources. AI3 said "We didn't have enough available technical computers for us all." In response to a question about using additional resources, AI8 said, "That's what we didn't have time for. By the time we got there, I was freaking out a little bit because people were trying to look stuff up."

Time constraints, the second subtheme, for the process affected all of the groups, particularly when working in the larger group. AW5 said, "We had less time. Less time and more people. . . . More opinions, more information." Suggestions were made to improve the time allotment of the activity. AI8 said, "I'd love to have an hour at the beginning for the small group and two hours with the big group." The time constraint affected what the group members were doing. In the large group, AI4 said, "Some of us had to stop talking so much just to get this done. Unless you totally disagreed with it, that's when people would chime in again." While some participants viewed the time constraint as negatively affecting outcomes, others viewed it benignly or even positively. IW8, who stepped into a leadership role, said, "I will step up and do stuff like that when I know we've got a deadline and I see craziness, but if we would have had a half a day, I would have sat back and just listened to you."

A major issue for many of the participants was the *uncertainty of the activity*, the third subtheme. II2 said, "I wasn't clear on specifically what the outcome was." This uncertainty on the end-goal caused much hesitancy at the beginning of the activity. IR1 said, "It was real like in the beginning, I was like OK, 'Where do we start?' We really need to get organized, but I don't know what to say or know how to help." To get past this uncertainty, many of the participants wanted more information or a better explanation. AI5 said, "Additional information on what our end product should have been would have helped us. . . . We wouldn't have spent as much time trying to figure out what we needed to do, doing what we did." A tactic for getting past the uncertainty was narrowing down the topic. IW9 said:

> Are we going to go this broad with it? No, you probably can't do that because you don't have the time to do that, and it's that broad appeal I think is hard. If you can go in with a

> very, very specific issue like we did or specific piece of legislation, um, then you can gather those facts and figures that you want to.

As a part of this process, the groups had to deal with *merging members' personalities*, the fourth subtheme. Overall, the variety of personalities and viewpoints were valued. AR7 said, "I think any time you do something like this, you're going to improve your problem solving skills just working with different personalities." While different personalities were valued, they could be problematic, particularly when the homogeneous groups merged to become larger heterogeneous groups. AW6 said, "We had formed that small group and whatever, and now you had to go, OK, one more step, you had to grow one more time, so it was almost like you were double processing again." One aspect of this merging of personalities was ensuring that everyone was listening and being heard. AW5 said, "We're all strong leaders and strong personalities, so I know that's a challenge for me. Listen, you gotta listen." AR9 said, "I listen way too much. I need to get my opinion out there and let the rest of the people hear it, and they can take it. If it's useful, it's useful, but if it's not, if they never hear it, nobody ever knows."

The development of team members' roles, the fifth subtheme, was important to the consensus building process. The regulation group spent the most time talking about the roles team members took. AR5 said, "When [IR2] got up and kinda took the lead, spearheaded it, everything kind of funneled that way." As for how roles were decided, IR2 said, "And it was pretty natural. I don't know how that happened but it kind of naturally fell. Everybody fell into place." AR9 responded to this, saying "I can tell you how it happened in my opinion, you (IR2) getting up and taking the bull by the horns. . . . I think [IR2] really helped out in the bigger group." The statements of roles and how they occurred were very similar across groups. Different individuals filled different roles, and this was valued.

Deliberation of issues and barriers to address issues.

There were three subthemes for the deliberation theme*: narrowing down the issues to be more specific, incorporating the different perspectives of team members,* and *the merger of the small groups.* Because of the broadness of the issues, the groups *narrowed down to focus on specific aspects of the issues,* the first subtheme. IR3 said, "It was such a big question. We didn't even know how we could go through that. . . . We tried four different ideas before we found the one we . . . ended up going with."

Narrowing down involved taking into account the various perspectives and ideas offered by group members. IR2 said, "We just threw everything up on the board, figured, okay, if we can just get all the thoughts out there when we get together with the 10 of us, we will be able to narrow it down." Part of this narrowing down process included components that would not make the final presentation. II9 said, "One of the things I thought was interesting was that a lot of the stuff we talked about, it mattered, but it didn't matter for the presentation."

Participants perceived benefits of *incorporating the different perspectives of team members,* the second subtheme, as it improved discussions. AR6 said, "Brainstorming is more effective with a few more people." During the discussion process, group members were able to learn from each other. AW3 said, "I would never have put tourism with this. . . . You know, there's so many things that were interrelated that we don't do a good job looking at others' perspectives that could support the program."

While sharing perspectives tended to be positive, it became contentious with the Immigration group. In particular, some of the group members had issues working with one of the adaptive members. AI6 said, “And at one point, we beat up on [AI5] pretty good because he is in the cattle industry, and he doesn’t have the same labor needs that some of us others have.” AI5 was typing for the group, which also led to conflict.

The *merger of the small groups*, the third subtheme, had effects on the discussion process. All three big groups remarked that the small groups were similar in their ideas. AR5 said, “The good part was when we joined with the other group, we made the comment that probably 80-85% of it, we had the same points.” Despite the similarities, there were still occasional difficulties melding the groups. IW9 said, “It was kind of like ‘Are people arguing?’ No, they’re not arguing. They’re sort of going past each other, not realizing they’re saying the exact same thing, just phrasing it a little differently.” The merger affected how some individuals contributed, including some who did not contribute as much. AR10 said, “You (AR9) were talking a lot in our smaller group, and then I noticed when we got into the bigger group, you quieted down again.”

Decision and implementation.

There were two subthemes for the decision and implementation theme: *how they would act when meeting legislators* and *reflecting on the process and product created*.

The Water group had the most discussion about how they would *act when meeting legislators,* the first subtheme. For some of the participants, the process was viewed as a blueprint they could use when they travelled to Washington, D.C. later in their leadership program. AR6 said, “Thinking about it, how’s it going to be, what am I going to say? And this is a nice opportunity to be part of that blueprint to take with you and to prepare.” The necessity of the outcomes of their activity being used by the other leadership program members in Washington was important to many participants, including having everyone on the same page. AW5 said, “Whoever is the spokesperson, that we are all in agreement and we are all sitting there endorsing it because we are going to go in groups to visit our congressman.” Part of this process for many participants was learning to understand the situation they would be operating in, including the need to make an impression on the legislators and the fluidity of policy situations. IW1 said, “We kept trying to think of how can we find and present information that makes it personal back home, affecting them and their responsibility to their constituents.” IW2 said, “We have to be fairly realistic in the issue, though. Let’s say we did go to Washington and something did happen fast there and we had to change our direction. . . . The urgency is real.”

Immigration was the group that spent the most time *reflecting on the process* of the activity, the second subtheme, although the other groups also did. For the other groups, their statements reflected an appreciation for the work that goes into the lobbying process. IW4, in talking about their current activity and prior experience meeting legislators, said, “The lobbyists had already done all their work so it made me appreciate what the organizations do ahead of time … when it’s an organized fly-in.” Participants also remarked about the differences between groups’ final presentations. II7 said, “It was interesting to look at everybody’s presentations because they were all a little bit different in the subject matter. . . . And because I think everybody had a different takeaway on what we were supposed to be doing.”

RQ2: How Did Adaptor and Innovator Characteristics Affect Team Dynamics of the Homogeneous and Heterogeneous Groups?

The results for the second research question emerged as the coders reviewed the consensus building process. The emergent data broke down into three themes: diversity in perspectives on problem solving, comfort with ambiguity, and leadership roles.

Diversity in perspectives on problem solving.

There were differences between innovators and adaptors in their perspectives on problem solving. The adaptors preferred narrower topics and incorporating more detail and structure into their discussions, as well as providing counter viewpoints to add depth. Innovators preferred broader topics and had more unstructured brainstorming in their small groups. The innovators also expressed fewer issues with the time constraints of the activity. There were three subthemes identified within the diversity in perspectives on problem solving theme: *level of detail, narrow versus broad topics,* and *counter viewpoints.*

The first subtheme related to differences regarding *level of detail*. For example, the Regulation group mentioned how they discussed their topics within their small groups. The adaptors reported being satisfied with the level of detail and thoroughness covered. AR5 said, "I thought we were very thorough in everything that we discussed. We definitely got all our ideas out there. And I don't think we left much out." The innovators tossed around ideas to be narrowed down later in the process. IR2 said:

> It just started with okay, throw it all out there, we haven't even researched this issue a lot it's just based on what we know or maybe what we've learned along the way. And so just throwing everything out there then kind of narrowing it down once we had more support [from the other small group].

The second subtheme related to preferences between *narrow versus broad topics*, with adaptors preferring to have a narrow topic while innovators were satisfied with broader ones. AW5 mentioned the struggles in the small group, saying, "We needed to get way down to one topic and not be so broad because you can't cover that broadness in the amount of time that congressman's going to give you. It just isn't going to happen." AI5 also mentioned being frustrated with trying to provide an answer to a broad topic, saying, "We gave up on trying to give a detailed dumb answer and gave a vague answer." On the other hand, some innovators enjoyed keeping their answers broad, and one group even chose this specifically for its potential impact on a congressperson. IW9 said:

> We were thinking of more, just going in, this is our argument on the agricultural side of it, and we thought no, I think we need to go with a broader base that does affect us and we can tell that story but we can also pull in how it affects other people.

The third subtheme relates to *counter viewpoints* in the discussion. When in the large group, adaptors often provided counter viewpoints. Speaking of her behavior in the large group, AR10 said, "When the bigger group came together, I found that I was trying to do the opposite, 'Let's think about it this way, or don't forget about this.'" The Immigration group mentioned that two people specifically played devil's advocate for the group, and both were adaptors. Some adaptors wanted more time for the large group discussions to meet their satisfaction. AI5 said if they "could have had another hour (AI5)" their answers would be more thorough. Some innovators, however, did not feel that more time was needed. II9 said, "I don't think we need more time. I think you're going to take as much time as you're given."

Comfort with ambiguity.

Adaptors were uncomfortable with the ambiguity of the task while the innovators were more at ease with the lack of clarity, with some even preferring less structure and direction. While both groups expressed confusion at times over the goals of the activity, adaptors tied emotional feelings to this lack of clarity. There were three subthemes identified within the comfort with ambiguity theme: *structure, additional information,* and *emotional response.*

The first subtheme related to differences regarding *structure*. Innovators preferred less structure and adaptors preferred more structure. IR3 believed the assignment would have been clearer and the task easier if the participants had "been told upfront, create a blue print . . . and don't give us specifics." Adaptors on the other hand, felt differently. AI4 said, "That's what I think the challenge was. To take this vague stuff and create something from it. Create a more solid piece."

The second subtheme was for adaptors wanting *additional information* regarding the requirements and expectations of the program staff. While innovators mentioned they were curious and wondered if they were following the staff's expectations, these concerns were particularly salient for adaptors. In response to a statement by AI5 that additional information would have been helpful, AI3 said, "Because I think we could have identified what specific statistical data that you wanted to include."

The third subtheme was the elicitation of *emotional responses* from the adaptors due to the lack of clarity of the assignment. While innovators expressed they wanted to know whether they were meeting expectations, adaptors tied negative emotions around not knowing whether they were meeting these expectations. Innovators provided more neutral statements, such as IR4 saying, "Were we off the mark? Were you looking for us to get more specific into to one type of regulation or was it a blue print?" On the other hand, adaptor statements were tinged with emotion. AR7 said, "We spent a lot of time in the beginning just worried about whether we were doing it right, you know if this is what you're looking for, wasn't looking for." AR10 said, "It was a tad bit overwhelming to have that power presentation beforehand. And to not, I guess, glean everything from it potentially that I needed then have to go back and read my notes."

Leadership roles.

In two of the three groups, the leadership role was taken on by an innovator with positive results. An adaptor took on the leadership role in the third group, resulting in conflict. IR2 stepped into the role of facilitator for the Regulation group. She received praise and appreciation from her group members for tackling this challenging role and helping to channel the thoughts of the group productively. Many of the members of this group mentioned how this role was not given to her, but she "stepped up" into this role. Describing her role, IR2 said:

> Well, I think I was in a good position because I was like kind of standing up so I could hear everybody and see everybody, and I think there was times when maybe someone didn't hear somebody start speaking, and so it was good to kind of be able to stop and say 'Wait, so and so is trying to say something. Let's stop and let them finish their thought

> before you start,' so that we could kind of build consensus that way and make sure everyone agreed is this where we want to go? Is this how we want to do it?

AR9 said, "Before we even get things set up you are already on the computer starting to do a PowerPoint. I mean I thought that got us off. I think [IR2] really helped out in the bigger group." In the Water group, another innovator was appreciated for stepping up to help the group move forward toward the development of the final presentation. IW4 said "I think we were lucky that we had [IW8]… she's over there already working on stuff… okay she's got this, this, and this, and she'd ask for more direction, and I think that's what really got us focused."

While innovators stepping into leadership roles helped facilitate the process for the Water and Regulation groups, an adaptor stepping into a leadership role caused tension in the Immigration group. II1 said they "butted heads," and while AI5 took the leadership in typing up the presentation, there was tension when AI5 would not allow the presenters to dictate to him what they wanted to say. AI5 said he "couldn't see how [some ideas] fit into the presentation." Other group members said he was playing the devil's advocate and pushing the group to see other sides of arguments. This elicited frustration in team members, particularly for lengthening the discussion, which culminated in the group nearly running out of time to finish their presentation.

Conclusions

The finding of this study indicated most of the thematic observations supported A-I Theory (Kirton, 2003). A-I Theory (Kirton, 2003) predicts innovators and adaptors will respond differently to high levels of ambiguity when problem solving. Innovators wanted less structure/details about the project while adaptors desired more details to alleviate the uncertainty. Adaptors also reported negative emotions around the lack of clarity. The adaptors preferred defining problems based on consensually derived agreement, explaining why some acted as "devil's advocates" in both the small and large group settings.

A-I Theory also asserts adaptors are skilled at creating efficient systems while innovators are skilled at creating new systems (Kirton, 2003). This is supported in the conversations that adaptors had about ways the task could be improved, specifically, how time could be allocated differently during the exercise. Innovators demonstrated their skill through restructuring the entire assignment. For example, in one group an innovator sought to expand the group's focus on the problem. As a result, instead of focusing on how water issues affect agriculture, the group chose to focus on how water issues affect all constituents in an effort to get a legislators' attention. Innovators also paid attention to long-term solutions which may explain why the regulation large group focused on discussing the long-term real world effects of their issue.

Overall, the participants appreciated the diversity of the larger groups, which aligns with previous research findings that heterogeneous groups are more effective at solving large scale problems (Gokhale, 1995; Lamm et al., 2012). The mix of characteristics seemed to be part of the success of the Water and Regulation groups. While innovators were active in brainstorming ideas, adaptors assisted with structuring their ideas into a final product. However, these differences were a source of stress in the Immigration group, where the adaptive leader frustrated many group members and communication broke down. The communication breakdown led to a lack of sufficient time to complete the project with full consensus of the group members. The decision and implementation step of the consensus building process requires action items which are difficult to create when discussion continues (Susskind, 1999).

While there were differences, all three groups were able to progress through the consensus building process (Susskind, 1999). The Immigration group, with an adaptive leader, was the only group whose results indicated they did not fully explore all issues and interests before reaching consensus. While time was a barrier, only the Immigration group indicated it prevented full discussion. Having the mix of adaptors and innovators appeared to be key to ensuring differences of opinion were discussed (Heller & Hollabaugh, 1992).

Implications and Recommendations

The findings of this study have implications for the future development of agricultural leadership programs as well as agricultural education broadly. Understanding the ways in which individuals with different problem solving styles interact and recognize the strengths they bring to a group are essential to enhancing the impacts of educational programs on developing problem solving and higher order thinking skills. Current and future adult leadership programs may do well to incorporate, and even manipulate, problem solving style differences in order to give participants practice in dealing with differing viewpoints. This can help prepare them for future leadership positions and increase sensitivity to differing viewpoints.

Within this study, the ambiguity of the problem caused adaptors more stress than innovators, which may explain the tendency of the innovators to step into leadership roles without being asked. Future leadership training programs replicating this program may want to incorporate situations in which the consensus building activity is vague and situations in which the consensus building activity is very explicit in order to draw out the particular strengths of adaptors and innovators, which may lead to more leadership activity amongst adaptors.

Incorporating a reflection session is also important to ensuring participants gain the maximum amount of benefit and learning about the influences of problem solving style on group interaction. In the large groups innovators helped adaptors move beyond the uncertainty of the project, and adaptors helped innovators see differing sides of arguments as well as narrow down the ideas given. Recognizing these different strengths and roles in the moment could help participants gain a deeper appreciation for the diversity of problem solving approaches and prepare them for the challenges and rewards of working with diversity.

To further explore the role problem solving style plays in group consensus building, a study could be conducted in which participants are informed of everyone’s unique style beforehand to examine how interactions differ between groups who are aware of each others’ differences versus groups that are unaware. Finally, a study could be conducted in which a very specific problem is given rather than an ambiguous one to see whether adaptors take on leadership roles to guide the heterogeneous groups into handling a more detailed process.

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Discussant Remarks: Dr. Amy Harder, Associate Professor, University of Florida

The Impact of Problem Solving Style on Team Dynamics while Consensus Building around Agriculture and Natural Resource Issues

In this study, participants in a professional agricultural leadership program coordinated by a land-grant university were intentionally placed into groups according to their problem-solving styles and observed to see how those styles impacted their ability to reach consensus when developing a political agenda. Problem-solving skills, team dynamics, and consensus building are all relevant topics that reach across the "traditional" specializations within agricultural education. Readers from a variety of backgrounds may find the information presented in the paper to be applicable to their work.

Well-written overviews of Adaption-Innovation Theory and Consensus Building Theory are presented by the authors. However, a summary explaining how those two theories specifically framed of the study and a brief (given page constraints) review of related literature would have been beneficial prior to addressing the purpose and research questions. Both research questions are clear, but the title of the paper and the later emphasis on team dynamics in the conclusions, implications, and recommendations section of the paper call into question whether or not the authors would be best served by addressing each question in independent publications. I believe doing so enables the authors to provide greater depth when considering each question, both of which have clear value for agricultural education.

The authors did a commendable job providing detailed methods and findings sections, particularly given the challenges of presenting qualitative work within a limited number of pages. Should the authors elect to consider expanding upon this paper for journal publication, it would be helpful to provide more background on the selection of participants to the agricultural leadership program as the participants are periodically referred to as opinion leaders, but no explanation is provided to justify the use of the title. Additionally, no mention was made of conducting member checks with the participants and this is a critical component for establishing trustworthiness.

Findings from this study confirmed the major tenets of Adaption-Innovation Theory. It is interesting to note that individuals purposively selected into a program on the basis of their leadership potential are still subject to the predictable behaviors outlined by A-I Theory. This is an important lesson highlighting the need to educate everyone – including those identified as some of agriculture and natural resources' best and brightest – on how they can become more effective at solving problems in team situations. The authors provide several excellent recommendations for practice. While those recommendations are intended specifically for agricultural leadership programs, they are worthy of consideration by anyone in the profession facilitating small and large groups.

Risky Business? Exploring Relationships between Optimism, Willingness to Take Risks and Opinion Leadership of Critical Agricultural Issues

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Abstract

Opinion leaders have been shown to have a significant amount of influence on their peers. However, there has been little research examining how individual traits of opinion leaders are related to serving as an opinion leader within agriculture and natural resources and an ability to disseminate information and teach others about critical agricultural and natural resource issues. In general, the assumption has been that these individuals share characteristics consistent with the existing literature; specifically that leaders tend to be optimistically oriented and willing to take risks. Without specific empirical evidence to support this assumption agricultural leadership development programs may be structuring their curriculum in a manner inconsistent with the needs of their intended audience. This study examined opinion leader characteristics related to optimism and willing to take risks in an agricultural leadership program. The findings suggest that contrary to the assumption that an agricultural and natural resource context would not influence specific opinion leader characteristics, this context was germane and these individuals tended to exhibit a less optimistic perspective and were less willing to take risks than anticipated based on existing literature. Recommendations for modifying developmental and communication approaches with these individuals include framing messages in pragmatic terms (versus optimistic), and addressing items in terms of risk avoidance (versus risk taking).

Introduction

Agricultural leadership programs based on the W.K. Kellogg Foundation's original principles share many common attributes, among them to enable agricultural and natural resource practitioners to develop and refine their capability to serve as leaders when addressing the issues facing the agricultural and natural resource industry (Whent & Leising, 1992), "Leadership must be transforming—focused on new ways of being" (Foster, 2001, p. 2). From a transformational perspective these individuals are also serving in an opinion leader capacity and act as critical linkages to the process of diffusion and information dissemination (Chiarelli, Stedman, Carter, & Telg, 2010; Valente & Davis, 1999). There is, however, a distinct lack of available research which examines how individual traits of opinion leaders are related to serving as an opinion leader within agriculture and natural resources (ANR) and an ability to disseminate information and teach others about critical agricultural and natural resource issues.

The existing literature offers numerous leadership theories and studies that would suggest universal application. Yukl, Gordon, and Tabor (2002) found that risk taking was a key attribute in successful change oriented leadership. Similarly, Gardner and Schermerhorn (2004) stated the "task of the authentic leader is to raise optimism." Wunderley, Reddy, and Dember (1998) determined "…optimism and pessimism are among many as yet unidentified factors that contribute directly or indirectly to effective leadership" when studying 48 Cincinnati business leaders. However, Ludwig (1994) found that metropolitan and agricultural opinion leaders differed in their attitudes towards global issues. By analyzing the relationship between risk, optimism, and opinion leadership within a population of agricultural leadership program participants it will be possible to assess the transferability of these theories and better identify the characteristics of potential future opinion leaders that can drive the agricultural and natural resource agenda. Increasing consumer and policy maker understanding about ANR is one of the research priority areas of the National Research Agenda: American Association for Agricultural Education 2011 – 2015 (Doerfert, 2011). Therefore, a study exploring how the trait characteristics of ANR opinion leaders is related to opinion leadership surrounding the political agenda can provide future direction for enhancing agricultural leadership programs to guide future practice related to communicating with consumers and policy makers.

Theoretical Framework

The theoretical framework for this study was based on the theory of opinion leadership introduced by Lazarsfeld, Berelson, and Gaudet (1948). In this context opinion leadership is the two step communication process whereby centrally disseminated information was processed by a group of individual opinion leaders and subsequently shared out to their followers (Lazarsfeld et al., 1948). The process by which individuals become opinion leaders includes self-selection, appointment, recruitment, nomination, or various other selection channels; however, it is clear that within a peer group "…some individuals will act as role models for others. These role models act as opinion leaders within their communities and can be important determinants of rapid and sustained behavior change" (Valente & Davis, 1999, p. 57). "Opinion leaders are people whose conversations make innovations contagious for the people with whom they speak" (Burt, 1999, p. 46). Corey (1971) conducted a study to identify opinion leader characteristics by self-report. The study determined that "opinion leaders will be significantly more involved in activities directly related to their consumer topic than nonleaders…[and] opinion leaders will be significantly more informed than nonleaders about new developments in their consumer topic" (Corey, 1971, p. 50-51). Opinion leaders tend to obtain their "perceived competency" by linking new ideas with the established social system, tend to have a higher socioeconomic status than non-leaders, and are typically more innovative than their followers. Opinion leaders may be seen as more optimistic due to their social standing (Rogers, 2003). Based on these descriptions and definitions of opinion leadership it is logical to conclude that opinion leaders are directly involved in the exercise of influence. In the existing literature one of the most pervasive descriptions of a leader is an individual that uses influence (Ciulla, 2008; Kort, 2008). In 2002 Yukl went so far as to state that "The essence of leadership is influence" (p. 141). Consequently, opinion leaders share the primary characteristic of leadership (in the general sense) and accordingly one would expect that they should share the traits and previously established characteristics of leaders in a broader context. From this perspective ANR opinion leaders should be expected to share characteristics with the existing literature regarding tendencies towards optimism.

Seligman (1998) defined optimism as a cognitive process whereby positive outcomes and expectations are internally originated, permanent, and prolific, negative events are externally originated, fleeting, and situational. Tiger (1979) provided a further definition of optimism as "a mood or attitude associated with an expectation about the social or material future--one which the evaluator regards as socially desirable, to his [or her] advantage, or for his [or her] pleasure" (p. 18). Luthans and Avolio (2003) noted it is difficult to find an inspirational leader who made a positive difference in their community who is not labeled as "optimistic." McColl-Kennedy and Anderson (2002) stated, "…a large body of evidence supports the contention that optimistic expectations of success play a significant role in the achievement of success" (p. 549). Optimism and leadership have subsequently been found to have a direct link with organizational performance (McColl-Kennedy & Anderson, 2002). In this manner optimism is juxtaposed with Seligman's (1998) ''helplessness theory'' that stated when individuals do not believe they will have any influence over the outcome of a situation they are less likely to exert the required effort to be successful. However, Thiel, Connelly, and Griffith (2012) distinguished between helplessness and pessimism in the context of leadership, by stating

> Pessimism is distinguishable from other similarly categorized emotions, such as hopelessness, by its triggers, intensity, and behavioral response. With pessimism, doubt and skepticism about the efficacy of one's own or another's actions are present, resulting in greater questioning or re-thinking of the situation…pessimism has the potential to improve cognitive performance by inducing deliberation and systematic information processing. (p. 519)

Although there is some disagreement in the literature regarding leaders and their orientation towards optimism, the general consensus seems to favor the position that leaders do tend to be more optimistic. Consequently, when extending this expectation to opinion leaders, one would also tend to expect a more optimistic outlook associated with individuals that are most associated with opinion leadership.

Wunderley et al. (1998) stated, "leaders who model an optimistic way of construing events may very well display those behaviors of risk taking and innovation" (p. 752). Information and communication behaviors have been found to be very closely associated with the characteristics of opinion leadership (Arndt, 1972). Strong relationships have been found between risk perception and information seeking behavior, as well as risk perception being correlated with communication behaviors. Conger and Kanungo (1992) found that personal risk was positively correlated with caretaker role, people oriented leadership role, and charismatic leadership role when individuals were asked to assess their supervisors. In certain organizational contexts personal risk taking has been correlated with follower identification of job knowledge of the leader, along with strengthening relations between the leader and followers (Frost, Fiedler, & Anderson, 1983). Conversely, Chan and Misra (1990) found that risk preference was not a significantly determining characteristic of opinion leaders. Chan and Misra did however acknowledge that risk preference is correlated with opinion leadership. Charismatic, transformational, and change related leadership styles all share a risk-taking, or risk proneness, characteristic in the literature (Javidan &Waldman, 2003; Yukl, et al., 2002). Based on the existing literature there is strong support for the position that leaders tend be more willing to take risks. Again, by extension, it would be expected that individuals that are most strongly associated with opinion leadership should also be more willing to take risks.

Purpose & Research Questions

The purpose of this study was to examine how agricultural leadership program participants' perceived optimism and willingness to take risks influenced their ability to serve as opinion leaders when addressing the primary issues facing the ANR industry. The study was driven by the following research questions:

1. What are agricultural leadership program participants' perceptions of their own optimism and willingness to take risks?
2. How do agricultural leadership program participants serve as opinion leaders when addressing the primary issues facing the ANR industry?
3. What relationships exist between agricultural leadership program participants' perceptions of their own optimism and willingness to take risks and how they serve as opinion leaders when addressing the primary issues facing the ANR industry?

Methods

Opinion leaders in ANR were specifically targeted for this study. A census of 30 agricultural leadership program participants in a single southern state was conducted. Previous research has shown that individuals that are selected to participate in such ANR leadership programs are likely to be identified by peers as opinion leaders (Kelsey, 2003; Whent & Leising, 1992). This study is descriptive and correlational. The study was limited to this specific leadership program based on the consistent manner in which individuals are selected for participation. The selection process for participants includes peer nomination followed by screening interviews and ultimately candidate selection.

Of the 30 participants for this study 60% were male and, 40% were female, ranging in age from 27 to 55. Twenty seven of the participants were Caucasian, two were Hispanic and one was Asian. The participants represented diverse industry backgrounds including specializations in horticulture, citrus, cattle, vegetable production and related agricultural and natural resource industry roles.

Initially, the participants engaged in an agenda setting activity where the top ANR issues facing the industry in the state of Florida were identified. The three primary issues identified by the participants were water, immigration, and agriculture regulation. The participants were then surveyed to measure their self-reported levels of optimism and willingness to take risks, in addition to their perceived level of opinion leadership within each of the three identified issue areas.

An online survey instrument was used to collect participant responses based on the target population's access to e-mail and the Internet (Dillman, Smyth, & Christian, 2008). The instrument was developed by combining researcher developed items with questions from previously developed, reliable instruments. Upon completion, the entire instrument was reviewed by a panel of experts knowledgeable in scale development, survey design, and leadership development for internal validity.

To measure perceived level of opinion leadership participants were asked to respond to six unique questions for each of the top three issues facing the agriculture industry in their state (water, immigration, and agricultural regulation), for a total of 18 opinion leadership questions. Questions were based on Childers' (1986) Opinion Leadership instrument, which has been shown to be reliable, with a Chronbach's a of .83 or higher. The instrument was adapted to the context of the question (either water, immigration, or agricultural regulation); however, the structure of the instrument was identical to Childers. The instrument uses a five-place bipolar response format with each question having a unique set of potential responses. In this format pairs of dissimilar statements are presented, one at each end of a rating scale, allowing participants to report their perceived location within the bipolar construct. In this instrument the lowest value, 1, included the negative statement. The highest value, 5, was the positive statement. Items 2, 3, and 4 did not have any descriptions associated; they represented bi-directional judgment placeholders within the scale. Participant responses to the six opinion leadership questions, focused on the specific issue, were averaged to create an overall water opinion leadership score, an overall immigration opinion leadership score, and an overall agricultural regulation opinion leadership score.

An instrument originally developed by Scheier and Carver (1985) was used to measure inherent level of optimism. No modifications to the instrument were made. Previous studies have noted a Chronbach's a of .76 or higher for the instrument (Scheier & Carver, 1985). Scheier and Carver's (1985) instrument asks participants to select their inherent level of optimism in certain situations using 10 statements on a Likert-type scale. The scale ranged from 1 – *Strongly Disagree*, 2 – *Disagree,* 3 – *Neutral*, 4 – *Agree*, 5 – *Strongly agree*. Three of the ten statements were posed in the negative and were reverse coded for data analysis purposes. The responses to the 10 optimism statements were averaged to create an overall optimism index score.

An instrument originally developed by Weber, Blais and Betz (2002) was used to measure risk aversion. No modifications to the instrument were made. Previous studies using this instrument have noted a Chronbach's a of .88 or higher (Weber et al., 2002). On this scale participants were asked to rate 28 statements related to their propensity to take risks on a Likert-type scale. The scale ranged from 1 – *Very Unlikely*, 2 – *Unlikely,* 3 – *Undecided*, 4 – *Likely*, 5 – *Very Likely*. The responses to the 28 risk propensity statements were averaged to create an overall risk propensity index score.

Ex post facto reliability was calculated on the five constructs germane to this study. The water opinion leadership construct had a Cronbach's a= .79, the immigration opinion leadership construct had a Cronbach's a = .87, and the agricultural regulation opinion leadership construct had a Cronbach's a = .88. The perceptions risk aversion construct had a Cronbach's a = .85. The perception of optimism construct has a Cronbach's a = .72. Based on accepted psychological and social science research standards, a Cronbach's a of .70 or greater is considered acceptable (Cortina, 1993; Schmitt, 1996; Streiner, 2003).

Participants were contacted by e-mail using Dillman et al.'s (2008) Tailored Design Method and asked to respond to the online instrument developed in Qualtrics. All e-mail addresses were valid, and a response rate of 100% (N = 30) was obtained.

Data Analysis

Descriptive statistics were used to address the first two research questions using SPSS. Relationships between agricultural leadership program participants' perceptions of optimism, willingness to take risks, and level of opinion leadership related to ANR issues were described by calculating Pearson's product-moment correlation coefficient using Davis' (1971) convention. Davis noted magnitude of the relationship as $.01 \geq r \geq .09$ = Negligible, $.10 \geq r \geq .29$ = Low, $.30 \geq r \geq .49$ = Moderate, $.50 \geq r \geq .69$ = Substantial, $r \geq .70$ = Very Strong.

Results

Perceptions of Optimism

Participants responded to a list of ten statements measuring dispositional optimism related to generalized outcome expectancies (Scheier & Carver, 1985). Four of the items are filler and are not included in calculation. All calculations are based on the remaining six items. Table 1 displays participants' personal perceptions of optimism. Using a five-point scale (1 = *Strongly Disagree*, 5 = *Strongly Agree*); responses to the six included items were summed and averaged to create an overall perception of personal optimism composite score. Overall, the participants were slightly optimistic (*M* = 4.02, *SD* = .60); however, the standard deviation would indicate a significant dispersion of optimism on an individual level. Participants strongly agreed that they expect more good things to happen than bad (*M* = 4.37, *SD* = .62). Participants had the least agreement that in uncertain times they usually expected the best. (*M* = 3.73, *SD* = .83).

Table 1
Participant's Perceptions of Optimism (N = 30)

	M	*SD*
Overall Mean Perception of Optimism	**4.02**	**0.60**
Overall I expect more good things to happen to me than bad.	4.37	0.62
I'm always optimistic about my future.	4.17	0.78
I rarely count on good things happening to me. (RC)	4.03	0.96
I hardly ever expect things to go my way. (RC)	4.03	0.81
If something can go wrong for me, it will. (RC)	3.77	0.94
In uncertain times, I usually expect the best.	3.73	0.83

Note: RC = Reverse Coded. Scale: 1 = *Strongly Disagree*, 2 = *Disagree,* 3 = *Neither Agree or Disagree*, 4 = *Agree*, 5 = *Strongly Agree*

Willingness to Take Risks

Participants responded to a list of 28 statements measuring willingness to take risks across a number of content domains (financial, health/safety, recreational, ethical and social) (Weber, et al., 2002). Table 2 displays participants' personal perceptions of willingness to take risks. Using a five-point scale (1 = *Very Unlikely*, 5 = *Very Likely*), responses to all 28 items were summed and averaged to create an overall perception of willingness to take risks composite score. Overall, participants were undecided on their willingness to take risks (*M* = 2.58, *SD* = .51). Participants were likely to admit their tastes differ from those of a friend (*M* = 4.37, *SD* = .49) and were likely to invest 10% of their annual income in a moderate growth mutual fund (*M* = 4.1, *SD* = 1.03). However, participants were very unlikely to not return a wallet they found that contains $200 (*M* = 1.13, *SD* = .35) and were very unlikely to bet a day's income at a high-stake poker game (*M* = 1.3, *SD* = .65).

Table 2
Participant's Willingness to Take Risks (N = 30)

	M	*SD*
Overall Mean Perception of Willingness to Take Risks	**2.58**	**0.51**
Admitting that your tastes are different from those of a friend.	4.37	0.49
Investing 10% of your annual income in a moderate growth mutual fund	4.10	1.03
Speaking your mind about an unpopular issue in a meeting at work	4.00	0.83
Going camping in the wilderness	3.80	1.40
Choosing a career that you truly enjoy over a more secure one	3.60	1.07
Disagreeing with an authority figure on a major issue	3.57	0.94
Going whitewater rafting at a high water in the spring	3.57	1.43
Starting a new career in your mid-thirties	3.47	1.25
Piloting a small plane	3.03	1.61
Investing 10% of your annual income in a new business venture	3.00	1.41
Moving to a city far away from your extended family	2.93	1.48
Sunbathing without sunscreen	2.63	1.33
Driving a car without a seatbelt	2.50	1.43
Going down a ski run that is beyond your ability	2.47	1.31
Bungee jumping off a tall bridge	2.37	1.56
Taking a skydiving class	2.27	1.44
Investing 5% of your annual income in a very speculative stock	2.20	1.10
Riding a motorcycle without a helmet	2.17	1.32
Walking home alone at night in an unsafe area of town	2.17	1.09
Taking some questionable deductions on your income tax return	2.10	1.21
Drinking heavily at a social function	2.07	0.98
Leaving your young children alone at home while running an errand	1.63	0.81
Revealing a friend's secret to someone else	1.53	0.78
Passing off somebody else's work as your own	1.47	0.94
Betting a day's income on the outcome of a sporting event	1.40	0.72
Betting a day's income at the horse races	1.33	0.55
Betting a day's income at a high-stake poker game	1.30	0.65
Not returning a wallet you found that contains $200	1.13	0.35

Scale: 1 = *Very Unlikely*, 2 = *Unlikely,* 3 = *Undecided*, 4 = *Likely*, 5 = *Very Likely*

Level of Opinion Leadership

Participants responded to a list of six questions related to opinion leadership behaviors for each of the three issues. Table 3 displays participants' personal perceptions of their opinion leadership behaviors related to water, immigration, and agricultural regulation. Using a five-point bipolar response scale (1 = *Low*, 5 = *High*), responses to all six items within a particular issue domain were summed and averaged to create an overall perception of issue opinion leadership score for each category. Participants reported an average level of overall opinion leadership within all three subject matter categories (Water (W): *M* = 3.32, *SD* = .64; Immigration (I): *M* = 3.54, *SD* = .68; and Agricultural Regulation (AR): *M* = 3.45, *SD* = .75).

In the past six months individuals discussed immigration (*M* = 4.20, *SD* = .96) and water issues (*M* = 4.17, *SD* = .95) with more individuals than agricultural regulation issues (*M* = 3.78, *SD* = 1.19). However, individuals were not used as a source of advice on water issues (*M* = 2.73, *SD* = .87) as frequently as they were for immigration (*M* = 3.03, *SD* = .89) or agricultural regulation (*M* = 3.18, *SD* = .82) issues.

Table 3
Participant's Perceptions of their Level of Opinion Leadership (N = 30)

	M	*SD*
Overall Opinion Leadership Surrounding Water Issues	**3.32**	**0.64**
During the past six months, how many people have you told about water issues affecting Florida's agriculture and natural resources sectors? [c]	4.17	0.95
In general, do you talk to your friends and colleagues about water issues… [a]	3.53	0.97
In a discussion of water issues, which of the following happens most? [e]	3.30	1.02
When you talk to your friends and colleagues about water issues, do you: [b]	3.20	0.71
Compared with your circle of friends, how likely are you to be asked about new information relating to water issues? [d]	3.00	0.98
Overall, in all your discussions with friends and colleagues, regarding issues surrounding water are you: [f]	2.73	0.87
Overall Opinion Leadership Surrounding Immigration Issues	**3.54**	**0.68**
During the past six months, how many people have you told about immigration issues affecting Florida's agriculture and natural resources sectors? [c]	4.20	0.96
In general, do you talk to your friends and colleagues about immigration issues… [a]	3.70	0.92
When you talk to your friends and colleagues about immigration issues, do you: [b]	3.53	0.90
In a discussion of immigration issues, which of the following happens most? [e]	3.42	0.72
Compared with your circle of friends, how likely are you to be asked about new information relating to immigration issues? [d]	3.37	0.85
Overall, in all your discussions with friends and colleagues, regarding issues surrounding immigration are you: [f]	3.03	0.89
Overall Opinion Leadership Surrounding Agricultural Regulation	**3.45**	**0.75**
During the past six months, how many people have you told about agricultural regulation issues affecting Florida's agriculture and natural resources sectors? [c]	3.78	1.19
In general, do you talk to your friends and colleagues about agricultural regulation issues… [a]	3.50	0.97
Compared with your circle of friends, how likely are you to be asked about new information relating to agricultural regulation issues? [d]	3.43	0.97
In a discussion of agricultural regulation issues, which of the following happens most? [e]	3.42	0.91

When you talk to your friends and colleagues about agricultural regulation issues, do you: [b]	3.37	0.77
Overall, in all your discussions with friends and colleagues, regarding issues surrounding agricultural regulation are you: [f]	3.18	0.82

Scale: [a] 1 – *Never* to 5 – *Very Often*; [b]1 – *Give very little information* to 5 – *Give a great deal of information*; [c]1 – *Told no one* to 5 – *Told a number of people*; [d]1 – *Not at all likely to be asked* to 5 – *Very likely to be asked*; [e]1 – *Your friends tell you about issues including new developments* to 5 – *You tell your friends about issues including new developments;*[f]1 – *Not used as a source of advice* to 5 – *Often used as a source of advice*

Relationships between Perceptions of Optimism, Willingness to Take Risks, and Level of Opinion Leadership

Both optimism and willingness to take risks composite scores were negatively correlated with participants' perceptions of their level of opinion leadership within all three issues (Table 4). Correlations ranged from negligible to moderate in magnitude. Optimism was moderately negatively correlated with opinion leadership of agricultural regulation issues (R = -.38). Optimism was also negatively correlated with opinion leadership of immigration issues (R = -.11) but had no relationship with opinion leadership related to water issues. Willingness to take risks had a low negative relationship with participants' perceptions of their opinion leadership within all three issue areas. Perceived opinion leadership of agricultural regulation issues had the largest negative correlation with both optimism and willingness to take risks, while opinion leadership of water had the smallest.

Table 4
Correlations between Optimism, Willingness to Take Risks, and Opinion Leadership of ANR Issues

	Optimism		Willingness to Take Risks	
Opinion Leadership of Issues	*R*	Magnitude	*R*	Magnitude
Agricultural Regulation	-.38	Moderate	-.26	Low
Immigration	-.11	Low	-.22	Low
Water	.05	Negligible	-.20	Low

Note. Magnitude: $.01 \geq R \geq .09$ = *Negligible*, $.10 \geq R \geq .29$ = *Low*, $.30 \geq R \geq .49$ = *Moderate*, $.50 \geq R \geq .69$ = *Substantial*, $R \geq .70$ = *Very Strong*.

Conclusions, Implications, and Recommendations

This study provided several interesting insights into opinion leader characteristics, especially those engaged in an ANR-oriented endeavor. Additionally, there are revelations regarding these opinion leader characteristics and their correlation to opinion leadership of contemporary policy related issues. This study has shown there is an overall orientation towards issue awareness and, accordingly, these individuals would typically act in an opinion leader capacity with their contemporaries. The opinion leaders also tend to be nominally less willing to take risks, and have a generally optimistic outlook. These overall results confirm Luthans and Avolio's (2003) statements regarding optimism being associated with leadership. However, the risk aversion results are slightly contradictory to Frost, Fiedler, and Anderson's (1983) positive association between willingness to take risks and leadership. Interestingly, individuals that were identified as having the most knowledge about a particular policy issue tended to have similar characteristics: they were less likely to view situations optimistically, and were less willing to take risks.

As with any sort of empirical results that are analyzed with subsequent correlations reported, the directionality of the correlations must be addressed. The existing literature indicated a leader will typically demonstrate an overall optimistic outlook (Luthens, 2003) and will have a greater willingness to take risks (Conger & Kanungo, 1992). The results of this study seem to contradict the expected results showing ANR opinion leaders tend to be less willing to take risks and less optimistic. However, what one cannot determine from the results is whether these individuals share this common set of characteristics because of their orientation towards taking leadership roles or being recognized as opinion leaders due to their knowledge of the subject matter. For example, Nistler, Lamm, and Stedman (2011) found that affiliation was the strongest need associated with volunteering for leadership positions. From this perspective individuals may wish to serve as opinion leaders first and then become more knowledgeable about policy related issues (information seeking behaviors and referent power to satisfy their need for affiliation). Alternately, individuals may have been elevated to the role of opinion leader by their peers because of their knowledge of the issues (expert power) (Corey, 1971). While directionality of the correlation should be considered for future research, the results of the study do indicate a strong, consistent characteristic disposition across opinion leaders in ANR to be less optimistic and less willing to take risks.

It should be noted that the scope of this study serves as one of the primary limitations. Although findings were unexpected and significant, the size of the population examined was limited. To further confirm the findings a more comprehensive examination of ANR opinion leaders in the United States, and other global locations with similar leadership development programs, should be conducted. Therefore, these results should only be used to gain an understanding of the sample studied and used as a benchmark to inform programs and assist in directing future research initiatives. Nevertheless, on the basis of this study additional conclusions, implications and recommendations are provided.

When considering the context from which the individuals in this study come perhaps these results are not that unexpected. For example, it would be uncommon to expect an agriculturalist to constantly speculate about the perfect growing conditions that are expected. Typically one would believe this group to be overly concerned about too much or too little moisture, too much or too little heat, and the lack of general control over the growing conditions so critical to the success of their endeavors. Perhaps the orientation towards a less optimistic outlook is a conditioned response from years of unpredictable crop yields (and the tendency to remember and reflect on the times when the crop did not come versus the times when a surplus was harvested). Similarly, the orientation towards risk aversion may also be a context-based response. The tendency to attempt to avoid those activities that are risky, and within ones spectrum of control, may be a reaction to the reality that so much of one's livelihood is directly dependent on circumstances outside of one's control (the weather for example).

There is little research that specifically focuses on the characteristics of opinion leaders in the ANR space. Therefore, the implications of this study indicate there may be fundamental differences in the way opinion leaders function based on the context of their leadership. This could in turn have a direct impact on the manner in which these individuals can, and should be, engaged.

Having a better understanding of characteristics associated with an ANR opinion leader should inform future work with this population. Specifically, messages or communications should be crafted in a more pragmatic (less optimistic) manner. Additionally, they should be constructed to highlight how the proposed outcome would have a lower overall risk profile than the alternative. Appealing to these characteristics should in turn reduce some of the initial resistance one may expect to encounter.

ANR leadership development programs may also consider including optimism and risk taking training interventions in their curricula. As was previously noted, the existing literature would indicate that leaders are generally considered to be more optimistic and willing to take risks. The development of these areas in ANR opinion leaders may result in a greater perception of leadership capacity to audiences outside of the ANR industry. Further research is suggested to measure the efficacy and effectiveness of such interventions, not only at an individual level but also at the broader relationship and general influence and perception level.

As was noted previously this study was specific to one state's agricultural leadership program; therefore results and generalization beyond this population should be done with significant care. To confirm the results of this study outside of a specific state, replication studies should be conducted in other representative populations, ideally in both the United States and abroad. Additionally, research into the directionality of the correlations between how ANR opinion leaders and their characteristics should be undertaken.

The results of this study may have a significant impact on the manner in which opinion leaders are recruited (nominations versus characteristics) and the way development programs are structured (appealing to a more referent versus expert power base, or vice versa). This may improve the efficacy of such programs and improve the perceived programmatic worth in the future. Finally, research should continue around the traits and characteristics of opinion leaders in the ANR field.

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Discussant Remarks: Dr. Amy Harder, Associate Professor, University of Florida

Risky Business? Exploring Relationships between Optimism, Willingness to Take Risks and Opinion Leadership of Critical Agricultural Issues

The importance of having trained individuals prepared to educate and advocate on behalf of agriculture and natural resources (ANR) cannot be understated in an environment where consumers no longer clearly understand the issues important to the industry. Even within ANR, a diversity of opinions exists. Therefore, this study designed to better understand the characteristics of ANR opinion leaders and their ability to teach others about critical issues is timely and valuable.

The authors provide a diverse array of literature to support the theoretical framework. They are commended for looking beyond the narrow scope of agricultural education to include relevant literature from complementary fields. There is concern that some of the references may be dated, possibly impacting their relevance to the findings of this current research. It is possible that optimism and willingness to take risks are characteristics that vary by generation, and so what is considered to be “normal” may differ based on when the research is conducted.

A careful job is done when explaining the methods of the study and an excellent response rate was achieved for the survey. While the findings are understandable, it might be more appropriate and more informative for the reader if the frequencies (rather than the means) were presented for the individual survey items. This would give the reader a better sense of the variation across the group, particularly for the respondents’ apparently “undecided” sense of their willingness to take risks. That objective is also worth highlighting, as some of the items measured – notably those with the highest levels of disagreement – asked participants about their willingness to engage in questionably ethical/moral behaviors. It would be interesting to re-examine the group’s overall willingness to take risks if the potentially objectionable items were taken out of consideration, or to consider in future research the possible influence of values and religious beliefs as variables affecting ANR opinion leaders’ willingness to take risks.

The scope of the study does justify the use of caution when interpreting the findings. However, some interesting questions for future research result from this study. For instance, what is the influence of environment on optimism, willingness to take risk, and self-perceived opinion leadership? Although no date was provided for when the data collection occurred, it is reasonable to believe that the uncertain political climate created by last year’s presidential election and the ongoing recession are significant events which may have affected the variables of interest. Understanding the influence of context – which the authors suggest may account for why the ANR participants studied were different from the historical norms for non-ANR opinion leaders – will help to determine if ANR opinion leaders really are less optimistic and more risk averse than opinion leaders from other sectors, or if the general trend during the time of this study was for all opinion leaders to share those characteristics. If future studies confirm that ANR opinion leaders are different than peers from other industries, then the authors’ observation that this may influence how the public perceives the leadership capacity of ANR opinion leaders is a serious concern. It is clear that there is a significant need to continue research in this line of inquiry.

Session B: STEM Preparation

Discussant: Dr. Matt Baker

Effects of Mathematics Integration in a Teaching Methods Course on Mathematics Ability of Preservice Agricultural Education Teachers
Christopher T. Stripling & T. Grady Roberts
Discussant Remarks

Mathematical Strengths and Weaknesses of Preservice Agricultural Education Teachers
Christopher T. Stripling, T. Grady Roberts, & Carrie A. Stephens
Discussant Remarks

The Effect of a Serious Digital Game on the Animal Science and Mathematical Competence of Secondary Agricultural Education Students: An Experimental Study
Dr. J. C. Bunch, Dr. J. Shane Robinson, Dr. M. Craig Edwards, Pavlo D. Antonenko
Discussant Remarks

Correlation of Secondary Agricultural Education Students' Science Achievement to Number of Agricultural Education Courses Passed
Sara Clark, Brian Parr, Jason Peake, Frank Flanders
Discussant Remarks

Effects of Mathematics Integration in a Teaching Methods Course on Mathematics Ability of Preservice Agricultural Education Teachers

Christopher T. Stripling, University of Tennessee
T. Grady Roberts, University of Florida

The purpose of this study was to determine the effects of incorporating mathematics teaching and integration strategies (MTIS) in a teaching methods course on preservice agricultural teachers' mathematics ability. The research design was quasi-experimental and utilized a nonequivalent control group. The MTIS treatment had a positive effect on the mathematics ability scores of the participants, and a statistically significant difference was found based upon the MTIS treatment. Based on the results of this study, the MTIS treatment should be considered for use in an agricultural teaching methods course to increase the mathematics ability of preservice agricultural education teachers.

Introduction

> An increasing number of jobs at all levels—not just for professional scientists—require knowledge of STEM [Science, Technology, Engineering, and Mathematics]. In addition, individual and societal decisions increasingly require some understanding of STEM, from comprehending medical diagnoses to evaluating competing claims about the environment to managing daily activities with a wide variety of computer-based applications. (National Research Council, 2011, p. 3)

However, employers are finding American job applicants do not possess the mathematics and problem-solving skills needed to be successful, and therefore, are turning to international students to fill their STEM positions (National Research Council, 2011). This is not surprising given the fact that the lack of mathematics proficiency among U.S. students is well documented (National Center for Educational Statistics, 2009, 2010, 2011). Furthermore, many preservice teachers, who will be charged with improving the mathematical ability of American students, are not proficient in mathematics, and this has created a troubling cycle in which teachers that are not proficient in mathematics are producing students with mathematical deficiencies, who then become the next generation of mathematics deficient teachers (Michigan State University Center for Research in Mathematics and Science Education, 2010). Similarly, research in agricultural education has shown preservice agricultural education teachers are not proficient in mathematics and are ill-prepared to make a meaningful contribution to the mathematics education of America's students (Miller & Gliem, 1996; Stripling & Roberts, 2012a, 2012b, in press). These findings are troubling since there have been numerous calls for all subject areas to contribute to the learning of academic content. To that end, emphasis is being placed on how agricultural education can contribute to the learning of core academics and research is needed to identify the best methods agricultural teacher education can use to prepare preservice teachers for this role (Myer & Dyer, 2004). Thus, the fundamental problem this study will address is the lack of mathematics proficiency among preservice agricultural education teachers. This study will investigate the effectiveness of the mathematics teaching and integration strategies (MTIS) treatment as a method for improving the mathematics ability of Florida preservice teachers by incorporate the MTIS treatment into the agricultural teaching methods course at the University of Florida.

Theoretical Framework and Literature Review

Bandura's (1986) social cognitive theory served as the theoretical framework for this study. Social cognitive theory seeks to explain the cognitive developmental changes experienced by people during a lifetime and provides a foundation for social learning (Bandura, 1989). Social cognitive theory asserts that cognitive development includes multifaceted sequences over time, and that most cognitive skills are socially cultivated (Bandura, 1986). Thus, people have the ability to shape direct and vicarious experiences into many forms within biological limits (Bandura, 1986). "Patterns of human behavior are organized by individual experiences and retained in neural codes, rather than being provided ready-made by inborn programming" (Bandura, 1986, p. 22). Furthermore, human thought and conduct are influenced by the interaction of experiential and physiological factors (Bandura, 1986). "Social Cognitive Theory encompasses a large set of factors that operate as regulators and motivators of established cognitive, social, and behavioral skills" (Bandura, 1997, p. 35). In addition, Bandura (1986) described behavior using the framework of triadic reciprocality (Figure 1) among behavior, environmental influences, and personal factors.

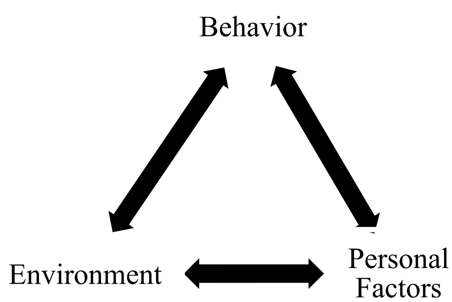

Figure 1. Triadic reciprocality model (Bandura, 1986, p. 24).

The interacting determinants of the triadic reciprocality model influence each other bidirectionally (Bandura, 1986). However, according to Bandura (1997), the reciprocal interactions are not of equal strength, and one determinant may demonstrate dominance over the others; although, in most situations, the determinants are vastly interdependent. Furthermore, time is needed for casual factors to exercise their influence, and that time makes it possible for one to study or understand the reciprocal causations (Bandura, 1997). For this study, the behavior of teaching contextualized mathematics, the environments of the teacher education program and the teaching methods course, and the personal factor of mathematics ability influence each other bidirectionally (Figure 2).

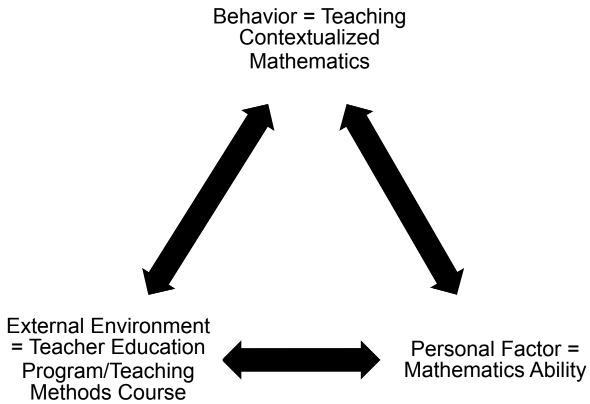

Figure 2. Triadic reciprocality model. Adapted from Bandura (1986).

Behavior: Teaching Contextualized Mathematics

When examined through the theoretical lens of social cognitive theory (Bandura, 1986) teaching mathematics found naturally in agriculture or contextualized mathematics is influenced bidirectionally by environmental and personal determinants within triadic reciprocal causation (Bandura, 1986). The behavior of teaching agriculture has also been influenced by the call to integrate academic subjects within career and technical education. Furthermore,

> expectations and ideals endorsed by current reform efforts in mathematics education (e.g., NCTM, 2000) challenge prospective teachers in their thinking about mathematics teaching and learning. Teachers are asked to teach in ways that promote an integrated, connected view of mathematics, rather than a procedural, rule-based view. (Benken & Brown, 2008, p. 1)

As a result, emphasis has been placed on teaching academic subjects in context (Shinn et al., 2003). Contextualized learning advocates neither general education nor career education can be taught in isolation but must be integrated to maximize the benefit for the learner (Prescott, Rinard, Cockerill, & Baker, 1996). Secondary agricultural education is an authentic context "rich with opportunities for learning mathematics" (Shinn et al., 2003).

The mathematics integration literature specific to agricultural education is limited. However, several studies have been conducted to test the effectiveness of the Math-in-CTE model (Stone, Alfeld, Pearson, Lewis, & Jensen, 2006). In a study of 38 secondary agricultural classes, Parr, Edwards, and Leising (2006) sought to determine if students that participated in a "mathematics-enhanced high school agricultural power and technology curriculum…would develop a deeper and more sustained understanding of selected mathematical concepts than students who participated in the traditional curriculum, thus resulting in less need for postsecondary mathematics remediation" (p. 84). Results indicated students who took part in the math-enhanced curriculum were less likely to need postsecondary remediation. In a similar study published in 2008, Parr, Edwards, and Leising investigated if students in a math-enhanced agricultural power and technology course would differ significantly from students in a traditional agricultural power and technology course in their technical skill acquisition. Parr et al. (2008) reported no significant difference in technical skills. In a third study investigating the effects of a math-enhanced agricultural power and technology curriculum, Parr, Edwards, and Leising (2009) did not find a significant difference in the mathematics ability of secondary students. Parr et al. (2009) hypothesized that this may have been due to the fact "of incomplete implementation of the treatment as reported by some experimental teachers coupled with an intervention time frame of only one semester" (p. 1).

The Young, Edwards, and Leising (2008, 2009) inquiries were very similar to the studies of Parr et al., (2006, 2008, 2009). Young et al. (2008) sought to determine if math-enhanced agricultural power and technology curriculum would significantly increase the mathematical ability of secondary students compared to a traditional mathematics agricultural power and technology curriculum. Results did not show a significant statistical difference in mathematics ability between the experimental and control groups. In 2009, Young et al. published a second study that mirrored Parr et al. (2008). However, this investigation was a one year analysis verses a semester long analysis. The results also mirrored the results of Parr et al. (2008) in which technical competence was not diminished by the math-enhanced curriculum.

Personal Factor: Mathematics Ability

Only a few studies that investigated the mathematics ability of preservice agricultural education teachers were found. Stripling and Roberts (2012a) sought to determine the mathematics ability of preservice teachers at the University of Florida during the Fall 2010 semester. Stripling and Roberts reported that the preservice teachers averaged 35.6% on a 26 item agricultural mathematics instrument and concluded that the preservice teachers were not proficient in agricultural mathematics concepts. Similarly, Stripling and Roberts (2012b) investigated the mathematics ability of the nation's preservice agricultural teachers. Based on their sampling criteria Stripling and Roberts reported the population mean was estimated with 95% confidence to be in the range of 28.5% to 48.5%. As a result, Stripling and Roberts concluded preservice agricultural education teachers are not proficient in mathematics. Furthermore, Stripling and Roberts found preservice teachers that completed an advanced mathematics course scored 19.48 percentage points higher than those that did not complete an advanced mathematics course and those that received an A in their highest college mathematics course scored 6.40 percentage points higher than those that did not receive an A.

In a pre-experimental study, Stripling and Roberts (in press) investigated the effects of a math-enhanced agricultural teaching methods course on preservice teachers' mathematics ability. Stripling and Roberts found the math-enhanced agricultural teaching methods course had a positive effect on the preservice agricultural educations teachers' mathematics ability scores. Stripling and Roberts posited peer-teaching that utilizes the seven components of a math-enhanced lesson may be an appropriate means to improve preservice teachers' mathematics ability and suggested that a quasi-experimental research design be utilized to further examine the effectiveness of math-enhanced agricultural teaching method courses.

Consistent with Stripling and Roberts (2012a, 2012b, in press), Miller and Gliem (1996) reported preservice agricultural education teachers averaged 37.13% on a mathematics problem-solving ability instrument. Miller and Gliem also reported preservice teachers with higher scores had completed advanced mathematics courses, completed a fewer number of mathematics courses, and possessed higher ACT math scores. The researchers concluded the "preservice agriculture educators were not capable of applying basic mathematics skills to agricultural problems" (Miller & Gliem, 1996, p. 19).

Environment: Teacher Education Program and the Teaching Methods Course

In the context of social cognitive theory and triadic reciprocality, the teacher education program is the underlying environment for preservice teachers to develop into effective educators. "The goal of preservice teacher education is to make the most effective use of the time available to prepare future educators for the task awaiting them" (Myers & Dyer, 2004, p. 47). More specifically, teacher education programs should "create opportunities for prospective teachers to develop productive beliefs and attitudes toward teaching and learning mathematics" (Charalambous, Panaoura, & Philippou, 2009, p. 161). Ensor (2001) found beginning teachers drew upon their experiences in a teacher education program to develop "a professional argot–a way of talking about teaching and learning mathematics" (p. 296). Berry (2005) stated research-proven instructional strategies in mathematics and literacy make a difference in student achievement as teacher educators incorporate the strategies into the teacher education program. However, preservice teachers sometimes finish their academic program with trivial changes in their content knowledge, teaching, and learning beliefs (Kagan, 1992; Seaman, Szydlik, Szydlik, & Beam, 2006). One cause is teacher education programs do not connect pedagogy and academic content throughout the teacher education program (Ishler, Edens, & Berry, 1996). To that end, the *National Standards for Teacher Education in Agriculture* (American Association for Agricultural Education, 2001) only indicate mathematics is an expectation within general education and guidelines for connecting pedagogy and academic content throughout the teacher education program were not given. Moreover, Myers and Dyer (2004) reported a gap in the literature on how preservice agricultural teacher education programs should prepare preservice teachers to contribute to the learning of core academic subjects.

In addition to the teacher education program, the teaching methods course is theoretically expressed as part of the physical and social environment from a social cognitive prospective. Furthermore, in the context of this study, the behavior of micro-teaching is theoretically a component of the social environment. The environment is not conceptualized as a fixed entity but is shaped by personal and behavioral influences (Bandura, 1989). Thus, micro-teaching influences the environment of the teaching methods course. To that end, Bandura (1986) stated not only do people learn from their actions, they can also learn by vicarious experiences or by observational learning. Observational learning allows a person to develop generalizations that can be used to influence future behavior without having to learn by experimentation or trial and error (Bandura, 1986). According to Bandura, most human behaviors are learned by observing others, and observational learning increases one's knowledge and cognitive skills.

The literature specific to an agricultural education teaching methods course is limited. Ball and Knobloch (2005) examined agricultural education teaching methods courses to identify the reading required, the types of assignments given, and the teaching methods taught. The researchers found Newcomb, McCracken, and Warmbrod's (1986) or Newcomb, McCracken, Warmbrod, and Whittington's, (1993) *Methods of Teaching Agriculture* was the most frequently required reading source. Additionally, the most frequent assignments were lesson plans and micro-teaching. Ball and Knobloch also found 22 different teaching methods were taught among the teaching methods courses. However, the researchers found teacher educators only spend on average 20.8% of their course on teaching methods. A study by Cano and Garton (1994a) sought to determine the personality type of preservice agricultural education teachers enrolled in an agricultural teaching methods course and determined all personality types were represented. As a result, Cano and Garton (1994a) suggested teacher educators use "teaching approaches effective with all of the learning preferences" (p. 11). In a related study, Cano and Garton (1994b) purported preservice teachers of agriculture need to have an understanding of how learning styles affect teaching and learning and should be "taught how to adapt their teaching style to be inclusive of the various learning styles of students" (p. 9). Stripling, Ricketts, Roberts, and Harlin (2008) examined the impact of the teaching methods course on teaching efficacy. Stripling et al. found instructional strategies, student engagement, classroom management, and overall teaching efficacy increased from before the teaching methods course to after the teaching methods course and from after the teaching methods course/before student teaching to after student teaching. In addition, Stripling and Roberts (in press) investigated the impact of a math-enhanced agricultural teaching methods course on personal mathematics efficacy, mathematics teaching efficacy and personal teaching efficacy. Stripling and Roberts reported the preservice teachers' personal mathematics efficacy decreased while mathematics teaching efficacy and personal teaching efficacy increased. However, the researchers stated the changes in self-efficacy were not statistically significant.

Purpose and Hypothesis

The purpose of this study was to determine the effects of incorporating mathematics teaching and integration strategies (MTIS) in a teaching methods course on preservice agricultural teachers' mathematics ability. The following null hypothesis was used to guide this inquiry, and a significance level of .05 was determined *a priori*.

H_{01} – There is no significant difference in the mathematics ability of preservice agricultural education teachers based upon the MTIS treatment.

Methodology

Research Design

This research was quasi-experimental and utilized a nonequivalent control group design (Campbell & Stanley, 1963). The research design was illustrated by Campbell and Stanley (1963) and is shown below:

$$O_1 \quad X \quad O_2$$

$$O_1 \qquad\quad O_2$$

According to Campbell and Stanley, selection interaction effects and possibly regression are threats to the internal validity of the nonequivalent control group design. Selection interaction effects are when other threats to interval validity interact with the selection of groups in multiple-group, quasi-experimental designs and are mistaken for the effect of the treatment (Campbell & Stanley, 1963). Thus, selection interaction effects are a limitation of this study. Statistical regression is the selection of participants based upon extreme scores (Campbell & Stanley, 1963). This was not an issue in this study. Participants were not selected based on extreme scores. Furthermore, the following possible threats to internal validity are controlled by the nonequivalent control group design: history, maturation, testing, instrumentation, selection, and mortality (Campbell & Stanley, 1963).

This design was utilized because random assignment of subjects was not possible due to the fact the subjects under investigation self-registered for a section of the teaching methods course at the University of Florida that best fit their schedule of classes. To that end, the students self-registered for one of three sections of the teaching methods course, and the MTIS treatment was randomly assigned to two of the sections, which resulted in an experimental group of 13 preservice teachers and a control group of 6 preservice teachers. The authors recognize sample size is a limitation of this study. Therefore, the findings of this study should not be generalized beyond the sample, unless data confirms the sample is representative of other populations of preservice agricultural education teachers.

The agricultural education teaching methods course at the University of Florida is organized into lectures and labs and is the instructional methodology course that "focuses on the selection and use of teaching strategies, methods/approaches, and techniques; evaluating learning; and managing learning environments for teaching agricultural subjects in formal educational settings" (Roberts, 2009, p. 1). The lectures are utilized to deliver content information related to teaching methods, strategies, and approaches. The labs are utilized to allow the preservice teachers to deliver micro-teachings to their peers, and the micro-teachings are based on the content discussed in the lectures. The MTIS treatment utilized in this study was assigned to the teaching methods lab sections randomly. The treatment group was administered the MTIS, and the control group received the same instruction except for the MTIS. The composition of the teaching methods course and the treatment are discussed further in the procedures sub-section.

Furthermore, the following student characteristics were included in this study as antecedent variables: gender, grade point average, number and type of mathematics courses completed in high school and college, grade received in last mathematics course completed, and age of the preservice agricultural teachers. The aforementioned variables were examined to determine if differences were present between the control and experimental groups. Chi-square tests were used to determine if significant differences existed between the groups for categorical data, and independent samples t-tests were used to determine if significant differences existed between the groups for continuous data. No statistically significant differences were found between the control and experimental groups in regard to the antecedent variables.

Population and Sample

The target population for this study was Florida preservice agricultural education teachers. The accessible population for this study was present undergraduate students in their final year of the agricultural teacher education program at the University of Florida. For this study, the accessible population was a convenience sample, which was conceptualized as a slice in time (Oliver & Hinkle, 1981). Gall, Borg, and Gall (1996) stated convenience sampling is appropriate as long as the researcher provides a detailed description of the sample used and the reasons for selection. To that end, the sample was selected based on Stripling and Roberts' (2012a, in press) studies, which found Florida preservice teachers were not proficient in mathematics.

The sample consisted of 19 preservice agricultural education teachers, 16 females and 3 males. The average age of the sample was 21.5 years old (SD = 1.12) with a range of 20 to 25.

All of the participants described their ethnicity as white and were seniors in an undergraduate agricultural education program. Their self-reported mean college grade point average was 3.44 (*SD* = 0.28) on a 4-point scale. The number of college level mathematics courses completed by the participants ranged from one to five with a mean of 3.02 (*SD* = 1.09), and two of the participants reported that they had not completed a mathematics course since high school. Thus, the time since the participants' last math course ranged from the previous semester in college to their senior year in high school or about four years prior. Lastly, 31.6% received an A, 21.1% a B+, 26.3% a B, and 21.4% a C in their highest level of mathematics successfully completed in college, and the highest mathematics course most often completed during college was introductory statistics.

Instrumentation and Data Collection

The *Mathematics Ability Test* (Stripling & Roberts, 2012b) was utilized in this study. The *Mathematics Ability Test* is a researcher-developed instrument that was developed based on the 13 National Council of Teachers of Mathematics (NCTM) sub-standards (Carpenter & Gorg, 2000) that are cross-referenced with the *National Agriculture, Food and Natural Resources Career Cluster Content Standards* (National Council for Agricultural Education, 2009). The instrument consists of 26 open-ended mathematical word problems or two items for each cross-referenced NCTM sub-standard, and the sum of the 26 items measures one construct – mathematics ability. According to Stripling and Roberts (2012b), the *Mathematics Ability Test* was pilot tested during the Fall 2010 semester at the University of Florida. The pilot test consisted of 25 preservice agricultural education teachers and yielded a Cronbach's alpha coefficient of .80 for the mathematics ability construct. Stripling and Roberts also reported face and content validity of the instrument was established by a panel of experts consisting of agricultural education and mathematics faculty from three universities and two secondary mathematics experts. A demographic section was added to the *Mathematics Ability Test* and the participants self-reported gender, age, ethnicity, grade point average, number of math courses taken, highest level of mathematics taken, and grade received in last mathematics course completed. Additionally, one of the researchers and a mathematics expert individually scored the *Mathematics Ability Test*, and items were scored incorrect, partially correct (students set the problem up correctly but made a calculation error), or correct. The scorers used a rubric that was developed by two secondary mathematics experts to score each item. Since more than one scorer was utilized, inter-rater reliability was assessed using Cohen's Kappa, and the analysis yielded a Cohen's Kappa of .95.

The data collection period of this study was during the Fall 2011 academic semester. Data were collected from preservice agricultural teachers during their final year of an agricultural teacher education program at the University of Florida. The agricultural education preservice teachers agreed to participate and complete the *Mathematics Ability Test* by signing an informed consent, which was approved by the Institutional Review Board at the University of Florida. Participants were informed the researchers would protect their privacy rights by ensuring anonymity and appropriate storage of data. Also, since students received and completed the instrument during an agricultural education course, they were informed that participation in the study would not have an impact on their course grades. A script was also developed and read to standardize administration, minimize error variance, and experimenter effects. The *Mathematics Ability Test* (Stripling & Roberts, 2012b) took the participants approximately 60 minutes to complete and was administered twice: (a) week 2 of the semester; and (b) week 16 of the semester.

Procedures

The treatment of this study was devised by the researchers and was incorporated into the teaching methods course during the final year of a teacher education program at the University of Florida. The MTIS treatment consisted of three parts. First, one researcher prepared and delivered a lecture to the treatment group of preservice teachers, which explained and demonstrated how to use the National Research Center for Career and Technical Education's seven components of a math-enhanced lesson (Stone et al., 2006; Figure 3) to teach contextualized mathematics concepts. The lecture was reviewed by an expert on the seven components of a math-enhanced lesson to ensure validity. Second, each preservice agricultural education teacher in the treatment group was randomly assigned two of the 13 NCTM sub-standards (Carpenter & Gorg, 2000) that have been cross-referenced to the *National Agriculture, Food and Natural Resources Career Cluster Content Standards*. Third, the preservice teachers in the treatment group were required to teach the two NCTM sub-standards to their peers in the treatment group using the seven components of a math-enhanced lesson (Stone et al., 2006). Therefore, each preservice teacher in the treatment group participated in the math-enhanced lesson lecture, integrated mathematics into two of the eight normally required micro-teachings of the teaching methods course, and observed their peers teaching up to 12 math-enhanced lessons, while roleplaying as a secondary student. For this study, a math-enhanced lesson is defined as an agricultural lesson that incorporates Stone et al.'s (2006) seven components of a math-enhanced lesson. In summary, beyond what was previously required in the teaching methods course the treatment added the following three elements: (a) a lecture on the seven components of a math-enhanced lesson, (b) random assignment of the NCTM sub-standards among the preservice teachers, and (c) requiring two of the micro-teaching lessons to be math-enhanced.

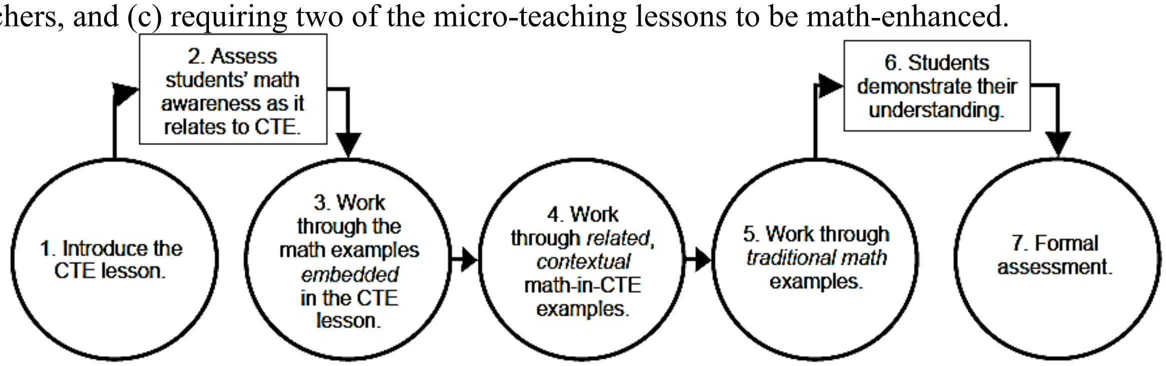

Figure 3. The National Research Center for Career and Technical Education: 7 Elements of a Math-Enhanced Lesson model (Stone et al., 2006, p. 13).

Analysis of Data

Frequencies, means, and standard deviations were calculated to summarize demographics and the mathematics ability scores of the preservice agricultural education teachers. ANCOVA was also used to determine if a significant difference existed in mathematics ability based upon the MTIS treatment. Partial eta squared was used to calculate effect size, and Huck's (2008) descriptors were utilized to describe the effect (.01 is a small effect size, .06 is a medium effect size, and .14 is a large effect size).

According to Huck (2008) the use of inferential statistics is appropriate for this type of research. Huck stated that inferential statistics can be used with a current sample to make inferences to an abstract population – population that is comprised of present and future members. Huck (2008) also purported that abstract populations exists "hypothetically as a larger 'mirror image' of the sample" (p. 102) or current accessible populations. Furthermore, Huck stated that abstract populations can be conceptualized from convenience samples that are described in detail. Consistent with Huck; Gall, Gall, & Borg (2003) justified the use of inferential statistics with a convenience sample. Gall et al. stated that "inferential statistics can be used with data collected from a convenience sample if the sample is carefully conceptualized to represent a particular population" (p. 176). Demographic data from the previous year of graduating preservice teachers at the University of Florida supported that the convenience sample was representative of the target population. In addition, qualitative data from the teacher educators at the University of Florida confirmed that the convenience sample was representative of the target population.

Findings

As depicted in Table 1, the control group's pretest mathematics ability scores week 2 of the teaching methods course averaged 45.51% (*SD* = 9.32), and the pretest scores ranged from 30.77% to 57.69%. At the end of the teaching methods course or week 16, the control group's posttest mathematics ability scores averaged 45.19% (*SD* = 11.26), and the posttest scores ranged from 30.77% to 59.62%. The control group's mathematics ability mean decreased 0.32% from week 2 to week 16 of the teaching methods course.

The experimental group's pretest mathematics ability scores increased from week 2 to week 16 of the teaching methods course (Table 1). The pretest scores averaged 38.31% (*SD* = 11.03), and the pretest scores ranged from 23.08% to 59.62%. At the end of the teaching methods course or week 16, the control group's posttest mathematics ability scores averaged 45.71% (*SD* = 11.69), and the posttest scores ranged from 36.54% to 69.23%. The experimental group's mathematics ability mean increased 7.40% from week 2 to week 16 of the teaching methods course.

Table 1
Mathematics Ability Means

	Pretest		Posttest		Difference posttest – pretest	
	M	*SD*	*M*	*SD*	*M*	*SD*
Control group	45.51	9.32	45.19	11.26	– 0.32	5.36
Experimental group	38.31	11.03	45.71	12.69	7.40	6.56

The hypothesis that there is no significant difference in the mathematics ability of preservice agricultural education teachers based upon the MTIS treatment was tested using an

ANCOVA. The analysis revealed a significant difference in the mathematics ability of preservice agricultural education teachers based upon the MTIS treatment, while controlling pretest mathematics ability scores, $F(1, 16) = 5.36$, $p < .05$ (Table 2). Thus, the control group's adjusted posttest mean score ($M = 40.25$, $SE = 2.72$) was significantly lower than the experimental group's adjusted posttest mean ($M = 47.99$, $SE = 1.81$; Table 3). The practical significance of the difference was assessed using a partial eta squared, and the effect size was .25, which is a large effect according to Huck (2008). Based on the statistically significant difference in adjusted posttest mean and the large effect size, the null hypothesis was rejected.

Table 2
ANCOVA summary

	SS	*df*	*MS*	*F*	*p*	η_p^2
Group	221.00	1	221.00	5.36	.03	.25
Error	660.21	16	41.26			

Table 3
Adjusted Posttest Mathematics Ability Means

	M	*SE*
Control group	40.25	2.72
Experimental group	47.99	1.81

Conclusions and Implications

Descriptive statistics indicated that the treatment had a leveling effect on the mathematics ability of the preservice teachers enrolled in the teaching methods course. Week 2 of the teaching methods course, the experimental group's pretest mathematics ability scores were lower than the control group's pretest mathematics ability scores. By week 16 of the teaching methods course, the experimental and the control groups' posttest mathematics ability scores were within a few tenths of a percentage point. This may suggest that the MTIS treatment is effective at providing some remediation to preservice teachers with lower mathematics ability scores.

In addition, the MTIS treatment had a positive effect on the mathematics ability scores of the preservice teachers, and the practical significance of the difference in the scores was described as large ($\eta_p^2 = .25$). This finding is consistent with Stripling and Roberts (in press) who reported a math-enhanced agricultural teaching methods course significantly increased the mathematics ability scores of preservice agricultural education teachers at the University of Florida. Further, this finding is consistent with Berry (2005) who stated that research-proven instructional strategies in mathematics and literacy make a difference in student achievement as teacher educators incorporate the strategies into the teacher education program. The results of this study also support Bandura's (1986) social cognitive theory, which purports cognitive skills can be socially cultivated, and that environment and behavior influences personal factors. In this study, the results suggests that the environment or the math-enhanced teaching methods course and the behaviors of developing math-enhanced lessons, teaching those lessons to peers, and roleplaying as secondary students within the teaching methods course positively influences the personal factor of mathematics ability. This may also support Bandura's assertion that observational learning increases one's knowledge and cognitive skills. Moreover, the findings of this study suggests micro-teaching that utilizes the seven components of a math-enhanced lesson (Stone et al., 2006), developing math-enhanced lessons, and roleplaying as secondary students during math-enhanced lessons in an agricultural teaching methods course can be an appropriate means to improve the mathematics ability of preservice agricultural education teachers.

Recommendations for Teacher Education

Based on the findings of this study, the following recommendations were made for agricultural teacher education:

1. The MTIS treatment should be considered for use in an agricultural teaching methods course to increase the mathematics ability of preservice agricultural teachers.
2. Agricultural educators should consider integrating content related to mathematics and mathematics instruction into teacher education courses.

Recommendations for Future Research

Based upon the findings of this study, the following recommendations for further research were made:

1. Due to the limited scope of this study, replication that uses preservice teachers from other teacher education programs should be conducted to further validate the effectiveness of the MTIS treatment in increasing the mathematics ability of preservice teachers.
2. A major component of the treatment of this study was the preparation of math-enhanced lessons by the preservice teachers, micro-teachings of math-enhanced lessons delivered by the preservice teachers, and the preservice teachers role-playing as secondary students during the micro-teachings. To that end, is the value of this component of the treatment in the preservice teachers preparing the lessons, teaching the lessons, participating as students in the lessons, or a combination of these activities? Future research should further investigate the effects of preparing math-enhanced lessons, teaching math-enhanced lessons, and participating in micro-teachings of math-enhanced lessons on preservice teachers' mathematics ability.
3. Future research should seek to determine if the use of the MTIS treatment in an agricultural teaching methods course impacts the teaching of mathematics in the secondary agricultural classes of the preservice teachers after graduation.
4. Future research should seek to determine if mathematics can be effectively and efficiently integrated into other agricultural teacher education courses.
5. Future research is warranted to investigate why preservice teachers have such low mathematics ability.
6. Future research should seek to determine the effects of having an expert in contextualized mathematics deliver instruction to preservice teachers on the teaching of contextualized mathematics.

Discussion

The authors believe a philosophical discussion that should take place within agricultural teacher education is how to best prepare preservice teachers for meeting the demands of teaching a subject that contributes to the STEM disciplines. How should the profession ensure beginning agricultural education teachers are prepared to make a meaningful contribution? Agricultural teacher education programs are limited in the number of credit hours available in a program of study for teacher preparation. So, is the incorporation of STEM content such as the teaching of contextualized mathematics and science into agricultural teacher education coursework appropriate or the best way to prepare preservice teachers for teaching STEM related subject matter? If so, what information or content will be removed from current teacher education courses to allow for the incorporation of STEM content? Regardless of the answer to the aforementioned question, the authors believe the incorporation of STEM content is appropriate because of the nature of agriculture. Agriculture is an applied science. For that reason, the authors believe the incorporation of STEM content is essential for developing the pedagogical content knowledge of preservice teachers. Research in teacher education has shown that the *subject matters*, and that "subject-specific pedagogical knowledge…enables teachers to represent the subject matter so that it will be accessible to learners" (Darling-Hammond, 2006, p. 82). Thus, generic pedagogy alone does not fully prepare preservice agricultural education teachers for teaching the science of agriculture; therefore, there is a need for teaching methods to be taught within the context of the subject (Darling-Hammond, 2006). As the role of the secondary agricultural teacher has changed from vocational education to career and technical education that emphasize core academics and seeks to create informed citizens (Phipps et al., 2008), agricultural teacher education programs must also change to meet the demands of the changing role of the secondary agricultural education teacher.

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Discussant Remarks Matt Baker
Texas Tech University

Effects of Mathematics Integration in a Teaching Methods Course on Mathematics Ability of Preservice Agricultural Education Teachers

In this well-designed study, Stripling and Roberts provide evidence that Mathematics Teaching and Integration Studies (MTIS) effect preservice students' mathematical ability scores. If these findings are transferrable to teachers in the field being able to significantly improve their students' mathematical ability scores, then this study could have a profound effect upon our future workforce.

I would like to begin the discussion period with questions that I had when reading through the paper:

- Did the researchers assess student satisfaction between the control and the experimental groups in the methods course? Did or will the researchers compare standardized course student evaluations between the two groups? What anecdotal reactions did the researchers observe between the two groups (e.g. Did the students in the treatment group display enthusiasm for the treatment (the lecture on MTIS and related micro-teaching requirement that two of the micro-teachings be math-enhanced)?
- Are there plans to collect observational data during student teaching to see if behaviors in practice are changed as a result of the treatment; and on a more longer-term basis, once students begin teaching in their own programs?
- Did the researchers calculate correlation coefficients between the antecedent variables included in the study and the pre-test scores and post-test scores? If so, what were the approximate magnitudes of the relationships?
- Finally, I was surprised that you were able to detect a significant difference between the treatment and control group using such a small sample of students. This tells me that you may really have discovered something important. Your reactions?

Mathematical Strengths and Weaknesses of Preservice Agricultural Education Teachers

Christopher T. Stripling, University of Tennessee
T. Grady Roberts, University of Florida
Carrie Ann Stephens, University of Tennessee

The purpose of this study was to describe the mathematics ability of preservice agricultural education teachers related to each of the National Council of Teachers of Mathematics (NCTM) content/process areas and there corresponding sub-standards that are cross-referenced with the National Agriculture, Food and Natural Resources Career Cluster Content Standards. To that end, the preservice teachers were not completely proficient in any of the content/process areas and were below proficiency in all of the corresponding NCTM sub-standards for 4 of the 6 content/process areas. They were proficient in 3 of the 13 NCTM sub-standards, moderately proficient in 4 of the 13 NCTM sub-standards, and not proficient in 6 of the 13 NCTM sub-standards. The results of this study suggest current practices are not sufficient for developing the mathematics content knowledge required for teaching the NCTM sub-standards found within the agricultural education curricula. To prepare preservice teachers for teaching mathematical concepts within the agricultural education curricula, agricultural educators should integrating mathematics subject matter related to the cross-referenced NCTM sub-standards into teacher education coursework, with an emphasis on the 10 NCTM sub-standards in which the preservice teachers were below the proficient level.

Introduction

> For people to participate fully in society, they must know basic mathematics. Citizens who cannot reason mathematically are cut off from whole realms of human endeavor. Innumeracy deprives them not only of opportunity but also of competence in everyday tasks…. Moreover, mathematics is a realm no longer restricted to a select few. *All young Americans must learn to think mathematically, and they must think mathematically to learn.* (National Research Council, 2001, p. 1)

Therefore, there is a need to ensure the mathematics proficiency of U.S. students; however, national assessments reveal a majority of U.S. students are not adequately proficient in mathematics (National Center for Educational Statistics, 2009, 2010, 2011). This is troubling given the implications above and the fact "there is growing concern that the United States is not preparing a sufficient number of students, teachers, and professionals in the areas of science, technology, engineering, and mathematics [STEM]" (Kuenzi, 2008, p. 1).

According to the National Academy of Sciences (2007), a key element to improving the mathematics performance of U.S. students and developing a scientifically literate workforce is developing exceptional K-12 teachers. According to the National Research Council (2001), "the effectiveness of mathematics teaching and learning is a function of teachers' knowledge and use of mathematical content, of teachers' attention to and work with students, and of students' engagement in and use of mathematical tasks" (p. 9). The role of mathematics teaching and learning is not solely the responsibility of K-12 science and mathematics teachers. Shinn et al. (2003) proclaimed improving student performance in mathematics is an important role for secondary agricultural education in the 21st century. Similarly, Conroy, Trumbell, and Johnson

(1999) purported agricultural education was a rich context for learning mathematics and stated there is a need for agricultural educators to include more mathematics in their instruction. Before Shinn et al. and Conroy et al.'s calls for agricultural education to support the mathematics education of secondary students, the National Research Council (1988) called for secondary agricultural education to become more than vocational agriculture, to prepare students for careers that require competencies in science and mathematics, and to help students to effectively use new technologies. The National Research Council (1988) also posited that "teacher preparation and in-service education programs must be revised and expanded to develop more competent teachers" (pp. 6-7) of agriculture to make the changes described above.

With that in mind, are preservice agricultural education teachers prepared for this role? Research suggests preservice agricultural education teachers are not prepared to effectively teach mathematical concepts (Miller & Gliem, 1996; Stripling & Roberts, 2012a, 2012b, in press). However, the aforementioned research does not identify specific mathematical strengths and weaknesses of preservice teachers related to the agricultural education curricula. This study will seek to identify mathematical strengths and weaknesses of preservice agricultural education teachers in relation to the NCTM sub-standards (Carpenter & Gorg, 2000) that are cross-referenced with the *National Agriculture, Food and Natural Resources Career Cluster Content Standards* (National Council for Agricultural Education, 2009).

Theoretical Framework

The theoretical framework for this study was Dunkin and Biddle's (1974) model for the study of classroom teaching, which is based on the original work of Mitzel (1960). Dunkin and Biddle's model for the study of classroom teaching is classified into the following four categories of variables: presage, context, process, and product. According to Dunkin and Biddle, presage and context variables have a causative relationship with process variables and process variables have a causative relationship with product variables (Figure 1).

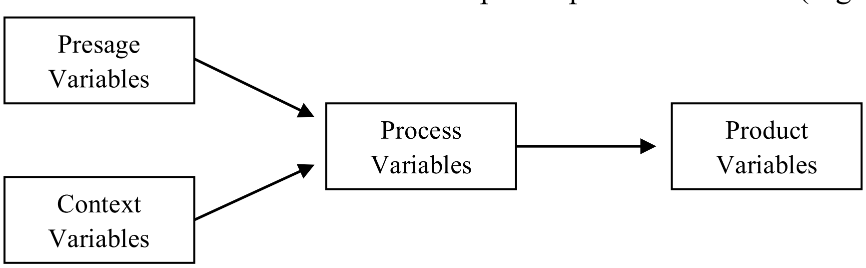

Figure 1. Adapted model for the study of classroom teaching.

First in Dunkin and Biddle's (1974) model for the study of classroom teaching are presage and context variables. Presage variables are described as "characteristics of teachers that may be examined for their effects on the teaching process–thus, teacher formative experiences, teacher-training experiences, and teacher properties" (Dunkin & Biddle, 1974, p. 39). Context variables are described as "characteristics of the environment about which teachers, school administrators, and teacher-educators can do very little" (Dunkin & Biddle, 1974, p. 41). Community, school, and classroom contexts, student populations, student formative experiences, and school and classroom budgets are examples of context variables. Presage and context variables influence process variables. Process variables are described as "the actual activities of classroom teaching–what teachers and pupils do in the classroom" (Dunkin & Biddle, 1974, p. 44). Furthermore, in the classroom, teacher and student behaviors interact and result in observable positive or negative changes in a student's behavior or academic learning. These changes that result from the interaction of student and teacher behaviors are described by Dunkin and Biddle (1974) as product variables or as "the outcomes of teaching" (p. 46).

Dunkin and Biddle (1974) stated the "entire business of teacher education is founded on the assumption that we can 'improve' teaching practices by providing appropriate educational experiences for young teachers" (p. 49), and thus, decisions made by teacher education programs concerning the "relationship between presage conditions and teaching processes" (p. 49) should be based on evidence. To that end, this study focused on one presage variable, the mathematics ability of preservice agricultural education teachers during their final year of an agricultural teacher education program.

More recent works have also proclaimed the importance of teacher characteristics or presage variables in the learning process. Bransford, Brown, and Cocking (2000) suggested that teachers must possess subject matter knowledge, pedagogical knowledge, and pedagogical content knowledge. Darling-Hammond and Bransford (2005) stated all teachers should

> acquire knowledge of learners and how they learn and develop within social contexts, conceptions of curriculum content and goals: an understanding of the subject matter and skills to be taught in light of the social purposes of education, and an understanding of teaching in light of the content and learners to be taught, as informed by assessments and supported by classroom environments. (p. 10)

Roberts and Kitchel (2010) synthesized theories related to the types of knowledge teachers must possess into four dimensions: (a) general knowledge, (b) subject matter knowledge, (c) pedagogical knowledge, and (d) pedagogical content knowledge. In light of these works, a preservice teacher's mathematics ability is related to general knowledge (mathematics needed as a citizen of a society), subject matter knowledge (contextualized mathematics in the agricultural education curricula), and pedagogical content knowledge (the teaching of contextualized mathematics in the agricultural education curricula).

Literature Review

Preservice Teachers' Mathematics Ability

Four studies were found that specifically examined the mathematics ability of preservice agricultural education teachers: Miller and Gliem (1996) and Stripling and Roberts (2012a, 2012b, in press). Miller and Gliem investigated the mathematical problem-solving ability of 49 preservice agricultural education teachers from The Ohio State University. The preservice teachers' average mathematics score on a mathematical problem-solving test was 37% and 87% solved fewer than 60% of the mathematics problems correctly. Miller and Gliem reported a low negative association between mathematics ability of the preservice teachers and completion of an intermediate mathematics courses and a low positive association between mathematics ability and advanced mathematics courses. Also, a substantial negative association was found between mathematics ability and students that completed basic mathematics courses. Miller and Gliem (1996) found "preservice educators with higher scores on the problem-solving test had taken advanced mathematics courses in addition to or instead of basic and intermediate math" (p. 18). In conclusion, the researchers stated "preservice agricultural educators were not capable of applying basic mathematics skills to agricultural problems" (Miller & Gliem, 1996, p. 19) and considerable attention should be given to improving the mathematics ability of preservice agricultural education teachers.

Stripling and Roberts (2012a) investigated the mathematics ability of preservice agricultural education teachers in their final year of a teacher education program at the University of Florida. Stripling and Roberts reported University of Florida preservice teachers averaged 35.6% on a 26 item agricultural mathematics instrument and concluded the preservice teachers were not proficient in agricultural mathematics concepts. Additionally, Stripling and Roberts investigated the associations between the types of mathematics courses completed in high school and college and the preservice teachers' score on the mathematics ability instrument and concluded the associations suggested that "preservice teachers that completed an advanced mathematics course in high school and/or college scored higher on the mathematics assessment than preservice teachers that completed a basic or intermediate mathematics course in high school and/or college" (p. 118). This finding is consistent with Miller and Gliem (1996).

Stripling and Roberts (2012b) studied the mathematics ability of U.S. preservice agricultural education teachers and the types of mathematics courses completed by the preservice teachers in high school and college. Consistent with preservice agricultural education teachers from The Ohio State University (Miller & Gliem, 1996) and the University of Florida (Stripling & Roberts, 2012a), Stripling and Roberts reported the nation's preservice teachers were not proficient in mathematics. Furthermore, Stripling and Roberts reported the highest level of mathematics completed by a majority of the preservice teachers in high school and college was basic or intermediate mathematics. Additionally, the researchers reported preservice teachers who completed an advanced mathematics course scored 19.48 percentage points higher than those who did not, and preservice teachers that received an A in their highest college mathematics course scored 6.40 percentage points higher than those who received a grade lower than an A.

Based on the results of the aforementioned studies, Stripling and Roberts (in press) sought to improve the mathematics ability and mathematics teaching efficacy of preservice teachers by incorporating mathematics into an agricultural education teaching methods course. The pretest mathematics ability mean was 34.4% on a 26 item mathematics instrument, which is consistent with Miller and Gliem (1996) and Stripling and Roberts (2012a, 2012b). After the math-enhanced agricultural teaching methods course, Stripling and Roberts stated the preservice teachers mathematics ability scores had improved 12.15 percentage points. This difference was found to be statistically significant and a medium effect size was reported. However, a statistically significant difference was not found related to the preservice teachers' mathematics teaching efficacy, mathematics efficacy, or personal teaching efficacy.

Teaching Contextualized Mathematics

"The basis for good teaching is combining an information rich subject matter content with an experience rich context of application" (Parnell, 1996, p.1). Today's reform efforts in mathematics education "challenge prospective teachers in their thinking about mathematics teaching and learning. Teachers are asked to teach in ways that promote an integrated, connected view of mathematics, rather than a procedural, rule-based view" (Benken & Brown, 2008, p. 1). As a result, emphasis has been placed on teaching academic subjects in context. Contextualized learning advocates that neither general education nor career education can be taught in isolation but must be integrated to maximize the benefit for the learner (Prescott, Rinard, Cockerill, & Baker, 1996).

Based on the philosophical stance above, Stone, Alfeld, Pearson, Lewis, and Jensen (2006) experimentally tested a "model for enhancing mathematics instruction in five high school career and technical education (CTE) programs (agriculture, auto technology, business/marketing, health, and information technology)" (p. ix). The study was conducted for one academic school year, and the combined number of participants from each program area/sample consisted of 236 career and technical teachers, 104 math teachers, and 3,950 students from 12 states. The career and technical educators had a mathematics teacher partner that provided support in developing math-enhanced lessons and suggested instructional methodologies. Survey data collected from the participants of the study indicated the "pedagogic framework to be 'very effective'" (Stone et al., 2006, p. 40). In addition, Stone et al. found the math-enhanced curriculum did not reduce the secondary students' technical skill or occupational content knowledge and had a positive effect on the mathematics ability of the secondary students.

Specific to secondary agricultural education, several studies have examined the effectiveness of Stone et al.'s (2006) Math-in-CTE model. Using the Math-in-CTE model, Parr, Edwards, and Leising (2006) found students were less likely to need postsecondary mathematics remediation. Parr, Edwards, and Leising (2008) and Young, Edwards, and Leising (2009) reported a math-enhanced agricultural power and technology course did not lesson secondary students' technical skills. In two additional studies, Parr, Edward, and Leising (2009) and Young, Edwards, and Leising (2008) did not find a significant difference in the mathematics ability of secondary students that participated in a power and technology course that utilized the Math-in-CTE model. However, Young et al. (2008) stated students' mathematics achievement "did show a positive effect in favor of the experimental group [Math-in-CTE]" (p. 14). In Parr et al.'s (2009) study, the authors suggested a significant difference may not have been found due to incomplete implementation of the treatment and an intervention time frame of only one semester.

Furthermore, in a survey of 26 outstanding secondary agricultural educators, Anderson, Williams, and Hillison (2008) reported agricultural educators taught mathematics in 23% of their lessons with a range of 0 to 75%. Similarly, Hunnicutt (as cited in Anderson, Williams, & Hillison, 2008) found secondary agricultural educators in Alabama self-reported to have integrated mathematics into 26-50% of their instructional units.

Purpose and Objective

This study is part of a larger study (Stripling & Roberts, 2012b), which investigated the mathematics requirements of agricultural teacher education programs and the mathematics ability of U.S. preservice agricultural education teachers. The purpose and the guiding objective of this study was to describe the mathematics ability of preservice agricultural education teachers related to each of the NCTM content/process areas and the corresponding sub-standards (Carpenter & Gorg, 2000) that are cross-referenced with the *National Agriculture, Food and Natural Resources Career Cluster Content Standards* (National Council for Agricultural Education, 2009).

Methods and Procedures

Research Design and Sample

The research design of this study was a one shot case study (Campbell & Stanley, 1963). The target population for this descriptive study was preservice agriculture teachers in their final year of a teacher education program, and based on Kantrovich's (2007) agricultural education supply and demand study, the population of preservice teachers in the United States was determined to be approximately 800. Since a list of all members of the target population was not available, cluster random sampling was utilized to select a random sample (Fraenkel & Wallen, 2006). Hence, the preservice teachers in their final year at each institution were considered a cluster. For this reason, preservice teacher education programs were randomly selected until an adequate number of teacher education programs agreed to participate to meet the predetermined needed sample size of 89 (Table 1). According to Israel (1992), a sample size of 89 is needed for a population of 800, a ±10% precision level, and a 95% confidence level. Precision level is a limiting factor of this study. A precision level of ±10% was chosen based on the resources available to conduct this study.

Table 1
Agricultural Teacher Education Programs

University	*n*	AAAE region	Approximate university enrollment	Carnegie classification
1	8	Western	19,000	Research Universities (high research activity)
2	10	Southern	35,000	Research Universities (very high research activity)
3	16	North Central	29,000	Research Universities (high research activity)
4	12	North Central	12,000	Research Universities (high research activity)
5	2	Southern	29,000	Research Universities (very high research activity)
6	8	Western	29,000	Research Universities (very high research activity)
7	15	North Central	31,000	Research Universities (very high research activity)
8	2	Southern	10,000	Master's Colleges and Universities (larger programs)

9	25	Southern	51,000	Research Universities (very high research activity)

For this study, the random sample consisted of 98 preservice agricultural education teachers, 61 females and 34 males (three participants did not provide this data). The average age of the sample was 22 years old (SD = 3.36) with a range of 20 to 51. Ninety-one participants described their ethnicity as white, one as African American, one as Hispanic, one as American Indian, and one as other. Of the participants that reported their program level, the majority of the participants were in an undergraduate program (n = 85, 89.47%), and the remaining were completing a graduate program (n = 10, 10.53%). Ninety-one participants provided their college grade point average, and the mean GPA was 3.44 (SD = 0.39) on a 4-point scale. The number of college level mathematics courses completed by the participants ranged from 0 to 6 with a mode of 1. The timing when the participants took their last math course ranged from the previous semester to 15 years prior with a mean of 3.33 years (SD = 1.85). Additionally, in their highest level of mathematics in college, 34.8% received an A, 37.1% a B, 23.6% a C, 3.4% a D, and 1.1% a F.

Instrumentation, Data Collection, and Data Analysis

Participants consented to take the *Mathematics Ability Test* (Stripling & Roberts, 2012a) by signing an informed consent approved by the University of Florida's Institutional Review Board. The *Mathematics Ability Test* consist of 26 open-ended mathematical word problems and was administered during the 2010-11 academic year at each of the randomly selected universities. At each university, the teaching methods course instructor or a graduate assistant administered the instrument and followed a script prepared by one of the researchers. Also, since the preservice teachers were asked to complete the instrument during instructional time, and to avoid coercion, participants were informed that participation in the study would not have an impact on their course grades. The *Mathematics Ability Test* took approximately 60 minutes to complete, and according to Stripling and Roberts (2012a) the instrument's 26 items were developed based on 13 NCTM sub-standards (Carpenter & Gorg, 2000) that are cross-referenced with the *National Agriculture, Food and Natural Resources Career Cluster Content Standards* (National Council for Agricultural Education, 2009). Furthermore, during item development, one of the researchers met with a secondary mathematics expert to determine which items from Miller and Gliem's (1996) agricultural problem-solving test would meet the requirements of the 13 NCTM sub-standards. The secondary mathematics expert determined seven of Miller and Gliem's 15 items aligned with the 13 NCTM sub-standards, and therefore, all seven items were included on the *Mathematics Ability Test*. The remaining 19 items were developed based on NCTM examples problems (Carpenter & Gorg, 2000). A list of the 13 sub-standards and the content/process areas are presented in Table 2. In addition, Stripling and Roberts stated face and content validity of the *Mathematics Ability Test* was "established by a panel of experts consisting of agricultural education faculty and mathematics faculty from three universities and two secondary mathematics experts" (p. 115). Stripling and Roberts reported the reliability or the Cronbach's alpha coefficient to be .80. The *Mathematics Ability Test* was scored using a rubric that, according to Stripling and Roberts, was developed by two secondary mathematics experts, and all items were scored as incorrect or correct. For this study, the categorization of correct included preservice teacher responses in which the preservice teachers set the problem up correctly but made a calculation error. Descriptive statistics were used to summarize demographics, and the *Mathematics Ability Test* results related to each of the NCTM sub-standards and the content/process areas. Lastly, the percentages of correct response for the NCTM sub-standards were categorized into the following levels of proficiency by the authors for discussion purposes: (a) 0 to 39% – not proficient, (b) 40 to 69% – moderately proficient, and (c) 70 to 100% – proficient.

Table 2
Cross-referenced NCTM Sub-standards for Grades 9-12

Content/Process Area	NCTM Sub-standards
Number & Operations	1A. Understand numbers, ways of representing numbers, relationships among numbers, and number systems.
	1B. Understand meanings of operations and how they relate to one another.
	1C. Compute fluently and make reasonable estimates.
Algebra	2C. Use mathematical models to represent and understand quantitative relationships.
	2D. Analyze change in various contexts.
Geometry	3A. Analyze characteristics and properties of two– and three–dimensional geometric shapes and develop mathematical arguments about geometric relationships.
Measurement	4A. Understand measurable attributes of objects and the units, systems, and processes of measurement.
	4B. Apply appropriate techniques, tools, and formulas to determine measurements.
Data Analysis & Probability	5A. Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them.
	5B. Select and use appropriate statistical methods to analyze data.
	5C. Develop and evaluate inferences and predictions that are based on data.
Problem Solving	6B. Solve problems that arise in mathematics in other contexts.
	6C. Apply and adapt a variety of appropriate strategies to solve problems.

Findings

The items related to NCTM sub-standard 1C had the highest frequency of correct responses ($f = 159$). NCTM sub-standard 1C was followed closely by NCTM sub-standards 5A ($f = 155$) and 1A ($f = 145$). The NCTM sub-standards with the lowest frequency of correct responses were 1B ($f = 20$), 4A ($f = 19$), and 5B ($f = 16$). A complete summary of the frequency and percentage of correct/incorrect responses is presented in Table 3.

Table 3
Descriptive Statistics of Preservice Teachers Responses

Content/Process Area	NCTM sub-standard	Correct		Incorrect	
		f	%	*f*	%
Number & Operations	1A	145	74.0	51	26.0
	1B	20	10.2	176	89.8
	1C	159	81.9	37	18.9
Algebra	2C	89	45.4	107	54.6
	2D	79	40.3	117	59.7
Geometry	3A	33	16.8	163	83.2
Measurement	4A	19	9.7	177	90.3
	4B	117	59.7	79	40.3
Data Analysis & Probability	5A	155	79.1	41	20.9
	5B	16	8.2	180	91.8
	5C	69	35.2	127	64.8
Problem Solving	6B	87	44.4	109	55.6
	6C	38	19.4	158	80.6

As depicted in Table 4, the preservice teachers were not completely proficient in any of the content/process areas and were below proficiency in all of the corresponding NCTM sub-standards for the following content/process areas: (a) algebra, (b) geometry, (c) measurement, and (d) problem solving. In regard to the individual NCTM sub-standards, the preservice teacher were proficient in three NCTM sub-standards: (a) understand numbers, ways of representing numbers, relationships among numbers, and number systems; (b) compute fluently and make reasonable estimates; and (c) formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them. Examples of mathematical concepts within the abovementioned standards are factions, exponents, scientific notation, whole numbers, rational and irrational numbers, approximation, sampling, types of data, and the term variable.

The preservice teachers were moderately proficient in four NCTM sub-standards: (a) use mathematical models to represent and understand quantitative relationships; (b) analyze change in various contexts; (c) apply appropriate techniques, tools, and formulas to determine measurements, and (d) solve problems that arise in mathematics in other contexts. Examples of mathematical concepts within these standards are growth rates, compound interest, log functions, slope, interpretation of statements related to rates of change, volume, area, unit conversion, and solving word problems.

Furthermore, the preservice teachers were not proficient in six NCTM sub-standards: (a) understand meanings of operations and how they relate to one another; (b) analyze characteristics and properties of two– and three–dimensional geometric shapes and develop mathematical arguments about geometric relationships; (c) understand measurable attributes of objects and the units, systems, and processes of measurement; (d) select and use appropriate statistical methods to analyze data; (e) develop and evaluate inferences and predictions that are based on data; and (f) apply and adapt a variety of appropriate strategies to solve problems. Examples of mathematical concepts within the six previously mentioned sub-standards are matrices, understanding of permutations and combinations as counting techniques, effect of operations (e.g., multiplication and division), computing powers and roots on the magnitude of quantities, proving theorems, determining lengths and angle measures using trigonometric relationships, making decisions about units and scales, using the quadratic formula, line of best fit, regression coefficients, displaying and discussing bivariate data when at least one variable is categorical, using models of a data set to make predictions and recognizing limitations of those predictions, and applying multiple strategies for solving word problems.

Table 4
NCTM Sub-standard Proficiency

Content/Process Area	NCTM sub-standard	Not proficient	Moderately proficient	Proficient
Number & Operations	1A			X
	1B	X		
	1C			X
Algebra	2C		X	
	2D		X	
Geometry	3A	X		
Measurement	4A	X		

	4B		X	
Data Analysis & Probability	5A			X
	5B	X		
	5C	X		
Problem Solving	6B		X	
	6C	X		

Note. Not proficient (0 to 39%), moderately proficient (40 to 69%), proficient (70 to 100%).

Conclusions, Implications, and Recommendations

The preservice teachers were not completely proficient in any of the content/process areas and were below proficiency in all of the corresponding NCTM sub-standards for 4 of the 6 content/process areas. They were proficient in 3 of the 13 NCTM sub-standards, moderately proficient in 4 of the 13 NCTM sub-standards, and not proficient in 6 of the 13 NCTM sub-standards. Based upon Dunkin and Biddle (1974), mathematics proficiency, a presage variable, has a causative relationship with process variables or classroom activities and process variables have a causative relationship with product variables (student learning outcomes). Thus, not being proficient in mathematics may negatively influence the teaching and learning of contextualized mathematics in school-based agricultural education.

Given the fact that the preservice teachers were not completely proficient in any content/process area and were only proficient in 3 of the 13 NCTM sub-standards, are the current cross-referenced NCTM sub-standards appropriate for secondary agricultural education? Jansen and Thompson (2008) purported that "as agricultural education becomes a viable avenue for increasing the rigor and relevance of core-academic connections, pre-service teaching requirements in mathematics may need to be increased to meet the demands of interdisciplinary instruction" (p. 26). The authors believe the NCTM sub-standards are appropriate for secondary agricultural education. The NCTM sub-standards require the teaching of basic and intermediate mathematics such as algebra, geometry, and basic statistics, which are embedded within essential agricultural skills needed for agricultural careers and college preparation. The authors also believe lowering the mathematics standards for secondary agricultural education would prevent the profession from answering the numerous calls for agricultural education to support core academics and the STEM disciplines in an era of higher accountability and more rigorous educational standards. Additionally, the authors hold the view that mathematics is fundamental to science, and research has shown that mathematics teaching is associated with increases in science achievement (Phipps, Osborne, Dyer, & Ball, 2008). Thus, lowering the secondary mathematics standards found within the agricultural education curricula may have a negative effect on science achievement of secondary students and minimize agricultural education's role in preparing a scientifically literate workforce.

With that in mind, future research should determine why preservice teacher are not proficient in 10 of the 13 NCTM sub-standards and investigate the most appropriate strategies and methods agricultural teacher education can utilize to improve the mathematics subject matter knowledge of preservice teachers. Stripling and Roberts (in press) found that a math-enhanced agricultural methods course significantly improved the mathematics ability of Florida preservice teachers, and as a result, hypothesized the summative effects of minor changes in agricultural teacher education may produce mathematics proficient preservice teachers and improve the teaching of mathematical concepts in the secondary agricultural education curricula. Future research should also explore pairing preservice agricultural education teachers and preservice mathematics teachers during their programs of studies as a means for improving mathematics subject matter, pedagogical, and pedagogical content knowledge. This recommendation is based on the fact that the preservice teachers were not proficient in the NCTM sub-standard and the finding of Stone et al. (2006). A major component of Stone et al.'s Math-in-CTE model was the pairing of a mathematics educator and a career and technical educator. In Stone et al.'s study, many of the CTE educators were not proficient in mathematical concepts and relied on their mathematics educator partner for support before and after teaching mathematics concepts. Pairing mathematics preservice teachers and agricultural education preservice teachers may also benefit the mathematics preservice teachers by exposing them to the context of agriculture as an avenue for teaching mathematical concepts. Furthermore, a major component of agricultural teacher education is the student teaching experience. If secondary agricultural education teachers are incorporating few mathematical concepts into daily instruction (Anderson et al., 2008), the lack of exposure to teaching contextualized mathematics during the student teaching experience may have a negative effect on preservice teachers' mathematics subject matter, pedagogical, and pedagogical content knowledge. For that reason, research should also evaluate the mathematics ability and teaching of current secondary agricultural education teachers, and if deficiencies are found, determine the most appropriate means to improve their mathematics subject matter and pedagogical knowledge. To that end, providing professional development on utilizing the seven elements of a math-enhanced lesson found within the Math-in-CTE model (Stone et al., 2006) and the cross-referenced NCTM sub-standards may be appropriate strategies from increasing the subject matter, pedagogical, and pedagogical content knowledge of secondary agricultural educators.

Furthermore, based on the results of this study, the following recommendations are given for agricultural teacher education:

- A review of current baccalaureate agricultural education coursework requirements should be conducted to determine if the current requirements are appropriate for developing a fluid conceptual understanding of mathematical concepts found within state and national agricultural education standards. The results of this study suggest current practices are not sufficient for developing the mathematics content knowledge required for teaching the NCTM sub-standards found within the agricultural education curricula.
- To prepare preservice teachers for teaching mathematical concepts within the agricultural education curricula, agricultural educators should integrating mathematics subject matter related to the cross-referenced NCTM sub-standards into teacher education coursework, with an emphasis on the 10 NCTM sub-standards in which the preservice teachers were below the proficient level. This will aid preservice agricultural education teachers in connecting mathematics subject matter knowledge and pedagogical knowledge. This recommendation

aligns with Stripling and Roberts (in press), who found that a math-enhanced teaching methods course that incorporated the NCTM sub-standards significantly increased the mathematics ability scores of preservice agricultural education teachers.

The authors believe the recommendations for future research and those given to agricultural teacher education above are vital to producing preservice agricultural education teacher that are proficient in mathematics and for answering the calls for secondary agricultural to contribute to student achievement in mathematics. Additionally, the authors feel the recommendations are important because subject matter knowledge, pedagogical knowledge, and pedagogical content knowledge are essential for effective teaching (Bransford et al., 2000; Darling-Hammond & Bransford, 2005; Roberts & Kitchel, 2010) and the effectiveness of mathematics teaching and learning is a function of teachers' knowledge and use of mathematical content (National Research Council, 2001, p. 9). Moreover, Dunkin and Biddle (1974), professed presage variables have a causative relationship with process variables and process variables have a causative relationship with product variables. Therefore, without sufficient preparation in mathematics teaching and learning, preservice agricultural education teachers will not be able to fully utilize the context of agriculture to maximize the academic benefits for their students.

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Discussant Remarks Matt Baker
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Mathematical Strengths and Weaknesses of Preservice Agricultural Education Teachers

The purpose of this paper is to provide a comprehensive look into the dependent variable data (e.g. mathematical abilities) of a larger multivariate study published recently in the *Journal of Agricultural Education*. The mathematical ability scores were examined based upon six National Council of Teachers of Mathematics (NCTM) content/process areas, and the 13 sub-standards embedded within the NCTM. The preservice teachers were not proficient in four of the content/process areas and were not proficient in ten of the 13 sub-standards.

The authors then surfaced the following issues which we may want to focus our discussion time on:

- Are the NCTM sub-standards appropriate for secondary agricultural educators;
- Would 'lowering' the mathematics standards have a negative effect on science achievement?
- Would a mathematics-enhanced methods course improve mathematics ability of preservice at your respective universities? If so, and this were a priority, what content would you sacrifice within your degree program? Might there be implications for NCATE accreditation in doing so?
- Would your mathematics teacher educators be willing to pair their preservice teachers with preservice teachers in agricultural education during their programs of study on your campuses? How would you design this experience to maximize student learning? What would be the benefit to the mathematics preservice teachers? If formal academic credit were given, how would semester credit hour-produced revenue be shared?
- How would practicing secondary agricultural teachers in your home state perform on the mathematical abilities assessment? Have continuing professional development courses for practicing agricultural teachers in your home state? If so, were their enrollments (e.g. participation) oversubscribed or undersubscribed?

The Effect of a Serious Digital Game on the Animal Science and Mathematical Competence of Secondary Agricultural Education Students: An Experimental Study

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Abstract

The purpose of this study was to compare the effectiveness of the lecture and discussion teaching methods and digital game-based learning on student achievement in agriculture and mathematics regarding a unit on swine diseases in animal science courses offered through secondary agricultural education programs in Oklahoma. Three research questions guided the study, which utilized a quasi-experimental, between-groups design. No statistically significant differences ($p < .05$) were found between the counterfactual group and the treatment group regarding animal science competency and mathematics achievement. As such, the researcher failed to reject the respective null hypotheses aligned with the study's research questions. However, this study demonstrated that teachers using a serious digital game in the context of animal science did not diminish their students' achievement. As a result, it can be recommended that teachers should consider incorporating this teaching method into their existing pedagogical practices without fear of decreasing student achievement. Another implication for practice is the importance of providing prolonged and sustained professional development opportunities for in-service teachers to learn how to use a digital game-based delivery method effectively to increase student achievement in agriculture and mathematics.

Introduction

"Now just over thirty years old, video games have quickly become one of the most pervasive, profitable, and influential forms of entertainment in the United States and across the world" (Squire, 2003, p. 2). The gaming industry is a multi-billion dollar industry in the United States (Van Eck, 2006). In fact, nearly three-quarters of all American households play games. Consumers spent $25.1 billion dollars on video games, hardware, and accessories in 2010, and purchases of digital content accounted for 24% of game sales in 2010, which generated $5.9 billion in revenue (Entertainment Software Association, 2011).

Games have always been a part of human culture, and digital video games are a new and novel way to facilitate this distinctive form of human social interaction and expression (Fullerton, 2004). Research has indicated that, not including television, playing electronic games, both console and computer, is the most widespread media activity in which young people participate (Heim, Brandtzaeg, Kaare, Endestad, & Torgersen, 2007). So what are digital games? According to Dempsey, Lucassen, Haynes, and Casey (1996), digital games are rule-guided scenarios that have goals, constraints, as well as consequences and are played by one or more participants. Further, Oblinger (2006) asserted that, "digital games are complex, require collaboration with others, and involve developing values, insights, and new knowledge" (p. 5).

Video games have changed over the years. Games have moved from a desktop computer, or gaming console, interface to a multi-user virtual world interface (Oblinger, 2006). The new games are "psychologically immersive in ways that the world-to-the-desktop interface is not" (p. 6). More important is the fact that, as a result of the gaming influence on American culture, numerous educators have shown interest in the effects digital games have on students, and how some of the immersive aspects might be used to enhance student motivation and facilitate learning (Squire, 2003).

Not all video games are designed for entertainment. The so-called *serious games* are digital gaming environments that are created for the primary purpose of solving a problem (Michael & Chen, 2006). The serious game movement began in 2002. According to Annetta, Murray, Laird, Bohr, and Park (2006), this movement provoked partnerships to be established between educators, the medical field, military, and game designers. Further, this movement supports the power that video games have to interest, engage, and associate gamers in and teach them about important content in the games' relevant concentration areas (Annetta et al., 2006).

Serious games are designed to run on personal computers or game consoles. They focus, primarily, on training, advertising, simulating, and educating (Michael & Chen, 2006). According to Corti (2006), serious games "[are] all about leveraging the power of computer games to captivate and engage end-users for a specific purpose, such as to develop new knowledge and skills" (p. 1). To that end, the primary intent of serious games is training and educating with definable learning objectives, and not for entertainment purposes solely.

One of the advantages of using serious games as an instructional method is that digital game-based learning puts the learner in the "driver's seat" of the educational process (sometimes literally). According to Garris, Ahlers, and Driskell (2002), an educational paradigm shift from a traditional, teacher-centric classroom to a more non-traditional, student-centric classroom has occurred. Tapscott (1998) asserted that this shift is a movement from "learning as torture to learning as fun" (p. 147). Research suggests that "children do enjoy learning when they have a sense of their own progression and where the learning is relevant and appropriate to them" (Kirriemuir & McFarlane, 2004, p. 12). In this new paradigm shift of a student-centric classroom, several attributes of the constructivist philosophy are apparent.

The focus of the constructivist paradigm is on the individual and not the teacher (Schunk, 2008). Constructivism stresses that individuals interact with their environment and formulate an understanding of that environment. Therefore, games have the potential to challenge students to inform their understanding by discovering information on their own, "and put their own quest of knowledge at the forefront of their learning experience" (Ibbitson, 2005, p. 14). Through interactions with their environment, individuals construct conceptualizations and find solutions to complex problems. These conceptualizations and solutions are developed when an individual makes meaningful connections between prior knowledge and a new experience. As a result, constructivists perceive that learning is a result of *mental construction* (Piaget, 1954). In addition, constructivists emphasize that learning is affected by the context and the individual's beliefs and attitudes. Constructivists assert that this type of teaching style equips students to be better problem solvers and to transfer their knowledge to new and novel settings more easily (Schunk, 2008).

Purpose

The purpose of this study was to compare the effectiveness of the traditional, lecture and discussion method to a digital game-based learning (DGBL) approach on student achievement in agriculture and mathematics regarding a unit on swine diseases in animal science courses offered through secondary agricultural education programs in Oklahoma.

Research Questions and Null Hypotheses

Three research questions guided the study: (1) What were the personal characteristics, such as age, gender, grade level, grade point average, number of agricultural education courses completed, and type of supervised agricultural experience, of students enrolled in selected animal science courses in Oklahoma during the Fall semester of 2011? (2) What was the effect of a DGBL delivery method on student achievement in animal science, as determined by a swine health and management unit examination? (3) What was the effect of a DGBL delivery method on student achievement in mathematics, as determined by a standardized mathematics unit examination? Two null hypotheses guided the study's statistical analysis: H_O1: In the population, no statistically significant difference existed ($p > .05$) in achievement between those students who received instruction via lecture and discussion versus those who engaged in DGBL on the swine health and management unit examination (H_O1: $\mu_{1Counterfactual} = \mu_{2Treatment}$). H_O2: In the population, no statistically significant difference existed ($p > .05$) in achievement between those students who received instruction via lecture and discussion versus those who engaged in DGBL on the standardized mathematics unit examination (H_O2: $\mu_{1Counterfactual} = \mu_{2Treatment}$).

Methods

The study utilized a quasi-experimental, between-groups design (Creswell, 2008). Participating teachers and their classrooms were assigned randomly to either the treatment or counterfactual groups using Randomizer.org. The resulting unit of analysis was individual subjects rather than intact classrooms (Stevens, 2009). Therefore, each subject's scores were independent of the other subjects' scores (Stevens, 2009).

The students populating the randomly assigned classrooms were pre-tested to determine the level of homogeneity regarding their prior knowledge of selected swine diseases and metacognitive awareness. To determine homogeneity for prior knowledge of general mathematics, school districts report cards were compared. A quasi-experimental design involves random assignment but not random selection of participants (Creswell, 2008). The researcher chose to use a volunteer sample of teachers who were willing to attend a two-day training session on swine health and pedagogy and who were willing to allow their students to be involved in the study.

The treatment was a serious game, known as *Virtual Walking the Pens*, and was assigned randomly to the teachers' students. This serious game was designed to assist swine producers in learning about production and management practices through digital gaming (S. Miller, personal communication, February 15, 2011). Essentially, *Virtual Walking the Pens* permitted students to interact with a swine housing facility, equipment, and pigs in a simulated virtual world, i.e., the game allowed students to work in a virtual swine confinement operation. The students performed virtual barn *walkthroughs* where they identified and treated unhealthy pigs in the barn, based on knowledge learned in their classes. In total, the game allowed students to experience 10 swine disease scenarios within a virtual world, which simulated the real-life experiences that a pork producer faces daily. In addition to exposing students to everyday swine management practices, the serious game had basic workplace mathematical principles embedded in each scenario. For example, the students had to complete a veterinarian report for each scenario, which required the students to solve basic mathematical problems using addition, subtraction, fractions, ratios, and percentages. To ensure fidelity of the treatment, teachers were asked to complete an online fidelity report at the end of each week.

To determine the effects that the DGBL instructional method had on student achievement in animal science, a criterion-referenced, swine health and management examination (SHME) was developed by *Virtual Walking the Pens* game content developer, Sarah Miller, DVM. It consisted of 50 multiple-choice questions designed to assess student conceptual knowledge in swine health and management. According to Wiersma and Jurs (1990), criterion-referenced tests, such as the SHME, do not require reliability estimates, such as Cronbach's coefficient alpha, to establish reliability. Rather, they require abiding by eight criteria to ensure reliability (Wiersma & Jurs, 1990). The eight criteria and the actions taken to meet those criteria are listed in Table 1.

Table 1

Actions Taken to Ensure Reliability of the Swine Health and Management Criterion-Examination

Criteria	Action Taken
Homogeneous Items	The SHME criterion-examination was created to assess students' content knowledge in the area of swine science. Examination items were linked directly to curriculum's objectives. All items were multiple-choice in form.
Discriminating Items	To be discriminative, game content developer, Sarah Miller, DVM, and a panel of experts in agricultural education confirmed that the examination's items had a range of difficulty.
Enough items	The examination consisted of 50 items. Attention was given to creating an examination with an adequate amount of items to assess student learning.
High Quality Copying and Format	The examination was formatted with adequate spacing, stapled, and printed on a high quality laser printer, professionally. In addition, the test included high-resolution, colored pictures. A panel of experts in agricultural education assessed the examination for face validity and formatting issues.
Clear Directions for the Students	Students were provided with written and verbal directions that explained how to respond properly to the examination's items. The panel of experts in agricultural education was also asked to provide feedback concerning the written examination's directions.

A Controlled Setting	All study participants were provided the examination and a pencil to complete the examination during a regularly scheduled class period. The examination was administered by a testing liaison at each participating school.
Motivating Introduction	The students were cognizant of the purpose of the study and the helpful suggestions the results could have on future coursework. The information was included in the consent form signed by each student, reiterated by the teacher, and stated again by the testing liaison before the examination was administered.
Clear Directions for the Scorer	The game content developer created an examination key for the researcher for the purpose of scoring. The researcher used the examination key to score all examinations. Further, the researcher entered all examination scores into SPSS version 18.

To determine the effects that the DGBL instructional method had on student achievement in mathematics, a standardized mathematics examination (SME) was employed. The SME was designed, originally, by the state of Texas Education Agency to examine eighth grade students' proficiency in general math. The ability to use basic mathematics has been recognized as the most important technical skill desired by animal science industry experts who hire high school graduates (Slusher, Robinson, & Edwards, 2011). The Texas Education Agency's SME was used because it was unlikely that students in Oklahoma would have been exposed to the examination in the past. A high school mathematics teacher in Oklahoma reviewed the examination and "cross walked" its questions with the Oklahoma Priority Academic Skill Standards (PASS) **(**Oklahoma Department of Education, 2011**)** to ensure face and content validity of the SME.

The SME consisted of 50 multiple-choice questions designed to assess student conceptual knowledge in (a) predicting the effect on the graph of a linear equation when slope or y-intercept changes; (b) inequalities model, write, solve, and graph one-two step linear inequalities with one variable; (c) use rules of exponents including integer exponents to solve problems; (d) find area of a 'region of a region' for simple figures and the area of cross sections of regular geometric solids; (e) graphs using the number line; (f) problems using scientific notation; and (g) measure of central tendency, mean, mode, median and range (Oklahoma Department of Education, 2011; D. Watts, personal communication, June 13, 2011).

The SHME had a maximum possible score of 46. The raw score for this part of the examination was based on the number of questions answered correctly by the student. The SME had a maximum possible score of 50. Similar to the SHME, the number of questions answered correctly by the student determined the raw score of this examination.

Limitations

As a result of confounding variables outside of the researcher's control, certain limitations existed in this study. For example, one teacher and his students in the treatment group dropped out of the experiment due to the teacher leaving the profession unexpectedly. In addition, one teacher in the counterfactual group and two teachers in the treatment group did not return all of the student assessment instruments; so, incomplete data sets existed. Therefore, the study's sample size was decreased. As a consequence, the overall power to detect a treatment effect suffered, and the chances of committing a Type II error increased (Field, 2009). As for variables within the researcher's control, random selection of teachers for this study did not occur. As a result, readers are cautioned against generalizing the results of this study.

Data Analysis

The data were analyzed using Predictive Analytics SoftWare® (PASW®) version 20.0 for Windows™. Responses were coded for computer analysis. The pre-test measure used to determine the homogeneity of groups was analyzed using an independent *t*-test. Ary, Jacobs, and Razavieh (2002) posited that an independent *t*-test is an ideal statistical method for determining if statistically significant differences exist between groups. Research question one used descriptive statistics to summarize the personal characteristics of students involved in the study. Research questions two and three were analyzed using a multivariate analysis of variance (MANOVA) procedure. MANOVA was conducted to determine the effect of the delivery method – DGBL versus lecture and discussion – on the two dependent variables – swine health and management examination (SHME) score, and standardized mathematics examination (SME) score. The SHME and the SME provided mean scores of student achievement. As a result, these dependent variables were part of the analysis.

To address the assumptions of parametric tests, examination score data were determined to be interval and independent. Further, data were tested for normality and homogeneity.
The K-S test was used to determine if the distribution of examination scores differed significantly from a normal distribution. The results of the K-S test revealed that the SHME scores were not significantly non-normal for either the counterfactual group ($D(47) = 0.20$, $p > .05$) or the treatment group ($D(50) = 0.10$, $p > .05$). Therefore, the assumption of normality was not violated, and the SHME scores were included in the MANOVA analysis.

Regarding the SME scores, the counterfactual group's scores ($D(48) = 0.07$, $p > .05$) were not significantly non-normal, but the treatment group's scores ($D(50) = 0.13$, $p < .05$) were. As a result of non-normality in the treatment group, the scores were transformed using the log transformation to normalize the data (Field, 2009). After completing the transformation, the K-S test revealed that the SME scores were not significantly non-normal for either the counterfactual group ($D(48) = 0.09$, $p > .05$) or the treatment group ($D(50) = 0.06$, $p > .05$). Therefore, the SME scores were included in the MANOVA analysis. As a result of transformation, the data were back transformed (10^X) for the purpose of interpretation (Field, 2009).

To examine homogeneity, Levene's test for equality of variances was conducted (Field, 2009). The Levene's test revealed that the variances were equal for the counterfactual and treatment groups regarding scores on the SHME ($F(1, 99) = 0.00$, $p < .05$). In addition, the Levene's test showed that the variances were equal for the counterfactual and treatment groups concerning scores on the SME ($F(1, 96) = 0.01$, $p < .05$). Therefore, the assumption of homogeneity was not violated.

Findings

Research question one sought to determine the personal and educational characteristics, such as age, gender, grade level, grade point average, number of agricultural education courses completed, and type of supervised agricultural experience of the students enrolled in the selected animal science courses during the Fall semester of 2011. The students involved in the study were asked to indicate their personal and educational characteristics in concurrence with their pre-test examinations. A total of 102 students completed the personal and educational characteristics questionnaire ($N = 48_{counterfactual}$; $54_{treatment}$). The personal and educational characteristics data were analyzed using modes of variability (i.e., frequencies and percentages).

The counterfactual group respondents consisted of 25 males (52.1%) and 21 females (43.8%). One student (2.1%) was 14 years of age, 16 (33.3%) were 15 years of age, 14 (29.2%) were 16 years of age, 11 (22.9%) were 17 years of age, and 4 (8.3%) indicated they were 18 years of age. Of those who responded, 39 students (81.1%) self-reported their race/ethnicity classification as White/Caucasian. None of the students selected their classification as African-American or Asian. Three students (6.3%) self-selected their classification as American Indian/Alaskan Native/Pacific Islander, and three students (6.3%) identified their race/ethnicity as "other."

In regard to grade classification, 18 students (37.5%) were tenth graders, 16 (33.3%) were eleventh graders, and 11 (22.9%) were twelfth graders. One student (2.1%) was a ninth grader, and no students from the counterfactual group represented the eighth grade. The grade point average category with the most students was the range of 3.6 to 4.0 ($f = 18$; 37.5%). Fourteen students (29.1%) indicated having had a grade point average of 3.1 to 3.5. The grade point average category with the fewest students was 2.5 to 3.0 ($f = 7$; 14.6%).

Fifteen students (31.2%) indicated that they had taken two agricultural education courses, nine students (18.8%) reported having taken four courses, eight students (16.6%) specified they had taken five agricultural education courses, seven students (14.6%) reported taking three courses, and seven students (14.6%) had taken one course. As for students' supervised agricultural experience (SAE) classifications, 21 students (43.6%) selected entrepreneurship as their classification. Eleven students (22.9%) indicated having had a placement SAE, nine students (18.8%) indicated, *I do not have an SAE*, and three (6.3%) indicated having a research SAE. The SAE classification with the fewest students was the *other* category ($f = 1$; 2.1%).

The SAE enterprise with the most students was beef cattle ($f = 10$; 20.8%), followed by the horse and horticulture enterprises, which consisted of five students each (4.2%), respectively. In addition, the swine (8.3%) and *other* SAE types consisted of four students each. The landscape SAE type was identified by three students (6.3%). The SAE categories with the least frequent involvement were goat ($f = 2$; 4.2%), sheep ($f = 2$; 4.2%), and poultry ($f = 1$; 2.1%) enterprises. It was found that none of the students in the counterfactual group indicated having dairy cattle, cereal crops, fiber crops, and oil crops as SAE enterprises.

The treatment group respondents consisted of 37 males (68.5%) and 16 females (29.6%). Twenty-one (38.9%) were 16 years of age, 18 (33.2%) were 15 years of age, nine (16.7%) were 17 years of age, five (9.3%) indicated they were 18 years of age, and none of the students were

14 years of age. Thirty-seven students (68.4%) self-reported their race/ethnicity classification as White/Caucasian, and 15 students (27.8%) self-selected their classification as American Indian/Alaskan Native/Pacific Islander; one student (1.9%) indicated African-American. In regard to grade classification, 32 of the students (59.1%) indicated they were tenth graders, 11 (20.4%) were eleventh graders, and nine (16.7%) were twelfth graders. One student (1.9%) represented the ninth grade, and none of the students from the treatment group indicated they were in the eighth grade. As for grade point average, the category with the most students was 3.6 to 4.0 ($f = 17$; 31.4%). Fifteen students (27.8%) indicated having a grade point average of 2.5 to 3.0, and nine students (16.7%) reported a grade point average of 3.1 to 3.5. Finally, the grade point average with the fewest students was 2.4 and below ($f = 2$; 3.7%).

Twenty-five (46.3%) students had taken two agricultural education courses, 14 (25.8%) indicated they had taken three, seven (13.0%) had taken one, five (9.3%) reported they had taken four, and two students (3.7%) indicated they had taken five courses. As for students' SAE classifications, 25 students (46.3%) selected entrepreneurship as their classification, and 10 students (18.5%) indicated having a placement SAE. Nine students (16.7%) indicated, *I do not have a SAE*. The SAE classification with the fewest students was the *other* category ($f = 8$; 14.8%).

Nine students (16.7%) self-reported their SAE enterprise as landscape, eight students (14.8%) identified beef cattle, and six students (11.1%) indicated swine as being their SAE enterprise. Four students (7.3%) self-selected goat, and students were distributed evenly among the poultry ($f = 2$, 3.7%), sheep ($f = 2$, 3.7%), and horticulture ($f = 2$, 3.7%) SAE enterprises. One student (1.9%) represented the horse SAE enterprise, and one (1.9%) identified having had a cereal crops SAE enterprise. Eleven students (20.4%), however, identified *other* as their SAE enterprise type.

Research questions two and three were analyzed using a multivariate analysis of variance (MANOVA) procedure. MANOVA was conducted to determine the effect of the DGBL instructional method versus the lecture and discussion method on the dependent variables SHME score and SME score. The counterfactual group students ($n = 47$) who took the SHME had a group mean of 25.89 ($SD = 6.29$); the treatment group ($n = 50$) mean was 25.46 ($SD = 5.47$) (see Table 2).

Table 2

Swine Health and Management Examination Scores of Counterfactual and Treatment Groups

Swine Health & Management Examination	Min. & Max.	*M*	*SD*
Counterfactual Group	3 to 37	25.89	6.29
Treatment Group	14 to 39	25.46	5.47

Note. The examination's score range was from 0 to 46.

As for group means regarding the SME, the counterfactual group students ($n = 47$) had a back transformation group mean of 25.70 ($SD = 1.51$); the treatment group ($n = 50$) back transformation group mean was 21.38 ($SD = 1.51$) (see Table 3).

Table 3

Standardized Mathematics Examination Scores of the Counterfactual and Treatment Groups

Texas Assessment of Knowledge and Skills 8th Grade Mathematics Examination	Untransformed		Natural Log Transformation		Back Transformation	
	M	*SD*	*M*	*SD*	*M*	*SD*
Counterfactual Group ($n = 47$)	26.17	9.97	1.41	0.18	25.70	1.51
Treatment Group ($n = 50$)	22.22	9.72	1.33	0.18	21.38	1.51

Note. The examination's score range was from 0 to 50.

The multivariate test statistic, Pillai's trace, did not reveal statistically significant between-group differences as a result of the treatment ($V = 0.04$, $F(2, 94) = 1.84$, $p > .05$) (see Table 4). Further, the treatment effect size, as calculated using partial eta squared, resulted in a *negligible* (Thalheimer & Cook, 2002) effect (Partial $\eta^2 = .04$). As such, the null hypotheses H_o1 and H_o2 were accepted, indicating that the DGBL instructional method did not have a statistically significant effect ($p > .05$) on students' animal science competence or their mathematics competence, as measured by the study's examinations.

Table 4

The Effect of a DGBL Delivery Method on Students' Animal Science Competence and Mathematical Competence

Effect	Pillai's Trace	*F*	*df*	Error *df*	*p*-value
Between-Groups	.04	1.84	2.00	94.00	.165

Conclusions

It was concluded that a majority of students who participated in this study were male, White/Caucasian, 15 and 16 years of age, and in the tenth grade. Further, the majority of students who participated self-reported having a grade point average of 3.1 or higher. A large percentage ($81.2\%_{counterfactual}$; $85.2\%_{treatment}$) of the participants had taken two or more agricultural education courses. Moreover, it was concluded that a majority of the students classified their SAE in the categories of entrepreneurship and placement; and, nearly one-half (46%) of the students reported having a livestock-oriented SAE.

When considering students' competence in selected animal science content knowledge, it was concluded that the use of a serious digital game, as developed by Pfizer® Animal Health, did not have a statistically significant effect ($p > .05$) on students' performance as determined by the SHME. Typically, serious games provide anchored instruction through the use of a simulation or virtual world that uses authentic contexts and activities (Oblinger, 2006; Van Eck & Dempsey, 2002). This result, however, refutes research conducted by Bottage, Rueda, Kwon, Grant, and

LaRoque (2007) who concluded that anchored instruction had a positive effect on students' performance levels. This finding did support research conducted by Parr, Edwards, and Leising (2008) and Young, Edwards, and Leising (2009) who found that agricultural content knowledge did not diminish when the agricultural curriculum was integrated with mathematical concepts.

Use of the serious game failed to make a statistically significant difference ($p > .05$) on improving students' mathematical performance. In the context in which this study occurred, this result does not support the assertion that teaching with technology promotes student learning of mathematics (National Council of Teachers of Mathematics, 2000). Further, *[Serious game]*, focused on applied workplace mathematics and provided a virtual world in which to solve workplace problems (Name, personal communication, date). As such, this finding supported Parr, Edwards, and Leising (2009) who concluded that a math-enhanced agricultural curriculum did not have a statistically significant effect ($p > .05$) on students' mathematics ability, as determined by a traditional math examination or by an authentic assessment of students' ability to use math to solve workplace problems.

Recommendations for Research

Although the results of this study did not reveal any statistically significant differences in selected animal science content knowledge and mathematics achievement, optimism exists that the study's intervention, a serious digital game, has the potential for positive effects in these areas. However, additional research is needed. Because the research period was only ten days, this study should be replicated to reflect a semester-long research period to provide enough time to produce a magnitude of effect that would result in detectable differences, assuming such an effect existed. Further, this study should be replicated with a larger sample of teachers and their students. This would increase the power of the study and assist in detecting treatment effects and lower the chance of committing a Type II error (Kirk, 2010).

In addition, the teacher participants and their students were sampled conveniently, which likely increased external threats to validity (Creswell, 2008). As such, this study should be replicated with teachers and their students who are selected randomly to minimize external threats to validity and make the results more generalizable. Also, this study should be replicated with more of a tightly controlled, "clinical" structure. For instance, in a "perfect world" with the experimenter exercising absolute control, students could be brought onto campus and assigned to either a counterfactual or treatment group. After random assignment had been established, the counterfactual group would receive a lecture and discussion teaching approach, and the treatment group would receive a DGBL teaching approach. Thereafter, the students would be assessed on their agricultural and mathematics content knowledge. This design would allow for a more *clinical* trial in which the extraneous and potentially confounding variables are controlled better resulting in a *truer*, more valid experiment.

Because research has shown that barriers may affect teachers' use of technologies in the classroom (e.g., Bauer & Kenton, 2005; Berge, Muilenburg, & Haneghan, 2002; Gammill & Newman, 2005; Hernandez-Ramos, 2005; Hope, 1998; Judson, 2006; Kotrlik, Redmann, & Douglas, 2003; Levin & Wadmany, 2008; McGrail, 2005; Murphrey & Dooley, 2000; Nelson & Thompson, 2005), future research should be conducted to determine the barriers teachers faced when incorporating serious games into their existing pedagogical practices. This type of inquiry would provide researchers the ability to identify barriers specific to using serious games. This knowledge could be beneficial when introducing pre-service teachers to DGBL in teaching methodology courses and when providing in-service teachers with professional development.

In addition, if the purpose of agricultural education is to prepare students for careers in agriculture and post-secondary education, simultaneously (Roberts & Ball, 2009), a qualitative impact analysis should be conducted with the treatment group students. In other words, did the game have an impact on students' decisions to pursue agriculture as career – specifically, a career in the animal sciences, or the swine industry in particular? Also, what impact did the game have on their opinion of and attitudes toward the agricultural industry? And, did the game have an impact on students' decisions to pursue an agriculturally-related degree at the postsecondary level? Further, future inquiries should examine how much learning was retained. For example, did the students in the treatment group retain knowledge longer than the students in the counterfactual group as a result of the intervention? Future research is warranted to answer these and related questions.

Recommendations for Practice

Although no statistically significant differences were found, this study showed that using a serious digital game in the context of animal science did not diminish student achievement. As a result, it is recommended that teachers incorporate this teaching method into their existing pedagogical practices without the fear of decreasing student achievement. In addition, professional development opportunities should be created for in-service teachers to develop the Technological Pedagogical Content Knowledge (Koehler & Mishra, 2009) required to integrate the DGBL method such that student engagement is prolonged and intensified. An emphasis should be placed on not only helping teachers understand how to teach via a DGBL delivery method, but also how to teach using more student-centric pedagogy in general.

Although 14 hours of professional development in-service was offered to the treatment group teachers in this study, not all of that time was devoted to pedagogy. In fact, only roughly five hours were devoted to preparing teachers to deliver the learning content digitally. Therefore, more intense efforts are needed to help teachers increase their confidence for using digital delivery modes and media. Further, the creators of these professional development opportunities should consider offering in-service workshops designed to assist teachers in overcoming perceived barriers associated with using technology in their classrooms (Bauer & Kenton, 2005; Berge, Muilenburg, & Haneghan, 2002; Gammill & Newman, 2005; Hernandez-Ramos, 2005; Hope, 1998; Judson, 2006; Kotrlik, Redmann, & Douglas, 2003; Levin & Wadmany, 2008; McGrail, 2005; Murphrey & Dooley, 2000; Nelson & Thompson, 2005). In addition, teacher educators of agricultural education may wish to consider incorporating DGBL into their teaching methodology courses for pre-service teachers. As such, teacher education programs could influence pre-service teachers' decisions in regard to integrating technology into their classrooms effectively in the future (Bai & Ertmer, 2009).

Discussion

According to Roberts and Ball (2009), agriculture provides a context for students to learn. In fact, Shinn et al. asserted that, "secondary agricultural education, through the use of a relevant curriculum delivered from a student-centered perspective by skillful teachers, has high potential for engaging students in active, hands-on/minds-on learning environments rich with opportunities for learning mathematics" (as cited in Parr et al., 2006, p. 16). However, the DGBL method tested in this study had no statistically significant effect on students' performance on assessments of swine content knowledge and mathematics. Could it be that the teachers in the counterfactual group had more animal science coursework during their teacher preparation programs, or perhaps the teachers in the counterfactual group had more work experience in the swine industry? If so, they may have had higher levels of teacher self-efficacy (Tschannen-Moran, Hoy, & Hoy, 1998) for the content taught and examined.

Further, the teachers in the counterfactual group may have had additional certifications in other curricular areas, such as science or math, which could have increased their ability to integrate mathematics more effectively. It is also possible that the teachers in the counterfactual group held a higher math aptitude than did the treatment group teachers. In addition, it could be that teachers in the treatment group spent more time teaching students how to play the serious game rather than teaching the content supporting students' achieving the lessons' objectives, thus, limiting their ability to affect student learning optimally. This explanation is plausible, as other researchers have shown that teachers have spent more time during a lesson teaching students basic technology skills (i.e., using technology for the sake of using technology) rather than teaching to the content-related objectives (Bauer & Kenton, 2005; McGrail, 2005). Therefore, similar teacher behaviors may have occurred in this study.

Moreover, based on the teachers' fidelity reports, instructors in the counterfactual group used more teaching methodologies and possibly possessed higher levels of Technological Pedagogical Content Knowledge (Koehler & Mishra, 2009) than did the treatment group teachers. Finally, it could be that teachers in the counterfactual group displayed a reactive behavior known as the John Henry effect (Gay, Mills, & Airasian, 2009). Because they were aware of the intervention used by the treatment group teachers, maybe they worked harder to outperform their treatment group colleagues.

As for the students, it is possible that those in the counterfactual group had a more extensive interest in agriculture than did their peers in the treatment group. In addition to agricultural interest, perhaps, the students in the counterfactual group had more extensive agricultural backgrounds, or swine industry experience, in particular. It is also possible that students in the counterfactual group had been exposed to more advanced mathematics courses, such as advanced placement math courses, than had the treatment group students. In addition to a more rigorous background in mathematics, the students in the counterfactual group may have held higher levels of math aptitude than did the treatment group students. In addition, the interactive three-dimensional (3D) game, *Virtual Walking the Pens*, was designed originally for adult learners (S. Miller, personal communication, February 15, 2011). So, because the game was used as an intervention with adolescents, this could have been a confounding variable that affected the study's outcome regarding students' acquisition of the animal science content knowledge examined.

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Discussant Remarks Matt Baker
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The Effect of a Serious Digital Game on the Animal Science and Mathematical Competence of Secondary Agricultural Education Students: An Experimental Study

A Discussion

This was a tightly designed study that was easy to read. The subject of the paper was timely as well. As a function of emerging technologies in Western Society, preteen and adolescent learners enter our classrooms adept in the use of entertainment technology and software not available at the time when their teachers were young. This phenomenon is not a new one and will continue in the future as technology is developed at exponentially higher rates. Thus, innovative educators will have an interest in redesigning entertainment-driven technology to enhance the teaching/learning process. Consequently, researchers must continuously examine the effects that entertainment-driven technologies have when re-engineered as an educational tool.

In this quasi-experimental study, the researchers utilized a serious digital game in swine health and management with a treatment group and compared it to a counterfactual group. Personological and educational variables of the two groups of high school students in Oklahoma were measured. After the treatment, both groups were tested on their knowledge in swine health and management and student achievement in mathematics.

For data analysis the researchers used MANOVA to examine the effects of teaching method upon the two dependent variables. They are to be commended for their sensitivity to issues in equality of variances between the two groups. The data analysis revealed that no statistically significant differences existed between the treatment and counterfactual groups based upon the two dependent variables. Likely paper space limitations prevented the researchers from reporting some of the detail related to a number of my questions such as: (1) were the pretest measures of 'prior learning of swine diseases and metacognitive awareness' and 'prior knowledge of general mathematics' from school district report cards used to equate the groups?, and (2) if the pretest measures were used, how were they used?

In conclusion, although the study was well designed and the research design limitations were acknowledged, I am puzzled why the researchers would 'recommend' the use of serious digital games when they had no apparent educational affect. Had the researchers found in an expanded study that motivation to learn was significantly enhanced, then I would have more fully understood why the researchers would recommend that "teachers incorporate this teaching method into their existing pedagogical practices . . ." because it did not have a deleterious effect on subject matter and mathematical knowledge gain.

Correlation of Secondary Agricultural Education Students' Science Achievement to Number of Agricultural Education Courses Passed

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Abstract

This study sought to determine the relationship between number of agricultural education courses passed and science achievement of regular education and special education agricultural education participants and concentrators. This study found that regular education agricultural education concentrators (n=1,320) had a statistically significant higher Georgia High School Graduation Test (GHSGT) science mean score than regular education agricultural education participants (n=2,345) with a GHSGT science mean score of 238.77. ($F_{(1, 3664)} = 3.883$, $p = .049$) at a priori alpha level of .05 although the effect size was .1 which was small. A point-biserial correlation test did reveal a low, but positive and statistically significant relationship between the number of agricultural education courses passed and GHSGT science scores of all regular education students. Special education students who were agricultural education concentrators did have a statistically significant relationship with science achievement on the GHSGT. Regular education students who were agricultural education concentrators did not have a statistically significant relationship with science achievement on the GHSGT.

Introduction

In 2001, Congress revised the Elementary and Secondary Act of 1965 to create the No Child Left Behind Act (NCLB) which President Bush signed in January 2002 (Linn, Baker, & Betebenner, 2002). The amended educational law required states to be accountable for academic achievement to measure adequate yearly progress (AYP) and each individual state devised assessments and proficiency standards for each core academic area (Reeves, 2003). Although reading and mathematics were the first academic areas tested, states were required to have science standards in place by 2005-2006 school year and administer science assessments by 2007-2008 school year. The testing minimum requirements translated into at least once in each grading interval of third through fifth, sixth through ninth, and tenth through twelfth. Although science testing was required, NCLB did not require science to be used for calculating AYP. Individual states adopted different policies and Georgia provided local systems the option of selected science as an additional indicator to be used to determine AYP (Judson, 2010).

As a result of NCLB mandates, each state began developing standards, assessments, and proficiency levels and 20 states administered mandatory graduation tests in 2004 (Gayler, 2004). However, standards, testing instruments and ages of students tested varied by states. Both Georgia and Alabama tested juniors in academic subjects of writing, English/language arts, mathematics, social studies, and science. Juniors taking the Georgia High School Graduation Test (GHSGT) and Alabama's High School Graduation Exam were required to pass all five standardized tests as a graduation requirement (Alabama Department of Education, 2003, Georgia Department of Education, 2011a). Rather than administering comprehensive exams during their junior year, Tennessee chose another avenue. Students were required to pass Tennessee's Gateway exams which were end-of-course assessments in algebra I, English II, and biology I to fulfill graduation requirements (Tennessee Department of Education, 2004). Instead of testing juniors, Florida and South Carolina assessed sophomores. Florida's graduation test, Florida Comprehensive Assessment Test (FCAT), assessed students in the areas of reading and mathematics while South Carolina utilized the High School Assessment Program (HSAP) that measured achievement in English language arts and mathematics (Florida Department of Education, 2010, South Carolina Department of Education, 2010).

After the passage of NCLB, educators became more focused on academic performance and techniques to improve test scores. One technique suggested was to connect agricultural education to academic subjects to reiterate academic course objectives (Martin, Fritzsche, & Ball, 2006). NCLB held academic and career and technology educators across the nation accountable for student achievement in core academic subjects by the year 2014.

Review of Literature

With the passing of NCLB in 2001, schools were held accountable for academic achievement of students in the areas of math, English, science, and social studies (Reeves, 2003). With the focus on core academic subjects, a perception study was conducted by Martin, Fritzsche, and Ball (2006) on 15 Illinois secondary agricultural education teachers and five agricultural education in-service professors to determine the effects of NCLB on secondary agricultural education programs. Four questionnaires provided data which were analyzed using descriptive statistics to determine means, standard deviations, frequencies, and percentages. According to the study, NCLB legislation had influenced secondary agricultural education programs to integrate academic material into the curriculum in order to justify non-academic subjects. The authors recommended additional research to be conducted concerning academic achievement of secondary agricultural education students.

With the advancements of science and technology, education and science experts agreed that science instruction must be improved in all grades. In 2007, a congressional report *Rising above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future* completed by the National Academy of Sciences, concluded in the areas of science and technology that the United States is falling behind the rest of the industrialized world. One response to this congressional report was made by the National Academies Committee on a Leadership Summit to Effect Change in Teaching and Learning. The committee was a combination of leaders from science, engineering, medicine, and research in which they recommended that agriculture be integrated into science, technology, engineering, and mathematics (STEM) curriculum creating STEAM (National Academies, 2009).

In order to apply academic concepts to real-life situations, agricultural education provides training for the whole person with three overlapping components. The components are: classroom and laboratory instruction, supervised agricultural experience (SAE) program, and FFA. Each part of agricultural education compliments and reinforces a complete education for high school students. Classroom and laboratory instruction allows students to investigate and integrate academic theories with agriculture applications. The SAE program provides an avenue for students to apply what they have learned from the classroom to relevant situations. The FFA is the component that offers leadership training, community involvement techniques, incentives for scholastic improvement, and recognition (Phipps, Osborne, Dyer & Ball, 2008).

In order to determine if student achievement was related to agricultural education program participation, tests were conducted using standardized test scores. Chiasson and Burnett (2001) researched state mandated exit exam science scores of 11th grade students from Louisiana in 1998. The data source was the Louisiana Department of Education. The data were analyzed using descriptive statistics of means, standard deviations, percentages, frequencies, and *t*tests to determine statistical significance. The relevant conclusions were that on the science section of the exam that agricultural education students obtained higher scores and had a higher pass rate than non-agricultural education students.

A study involving Georgia students was conducted by Rich, Duncan, Navarro, and Ricketts (2009). They investigated 51 Georgia middle schools with agricultural education programs and 51 middle schools with no agricultural education programs. The study utilized science scores from the state created instrument Criterion-Referenced Competency Test (CRCT) to compare the two groups of schools. The unit of analysis was school scores rather than individual scores. Student demographics, enrollment, and CRCT science test scores were provided by the Georgia Department of Education. The data were analyzed using descriptive statistics of means, standard deviations, percentages, and frequencies. In addition to descriptive statistics, means were compared with paired samples *t*tests and Cohen *d* was used to determine effect size. The relevant conclusion was that middle schools with agricultural education programs had significantly higher percentages of students meeting or exceeding the standards than middle schools without agricultural education programs.

To expand the scope nationwide and include all CTE areas, Levesque, Wun, and Green (2010) analyzed science achievement and number of science courses of the 2005 graduating class. About 9,000 public school students' transcripts were analyzed for core science credits and the 12^{th} grade national assessment of educational progress (NAEP) science test scores were the instruments utilized for gathering data. The study grouped students as regular education and CTE graduates. The CTE students were subdivided as concentrators and non-concentrators into 13 occupational program areas such as: agriculture, business, health, and manufacturing. The report concluded that agriculture concentrators scored higher than non-concentrators who passed similar amounts of foundation science courses.

This study was developed to help meet the goals of the National research agenda for Agricultural Education. According to Doerfert, a "key outcome" identified by the agenda included "Accurate and reliable data that describe the quality and impact of educational programs and outreach efforts at all levels [that] will be distributed to respective decision groups (e.g. students, parents, administration, industry, policy makers)" (p. 24). This research represents an attempt to fulfill this aspect of the agenda.

Conceptual/Theoretical Framework

The conceptual/theoretical framework for this study is built on contextual learning and constructivism philosophy of teaching that educational pioneer, John Dewey, first brought to the forefront of educational debates over 100 years ago (Dewey, 1959). Dewey believed that a holistic approach between all disciplines was essential to student learning (Roberts & Ball, 2009). According to Doolittle and Camp (1999) and Crawford (2001) constructivism has these characteristics:

- lessons are presented utilizing genuine situations;
- collaboration between students is encouraged;
- subject matter is pertinent;
- new material is connected in context to previous skills attained;
- students practice new concepts or skills and transfer information to other situations or other academic areas; and
- teachers act as facilitators.

Constructivism emphasizes acquiring new skills and knowledge within the context of previous experiences, relevant situations, and other academic subjects which is contextual learning (Bransford, J., Brown, A., & Cocking, R., 2000; Crawford, 2001). According to Roberts and Ball (2009), "agriculture as a context for learning is anchored theoretically in constructivism" (p. 85). In 1988, the National Research Council (NRC) published the book, *Understanding Agriculture: New Directions for Education* which accentuated the importance of integrating agricultural education with science courses to teach academic theories using relevant agriculture principles. Up to this point, vocational education's primary goal was to train students for production agriculture careers. The NRC recommended expanding the curriculum of teaching job skills to include teaching agricultural science principles associated with nontraditional as well as traditional agriculture. A few years following the NRC recommendation, the 1991 Secretary's Commission on Achieving Necessary Skills (SCANS) issued this proclamation:

> We believe, after examining the findings of cognitive science, that the most effective way of learning skills is "in context," placing learning objectives within a real environment rather than insisting that students first learn in the abstract what they will be expected to apply (p. xv).

With this change in policy, agricultural education began integrating academic objectives to increase academic achievement of students (Parr, Edwards, Leising, 2009).

Purposes and Objectives

The purposes of this quantitative descriptive, assessment of group differences, and correlational study were to describe the science achievement of secondary agricultural education students both regular education and special education to determine if the number of agricultural education courses passed would statistically significantly improve students' performance on science achievement when compared to students who did not participate in agricultural education.

1. Determine the relationship between number of agricultural education courses passed and science achievement of regular education agricultural education participants and concentrators.
2. Compare and correlate science achievement of special education agricultural education concentrators with non-agricultural special education students.
3. Compare science achievement of regular education agricultural education concentrators with non-agricultural regular education students.

Methodology

The research design of this quantitative study was descriptive, correlational, and assessed group differences. The treatment group was the group of students who were in the eleventh grade during the academic year 2009-2010, had passed at least one secondary agricultural education course, and whose agricultural education instructors responded to the request by Georgia's State Director of Agricultural Education. The treatment group was subdivided into two groups based on number of agricultural education courses passed. The students that passed one or more secondary agricultural education course were labeled as participants and the students that passed three or more secondary agricultural education courses were labeled as concentrators (Georgia Department of Education, 2010a).

The instrument utilized to measure science achievement was the state mandated standardized science portion of the Georgia High School Graduation Test (GHSGT). According to Steve Cramer, Associate Director of Test Scoring and Reporting Services, the Kuder-Richardson-20 reliability index of the science portion of the spring 2010 GHSGT was .937 (S. Cramer, personal communication, December 29, 2011). In addition to the Kuder-Richardson-20 test, the Cronbach's alpha index was 0.92 (Georgia State Department of Education, 2010b).

The GHSGT science portion has four performance level divisions to classify student achievement. The score levels are divided into "below proficiency (below 200), "basic proficiency" (200 - 234), "advanced proficiency" (235 - 274), and "honors" (275 or above) (Georgia State Department of Education, 2011b).

The control group consisted of 97,364 students and was subdivided into 89,965 regular education students and 7,399 special education students. All students had a GHSGT science mean score of 238 with 10 percent below proficiency, 34 percent basic proficiency, 41 percent advanced proficiency, and 16 percent honors. Regular education students had a GHSGT science mean score of 241 with 7 percent below proficiency, 33 percent basic proficiency, 42 percent advanced proficiency, and 17 percent honors. Special education students had a GHSGT science mean score of 207 with 42 percent below proficiency, 37 percent basic proficiency, 17 percent advanced proficiency, and 3 percent honors.

The dependent variable was the student scores on the science portion of the GHSGT taken spring 2010. The independent variables were the number of secondary agricultural education courses passed and IEP status of eleventh grade agricultural education students that completed the science portion of the 2009-2010 GHSGT.

According to Kotrlik, Williams, and Jabor (2011), Cohen *d* was calculated to estimate effect size on *t* tests and compared to the following values: .20 small effect size, .50 medium effect size, and .80 large effect size. As Cohen *d* was calculated to determine effect size for *t* tests, *Eta-squared* was calculated to estimate effect size for ANOVA and compared to the following values: .10 small effect size, .25 medium effect size, and .40 large effect size. (Kotrlik, Williams, &Jabor, 2011).

Findings

The study consisted of 97,364 students who completed the GHSGT science portion for the first time in the spring of 2010. The regular education student population totaled 89,965 (92.5%) and the special education student population totaled 7,399 (7.5%)(Table 1).

Table 1
Descriptive Statistics for GHSGT Science Exam Population of Students: General population (n=97,364) and Agricultural Education (n=4,221)

GHSGT Category	General Population Percentage	Agricultural Education Population Percentage
Regular Education	92.5	87
Special Education	7.5	13

The percentage of special education students in each GHSGT science score category was: below proficiency 42%, basic proficiency 37%, advanced proficiency 17%, and honors 3% (Table 2). The following section describes the 4,221 agricultural education students who completed the GHSGT science portion for the first time in the spring of 2010. The regular education student population totaled 3,665 (87%) with a GHSGT science mean score of 239. The percentage of regular education students in each GHSGT science score category was: below proficiency 2%, basic proficiency 41%, advanced proficiency 44%, and honors 13% (Table 2). The special education student population totaled 556 (13%) with a GHSGT science mean score of 215. The percentage of special education students in each GHSGT science score category was: below proficiency 20%, basic proficiency 58%, advanced proficiency 18%, and honors 4% (Table 2).

Table 2
Descriptive Statistics for GHSGT Science Exam Scores of Regular and Special Education Students:Regular Education General Population (n=89,965),Regular Education Agricultural Education (n=3,665), Special Education General population (n=7,399) and Special Education Agricultural Education (n=556)

GHSGT Category	Regular Education General Population	Regular Education Agricultural Education	Special Education General Population	Special Education Agricultural Education Population
Below	07	02	42	20
Basic	33	41	37	58
Advanced	42	44	17	18
Honors	17	13	03	04

To further describe the agricultural education students, the number of agricultural education courses was explored. Agricultural education students who had passed one or two classes were classified as participants. A total of 2,692 (64%) were participants with 2,345 (87%) classified as regular education with a GHSGT science mean score of 239 (Table 3).

Table 3
Descriptive Statistics for GHSGT Science Exam for Agricultural Education Participants

GHSGT Category	n	Percentage of population
Total	2,692	100
Regular Education	2,345	87
Special Education	347	13

The percentage of regular education students in each GHSGT science score category was: below proficiency 2%, basic proficiency 43%, advanced proficiency 43%, and honors 12% (Table 4). The special education student population totaled 347 (13%) with a GHSGT science mean score of 215 (Table 4). The percentage of special education students in each GHSGT science score category was: below proficiency 22%, basic proficiency 56%, advanced proficiency 19%, and honors 3% (Table 4).

Table 4
Descriptive Statistics for GHSGT Science Exam Score Percentages of Regular Education Agricultural Education Overall (n=3,665), Regular Education Participants (n=2,345), Regular Education Concentrators (n=1,320) Special Education Agricultural Education Overall (n=556), Special Education Agricultural Education Participants (n=347), and Special Education Concentrators (n=209)

GHSGT Category	Regular Education Overall	Regular Education Participant	Regular Education Concentrator	Special Education Overall	Special Education Participant	Special Education Concentrator
Below	02	02	02	20	22	19
Basic	41	43	39	58	56	60
Advanced	44	43	46	18	19	16

Honors	13	12	13	04	03	05

Agricultural education students who have passed three or more classes were classified as concentrators. A total of 1,529 (36%) students were concentrators with 1,320 (86%) classified as regular education with a GHSGT science mean score of 241(Table 5). The percentage of regular education students in each GHSGT science score category was: below proficiency 2%, basic proficiency 39%, advanced proficiency 46%, and honors 13% (Table 4). The special education student population totaled 209 (14%) with a GHSGT science mean score of 216. The percentage of special education students in each GHSGT science score category was: below proficiency 19%, basic proficiency 60%, advanced proficiency 16%, and honors 5% (Table 4).

Table 5
Descriptive statistics for GHSGT science exam for agricultural education concentrators

GHSGT Category	n	Percentage of population
Total	1,529	100
Regular Education	1,320	86
Special Education	209	14

The science portion of GHSGT was the instrument utilized for measuring science achievement. Agricultural education participants (N=2,345) had a GHSGT science mean score of 238.77 with a standard deviation of 27.89 (Table 6). Agricultural education concentrators (N=1,320) had a GHSGT science mean score of 240.65 with a standard deviation of 27.53. An ANOVA test did reflect a statistically significant difference between the groups ($F_{(1, 3664)}$= 3.883, p = .049) at a *priori* alpha level of .05. To determine the effect size, *Eta-squared* was calculated. The effect size was .1% which was small (Table 6).

Table 6
GHSGT Science Exam Scores of Regular Education Participants (n=2,345) and Concentrators (n=1,320)

Student Category	n	M	SD	*p*-value
Participant Regular Education	2345	238.77	27.89	
Concentrator Regular Education	1320	240.65	27.53	
Between Groups				.049

Eta^2= 0.001

A point-biserial correlation test did reveal a “low” (Davis, 1971), but positive and statistically significant relationship between the number of agricultural education courses passed and GHSGT science scores, (ρ_{bi}= .033, p = .024) of all regular education students (Table 7). Therefore, the number of agricultural education courses passed did have a statistically significant relationship with science achievement on the GHSGT.

Table 7
Relationship Between GHSGT Science Exam Scores of All Regular Education Agricultural Education Students (n=3,665), Number of Agricultural Education Courses Passed, FFA Participation, and SAE Activities.

Variable	Y_1	X_1	*M*	SD
GHSGT Science Score (Y_1)	1.000	.033*	239.43	27.77
Number of agricultural education courses passed (X_1)		1.000	1.36	.48

*p < .05, **p < .001

Regarding concentrators, the students who had an IEP (N=1,320) were considered special education students; and the students who did not have an IEP (N=3,665) were considered regular education students. The science portion of GHSGT was the instrument utilized for measuring science achievement. Agricultural education concentrators who received special education services (N=209) had a GHSGT science mean score of 215.91 with a standard deviation of 24.94. Non-agricultural education students who received special education services for the state of Georgia (N=7,399) had a GHSGT science mean score of 207. A one sample *t*test did reflect a statistically significant difference between the groups ($t_{(208)} = 5.163$, $p < .001$) at a *priori* alpha level of .05. The Cohen *d* test was calculatedand found to be .357 which was between a small and medium effect size. Therefore, special education students who were agricultural education concentrators did have a statistically significant relationship with science achievement on the GHSGT (Table 8).

Table 8
GHSGT Science Exam Scores of Special Education Concentrators (n=209) and Non-agriculturalEducation Students (n=7,399)

Student Category	n	M	SD	*t*-value	*p*-value
Special Education Concentrator	209	215.91	24.94	5.165	<.001

Cohen *d* = .357

Regarding concentrators the students who had an IEP (N=556) were considered special education students; and the students who did not have an IEP were (N=3,665) were considered regular education students. The science portion of GHSGT was the instrument utilized for measuring science achievement. Agricultural education concentrators who were regular education students (N=1,320) had a GHSGT science mean score of 240.65 with a standard deviation of 27.53. Non-agricultural education students who were regular education for the state of Georgia (N=89,965) had a GHSGT science mean score of 241. A one sample *t*test did not reflect a statistically significant difference between the groups ($t_{(1319)} = -.462$, $p = .644$) at a *priori* alpha level of .05. Therefore, regular education students who were agricultural education concentrators did not have a statistically significant relationship with science achievement on the GHSGT (Table 9).

Table 9
GHSGT Science Exam Scores of Regular Education Concentrators (n=1,320) and Non-agriculturalEducation Regular Education Students (n=89,965)

Student Category	n	M	SD	*t*-value	*p*-value
Regular Education Concentrator	1320	240.65	27.53	-.462	.644

Conclusions and Recommendations

Objective one focused on determining the relationship between number of agricultural education courses passed and science achievement as measured by GHSGT of regular education agricultural education participants and concentrators. This study found that regular education agricultural education concentrators (n=1,320) had a higher GHSGT science mean score of 240.65 than regular education agricultural education participants (n=2,345) with a GHSGT science mean score of 238.77. An ANOVA test was performed between the two groups and was statistically significant ($F_{(1, 3664)} = 3.883$, $p = .049$) at a *priori* alpha level of .05 although the effect size was .1 which was small. A point-biserial correlation test did reveal a low, but positive and statistically significant relationship between the number of agricultural education courses passed and GHSGT science scores of all regular education students. Therefore, the number of agricultural education courses passed did have a statistically significant relationship with science achievement on the GHSGT. These findings were comparable to results depicted by Levesque, Wun, and Green (2010) that concluded agricultural education concentrators scored higher than or not measurable different from non-concentrators on the national assessment of education progress (NAEP) science test. An additional study conducted by Ricketts, Duncan, and Peake (2006) found that agricultural education students attained higher GHSGT science scores because of involvement in agricultural education courses.

Objective two investigated how science achievement on GHSGT of special education agricultural education concentrators compared to non-agricultural special education students. Agricultural education concentrators who received special education services (N=209) had a GHSGT science mean score of 215.91. Non-agricultural education students who received special education services for the state of Georgia (N=7,399) had a GHSGT science mean score of 207. A one sample *t*test was performed between the two groups and was statistically significant ($t_{(208)} = 5.163$, $p < .001$) at a *priori* alpha level of .05. The Cohen *d* test revealed a small to medium effect size (.357). Therefore, special education students who were agricultural education concentrators did have a statistically significant relationship with science achievement on the GHSGT. These findings were comparable to results depicted by Easterly III and Myers (2011) which concluded that inquiry-based instruction in agricultural education was a supportive technique of instruction for special needs students.

Objective three studied how science achievement on GHSGT of regular education agricultural education concentrators compared to non-agricultural regular education students. Agricultural education concentrators who were regular education students (N=1,320) had a GHSGT science mean score of 240.65 and non-agricultural education students who were regular education for the state of Georgia (N=89,965) had a GHSGT science mean score of 241. A one sample *t*test was performed between the two groups and was not statistically significant ($t_{(1319)} = -.462$, $p = .644$) at a *priori* alpha level of .05. Calculating the effect size was not necessary due to lack of statistical significance. Therefore, regular education students who were agricultural education concentrators did not have a statistically significant relationship with science achievement on the GHSGT. Although the hypothesis failed to be rejected, the scores of non-agricultural education students and agricultural education students had less than one point difference. These findings were comparable to results depicted byTheriot and Kotrlik (2009) which found that on the graduate exit exam (GEE) of Louisiana, science achievement of agricultural education students were at least equal to the science achievement scores of non-agricultural education students. However, the findings were not similar to research conducted earlier by Chiasson and Burnett (2001) which found that on the science portion of the GEE agricultural education students obtained higher scores than non-agricultural students.

This study determined that secondary special education students enrolled in three or more agricultural education courses improved science achievement on the standardized GHSGT exam. Therefore, additional research is recommended for examining other areas of academic achievement such as math and English, as well as determining if other career and technical programs have a positive outcome on academic achievement.

This study was inconclusive about academic achievement of regular education agricultural education students. Although the mean test scores of regular education for the entire state of Georgia were higher than agricultural education concentrators, the failure rate was lower for agricultural education concentrators than Georgia students. Another area of concern was the low percentage of agricultural education students in the honors GHSGT category. Therefore, additional research is recommended for examining these discrepancies.

As a result of regular education agricultural education concentrators scoring statistically significantly higher on the science portion of the GHSGT than regular education agricultural participants, agricultural education students should be encouraged to pass three or more secondary agricultural education courses. Likewise, special education agricultural education concentrators scored statistically significantly higher than non-agricultural education special education students on the science GHSGT. Special education students must be advised to pass three or more agricultural education courses.

The implications were that science achievement of regular education and special education agricultural education concentrators were improved with involvement in secondary agricultural education programs by participating and passing three or more agricultural education courses. Since congress passed NCLB, school systems are held accountable for adequate academic achievement of all students (Linn, Baker, &Betebenner, 2002). According to research, teaching strategies taught in agricultural education programs such as problem solving (Pate & Miller, 2011), inquiry- based (Myers & Dyer, 2006; Thoron & Myers, 2011), integrated curriculum (Parr, Edwards, & Leising, 2006; Stone, Alfeld, Pearson, Lewis, & Jensen, 2006), and contextual learning (Balschweid, 2002) improved academic performance.

Few empirical studies existed concerning academic achievement on standardized state-wide tests of secondary agricultural education students (Chiasson & Burnett, 2001; Levesque, Wun, & Green, 2010; Ricketts, Duncan, & Peake, 2006; Theriot & Kotrlik, 2009). Many recent studies suggested more empirical research be conducted about academic achievement of regular education and special education students (Eisenman, 2000; Ramsey & Edwards, 2004; Wilson &

Curry, Jr, 2011). This study utilized data generated from every public high school in Georgia and 110 public high school agricultural education programs with a focus on determining if agricultural education programs had a relationship with academic achievement. The major contribution of this study was to provide data that supported the claims that agricultural education programs contributed to the academic education of all students.

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Discussant Remarks Matt Baker
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Correlation of Secondary Agricultural Education Students' Science Achievement to Number of Agricultural Education Courses Passed

This was an interesting paper to read and provides program monitoring-type data which are politically important in our high stakes testing environment. In a most noble effort, the researchers worked with the Georgia Department of Education to assess differences between a number of populations of students including the general population of students and special education students, Agricultural Education students and non-Agricultural Education students, and within the Agricultural Education student population, 'concentrators' (students completing three or more courses in Agricultural Education) and 'participants' (students who completed one or two courses). There are obviously many challenges to program evaluation, and below I pose a number of questions that we might consider during our discussion time together:

- Data and metrics are a challenge for all of us employed in education. In a perfect world we would have access to every defined variable that we have an interest in; however we do not live in a perfect world and in most cases our institutional databases reflect required state and federal data metrics.
    - For example, as educators we have a greater impact on students who enroll in a planned program of study in career and technical education versus those who are in- and out- of our programs based upon schedule availability and interest. Was it possible to aggregate the data in such a way, or was the 'blunt instrument' of 'passing three or more Agricultural Education courses' the only way of aggregating the data based upon how the data were collected?
    - Did your definition of 'concentrators' include middle school program enrollment?
- Rossi, Lipsey, and Freeman (2004) make a distinction between proximal and distal outcomes and remind us that distal outcomes are "also influenced by many other factors outside of the program's control" (p. 212). Did you attempt to build control variables into your design which may have an effect on standardized scores such as academic ability, gender or race differences, family socioeconomic status, or whether or not students were from rural or urban communities?
- Program evaluations are always conducted in a political environment. In terms of political damage or support, what are the implications of these types of studies?

Rossi, P. H., Lipsey, M. W., & Freeman, H. E. (2004). *Evaluation: A systematic approach. (7th ed.)*. Thousand Oaks, CA: Sage Publications.

Session C: Teaching Strategies

Discussant: Dr. Cliff Rickets

A Comparison of Lecture and Cooperative Learning

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Abstract

Agricultural educators are challenged to provide a variety of teaching methods to address diverse student needs. Students entering agricultural education programs have less knowledge and hands on experiences about agriculture than previous generations. The purpose of this study was to determine if there was a difference in knowledge acquisition of secondary agricultural students who received two different teaching methods. Results indicated no significant difference in test scores between methods of instruction, but a significant difference was noted between traditional and non-traditional students. Traditional students had a higher gain in knowledge acquisition than non-traditional students. Overall, students preferred the lecture based instruction but both methods of instruction improved knowledge acquisition.

Introduction

"U.S. agriculture underwent a tremendous transformation during the 20th century—the structure of farming and rural life today barely resembles that of the early 1900s" (Dimitri & Effland, 2005, para. 1). Agriculture was once labor intensive with diversified farms and ranches. Today, 40.8% of U.S. land is in specialized farms and ranches (USDA, 2012), only 16 % of the U.S. population lives in rural areas (USDA Economic Research Service, 2012), yet over 24 million are employed in some field of agriculture (National FFA Organization, 2011). While declining in numbers, farmers and ranchers are the most productive in the world (USDA-National Agricultural Statistical Service, 2007). The American Farm Bureau (2009) reports that each farmer "produces food and fiber for 155 people in the U.S. and abroad" (p. 6).

At the turn of the century, instruction in agricultural education was greatly needed. Land grant colleges were established by the Morrill Act in 1862 and 1890 specifically for instruction in agriculture and the mechanic arts. The Smith-Hughes Act of 1917 was passed "to promote and further develop vocational education programs which otherwise might not have been provided in state educational systems" (Phipps, Osborne, Dyer, & Ball, 2008, p. 28). This act allowed young, rural, males to gain technical skills needed to work on the farm through secondary education courses.

Just as farms and ranches have decreased, several changes have occurred in vocational programs. A major expansion and redirection of vocational education was authorized under the Vocational Education Act of 1963. It was further expanded to Career and Technical Education under the Carl Perkins Act of 1984 focusing on providing knowledge and skills in any given industry of employment (Roberts & Ball, 2009). More recently, the Elementary and Secondary Education Act of 2001 was established to "close the achievement gap with accountability, flexibility, and choice, so that no child is left behind" (Public Law 107-110, 2002, p. 1425). This act has had a profound impact on the instructional efforts in agricultural education as new curriculum frameworks were created to guide educators to teach 21st century skills. Furthermore, secondary agricultural courses have begun to be tested through End-of-Course (EOC) tests to insure these programs are meeting core academic standards.

Agricultural education programs continue to diversify and change, trying to meet the needs of students and academic program requirements. Additionally, agricultural educators are constantly looking for new methods of instruction to engage both traditional and non-traditional high school agricultural education students who desire to have careers in the diverse areas found in agriculture (National Research Council, 1988). According to Schunk, Pintrich, and Meece(2008), "students are more likely to be engaged in tasks that take advantage of their backgrounds, interests, and experiences" (p. 370). Therefore, understanding how best to educate a highly diversified student population in today's schools is needed.

Conceptual / Theoretical Framework

"Most Americans know very little about agriculture" (National Research Council, 1988, p. 9) and students entering agricultural education classrooms have less hands-on experiences and varying perceptions of agriculture and agricultural education (Hoover & Scanlon, 1991). Teachers are challenged to educate all students who have different levels of knowledge and experience about agriculture. According to Newcomb, McCracken, Warmbrod and Whittington (2004), lecture has been the primary teaching method used in agricultural education, but with changes in student knowledge, skills, or experiences, agricultural educators need to vary teaching practices to better meet the needs of students (Hoover & Scanlon, 1991).

Vocational education was once intended for individuals to gain skills or competencies through instruction or apprenticeships. However, instruction is now directed towards all facets of agriculture, including non-farming activities in preparation for college (Talbert & Balschweid, 2005). In the effort to aid students to develop skills and master knowledge, "vocational agriculture instructions are challenged by students with a wide variety of learning styles" (Rollins, 1990, p. 64).

Curricula are an essential aspect of education and serve as a guide for teachers; however, agricultural education curricula differ from traditional academic curricula (Phipps et al., 2008). Agricultural education curricula are designed for students to learn through application (Phipps et al., 2008). The concept is expressed in the National FFA Organization (2010) motto "learning to do, doing to learn, earning to live, living to serve" (p. 17). Humans retain information using a variety of methods, developing methods to acquire information, or master skills that suit them the most (Landrum & McDuffie, 2010).

Lecture is one-way, teacher-centered presentation of information and ideas and is the most common method of instruction for passing on information to students (Kindsvatter, Wilen, & Ishler, 1995; Morrison, Ross, Kemp, & Kalman, 2011; Waldron & Moore, 1991). Lecture is designed as a good teaching method to present factual information, yet lectures have been overused and abused (Newcomb et al., 2004). Although lecture allows for student learning, it permits little opportunity for communication between the instructor and students.

Cooperative learning is an aspect of both social constructivism and learning styles. Cooperative learning is a successful teaching strategy where students work together in groups to learn and to teach one another until all group members successfully understand and complete the assignment (Haller, Gallagher, Weldon, & Felder, 2000). Cooperative learning is successful because members of the team are responsible for not only learning the material taught, but also for contributing to classmates, thereby creating achievement ("Cooperative learning," n.d.). A study by Yoder and Hochevar (2005) discovered an increase in test scores of students taught with cooperative learning.

For the past decade, the theory of constructivism has been examined by a number of researchers as the framework best suited for education and more specifically, agricultural education (Doolittle & Camp, 1999). Agricultural education programs have utilized constructivism as the "learning by doing" theory in which lessons are based upon. Constructivism is "based on the premise that we all construct our own perspective of the world, based on individual experience and schema" (Schuman, 1996, Constructivism section, para. 4) in order to prepare learners to solve problems in ambiguous situations.

Social constructivism is an aspect of constructivism. Prawatt and Floden (1994) explained the focus of social constructivism as a shared social experience and social negotiation of meaning. "Social constructivism is based on the social interactions of a student in the classroom along with a personal critical thinking process" (Powell & Kalina, 2009, p. 243). Doolittle and Camp (1999) used social constructivism as a social learning experience "through teacher-student interactions, cooperative learning groups, or classroom discussions" (social constructivism section, para. 3). Social constructivism is an effective teaching method that benefits all students through incorporating collaboration and social interaction (Powell & Kalina, 2009).

Cooperative learning has a place in education and more specifically agricultural education as students need to receive instruction through varying teaching methods. In using cooperative learning, students communicate and work in groups to learn material and assist team members to achieve a common goal. While achieving a common goal, students are challenged to develop social skills to explore and negotiate with classmates and the instructor using constructs of social constructivism.

Purpose

The purpose of this study was to determine if there was a difference in knowledge acquisition between students enrolled in secondary agricultural education classes taught by cooperative learning and lecture instruction. Additionally, this study explored the knowledge acquisition of traditional and non-traditional secondary agricultural education students and perceptions of instructional methods presented.

Methodology

This study sought to address the following hypotheses:

Ho_1: There will be no significant difference in knowledge acquisition found between students taught by lecture instruction compared with cooperative learning instruction through the *FFA Doors for the Future* instructional materials.
Ho_2: There will be no significant difference in knowledge acquisition found between traditional and non-traditional students through the *FFA Doors for the Future* instructional materials.
Ho_3: There will be no significant difference in student perceptions of the methods of instruction through the *FFA Doors for the Future* instructional materials.

This study conformed to the design as outlined by Campbell and Stanley (1963) as a quasi-experimental design #10 (Figure 1). This quasi-experimental design utilized a Nonequivalent Control Group Design with pretest-posttest (Campbell & Stanley, 1963). An alpha level was set *a priori* at 0.05.

Group	Pretest	Lesson	Posttest
1	O_1	X_{C1}	O_2
2	O_1	X_{L1}	O_2

Note. O = observations, X = treatment, C = cooperative learning, and L = lecture.

Figure 1. Modified Nonequivalent Control Group Research Design #10 by Campbell and Stanley (1963).

Based on teacher's voluntary participation, selection posed the greatest threat to internal validity as the students of each class differed in age, ability, gender, race and agricultural experience which could affect the results. A minor threat was mortality as students left the classroom for other school functions, causing the population of the study to decline. The setting of the research was controlled because the students took part in the study for approximately 50 minutes—one class period. Thus, the administration of the pre-test/post-test in this time period may have influenced the post-test results.

Because the classes were intact groups, the results of the knowledge acquisition for the two teaching methods cannot be generalized to all student populations. The reactive effects of experimental arrangement and multiple treatment interferences were not considered threats.

This study used a convenience sample of schools who participated in the *Visual Communications on the Road in Arkansas: Video and Creative Projects to Promote Agriculture* (mobile classroom) project conducted through the University of Arkansas Agricultural and Extension Education Department. The target population was students enrolled in high school agriculture courses at eight Arkansas secondary schools during the fall 2011 semester. Teachers of participating schools were informed of the research study that would take place during breakout sessions coinciding with the mobile classroom visits. Of the original 548 students enrolled in agricultural education classes, 108 students were removed due to an absence of any instrument (pretest or posttest) and/or consent form required for the study, resulting in a usable sample size of 440 participants. This resulted in an 80.3% response rate of potential participants. Participate demographics include gender, grade classification, ethnicity, method of instruction, and student classification.

Instruments developed for this study were constructed from the literature to measure the main constructs found in the *FFA Doors for the Future* instructional materials. Instruments were developed based on current literature and reviewed by a panel of agricultural education, communications, and technology experts familiar with secondary agricultural education instruction to maintain face and content validity. The panel also reviewed the instructional materials used in the research. Improvements were made to insure the instruments were valid to test the hypotheses of this study. Instruments administered consisted of two sections: (a) a pretest with demographics and (b) a posttest with perceptions of each instructional method.

The pretest was composed of two sections. The first section, knowledge, was comprised of 10 multiple choice questions regarding material presented in the *FFA Doors for the Future* instructional materials. The knowledge section was divided into three subsections; agriculture careers, scholarships, and higher education. The second section, demographics, was composed of 11 questions covering basic demographics, questions associated with number of courses taken in agriculture as well as participation in the FFA. This information was used to classify students as either traditional or non-traditional secondary agricultural education students.

The posttest was composed of two sections. The knowledge portion was comprised of the same 10 multiple choice questions regarding material presented in the *FFA Doors for the Future* instructional materials as the pretest. The knowledge section of the posttest was broken into the three subsections; agricultural careers, scholarships, and higher education. The student perceptions questions were adapted from an instrument by Silance and Remmers (1934) to fit each method of instruction. Twenty one questions were used for the students to rank on a Likert scale from one to seven: 1 = *strongly disagree* and 7 = *strongly agree*. Questions were developed about student perceptions pertaining to the instructional topic and likelihood of going to college and/or seeking a degree in agriculture.

A pilot was conducted using participants of schools who participated in the mobile classroom project during the spring 2011 semester. After the pilot was completed, adjustments were made to the curriculum and instruments to make the information. Consent forms were sent to the participating schools' secondary agricultural education instructors prior to the school visit. Students were required to have a parental/guardian sign a consent form to participate in the study. Consent forms were collected before students received the pretest, which was followed by either lecture instruction or cooperative learning instruction. Following each teaching method, participants were given a posttest.

Data were collected from the study participants two separate times. The researcher was present for all class periods in which lecture instruction or cooperative learning instruction was administered. Before each test, the researcher informed the participants that a grade would not be assigned on the tests. The participants were, however, encouraged to answer each question to the best of their ability and as honestly as possible. The instruments consisted of questions covering important constructs in the lecture and the cooperative learning activity, questions on perceptions of the curriculum and teaching method, demographics, and courses taken in a secondary agricultural education program.

The participants' initial knowledge acquisition for the *FFA Doors for the Future* instructional materials was measured using a pretest at the beginning of the lecture or cooperative learning instruction class period. The *FFA Doors for the Future* instructional materials were administered by the researcher after all pretests were collected. Following *FFA Doors for the Future* instructional materials, the posttest was administered and collected.

Methods of teaching, lecture or cooperative learning, were randomized from class to class throughout the visit. The first class received a traditional lecture following the lesson plan, *FFA Doors for the Future*. The lecture required approximately 30 minutes of the class period used for treatment implementation. The next class received the *FFA Doors for the Future* instruction through cooperative learning using the Kagan Cooperative Learning structures worksheet. The cooperative learning instruction was based on students learning in groups about the curriculum from given materials. The time allotted for participants was approximately 30 minutes.

Following each method of teaching, posttests were administered to the participants to assess knowledge acquisition. The posttests used the same constructs found in the pretest. There was also an additional section covering the student's perception of the lesson and method of instruction. Instrument reliability was tested for internal consistency. The Cronbach's Alpha statistic was .93. Data were analyzed using Statistical Package for the Social Sciences (SPSS©) PASW Statistics 18 software package. Descriptive statistics were used to characterize the study population. Inferential statistics were used to complete analyses of pretests and posttests.

Results and Findings

Demographics

Gender classification was obtained to help describe the enrollment in the agricultural education programs. Results show that a majority of the participants was male (76.8%) and (23.2%) were female. Grade classification was used as a variable of study to further delineate participants. Students in the ninth grade comprised the largest percentage of students (30.0%) while 10th-grade students represented 25.2% of participants in the study. Eleventh graders comprised 17.5% and 12th-graders represented 17.0% of the participants for this study. A small number of seventh graders (4.3%) and eighth graders (5.9%) participated in the study.

Participants of the study were of various ethnic backgrounds. The majority of the participants' indicated they were Caucasian (72.0%) with the second largest percentage of participants indicated that they were Hispanic/Latino (7.3%). Twenty seven participants indicated they were of another ethnicity (6.1%). The remaining participants reported being African American (4.8%), American Indian/Alaskan Native (4.8%), and Foreign (0.9%). Additionally, 18 participants (4.1%) did not report their ethnicity.

The majority (55.2%) of the participants received instruction through a lecture, with 44.8% of participants received cooperative learning instruction. Fifty five percent of the participants were classified as traditional students, meaning they had taken more than four secondary agricultural education courses prior to the junior or senior year of high school and were members of the FFA. Non-traditional students do not live on a farm or in a rural area, taken four or fewer courses in secondary agricultural education and who were not members of the FFA. Non-traditional students represented 45.0% of the participants.

Null Hypothesis One

To test this hypothesis, participants were administered a pretest and posttest. Table 1 displays the mean scores for the pretest and posttest for both lecture and cooperative learning (n = 440). The pretest and posttest consisted of 10 multiple choice questions to assess knowledge acquisition. Each question was worth one point and resulting sums by each participant were used to test hypothesis one on a 0 to 10 scale. While the lecture group had a pretest average mean of 3.44 (SD = 1.45), the cooperative learning group pretest mean was 3.38 (SD = 1.32). Mean posttest scores for the lecture group was 5.19 (SD = 1.90) with the cooperative learning group recorded mean score of 5.11 (SD = 1.87). The mean scores show about the same level of knowledge before and after the lessons; however, students in the cooperative learning classes had the lowest mean scores on the pretest and posttest.

Table 1
*Knowledge Acquisition Means for Methods of Instruction (*n *= 440)*

		Pretest		Posttest	
	n	M^a	*SD*	M^a	*SD*
Lecture	243	3.44	1.45	5.19	1.90
Cooperative Learning	197	3.38	1.32	5.11	1.87
Total	440				

[a] Based on a scale where 0 = no knowledge and 10 = correct responses for all questions.

An independent samples *t*-test was used to test hypothesis one, which stated that there would be no significant difference in knowledge acquisition between students taught by lecture instruction compared with cooperative learning instruction of the *FFA Doors for the Future* instructional materials. Means for knowledge acquisition were analyzed for the lecture and cooperative learning groups by using gain scores (subtracting the pretest mean from the posttest mean). Results indicated about the same level of change occurred with both methods of instruction at about the same level of change. Mean gain score of the lecture method was 1.76 (*SD* = 2.08); cooperative learning methods mean gain score was 1.74 (*SD* = 1.91). As shown in Table 2, no significant difference in knowledge acquisition between the lecture instruction and cooperative learning instruction, t (438) = .11; p = .91 was found. The null hypothesis failed to be rejected (p = .91). Knowledge acquisition was greater for students in lecture based instruction.

Table 2

t-*test for Knowledge Acquisition in Methods of Instruction (*n *= 440)*

Instructional Methods	*n*	M^a	*SD*	*t*	*p*
Traditional Lecture	243	1.76	2.08		
				.11	.91
Cooperative Learning	197	1.74	1.91		

[a] Derived from gain score (pretest score subtracted from posttest score).

Null Hypothesis Two

Null hypothesis two was tested using an independent samples *t*-test. Means for knowledge acquisition were calculated for the lecture and cooperative learning groups by using gain scores (subtracting the pretest mean from the posttest mean). Traditional students had a mean gain score of 2.05 (*SD* = 1.88) for knowledge acquisition and non-traditional students mean gain score was 1.38 (*SD* = 1.08). A significant difference was found in knowledge acquisition between traditional and non-traditional secondary agricultural education students, $t(438) = 3.51$; $p = .001$, resulting in the null hypothesis being rejected. This data is shown in Table 3. Traditional students' knowledge acquisition was greater than non-traditional students.

Table 3

t-*test for Knowledge Acquisition in Student Classifications (*n *= 440)*

Student Classifications	*n*	*M*[a]	*SD*	*t*	*p*
Traditional	242	2.05	1.88		
				3.51	.001*
Non-traditional	198	1.38	1.08		

[a] Derived from gain score (pretest score subtracted from posttest score).

* $p < .05$

Null Hypothesis Three

Perceptions were measured using a Likert Scale from 1 to 7 with 1 = *strongly disagree* to 7 = s*trongly agree*. The means of perception toward the methods of instruction (traditional lecture and cooperative learning) are noted in Table 4 by each statement. Missing responses were noticed for both lecture and cooperative learning groups. The number of responses varied due to students not answering perception statements. The statement, *I hate the lesson,* received the highest score by both lecture (*M* = 5.81; *SD* = 1.59) and cooperative learning (*M* = 4.99; *SD* = 1.98) groups and *the lesson amazed me* perception statement received the lowest score by both lecture (*M* = 3.72; *SD* = 1.79) and cooperative learning (*M* = 3.21; *SD* = 1.81) groups.

Table 4

*Perceptions for Methods of Instruction (*n *= 440)*

	Lecture		Cooperative Learning	
Statements	*n*	*M*[a] (*SD*)	*n*	*M*[a] *SD*)
I really enjoyed the lesson.	241	4.60 (1.49)	197	3.94 (1.67)
The lesson is very practical.	241	4.93 (1.44)	197	4.38 (1.58)
I could do very well without the lesson.	238	4.61 (1.65)	196	4.05 (1.85)
The lesson is okay.	243	4.60 (1.53)	194	4.47 (1.57)
The lesson is a waste of time.	240	5.68 (1.55)	196	4.82 (1.86)
I am not interested in the lesson.	242	4.98 (1.90)	197	4.44 (1.95)
I have no desire for the lesson.	241	5.22 (1.80)	194	4.36 (2.01)
I have seen no values in the lesson.	241	5.59 (1.62)	193	4.55 (1.97)
The lesson is a good subject.	241	5.09 (1.68)	194	4.46 (1.71)
I hate the lesson.	241	5.81 (1.59)	195	4.99 (1.98)
The lesson amazed me.	240	3.72 (1.79)	196	3.21 (1.81)
The lesson did not hold my interest at all.	240	5.00 (1.71)	192	4.36 (1.86)
The lesson is interesting.	242	4.56 (1.62)	196	3.87 (1.78)
To me the lesson is boring.	241	4.98 (1.79)	194	4.15 (2.02)
The lesson is dull.	238	4.78 (1.90)	193	4.29 (1.98)

The lesson can be used in real life.	240	5.47 (1.65)	192	4.68 (1.81)
All the materials in the lesson are not interesting.	240	5.28 (1.71)	193	4.44 (1.90)
The lesson cannot benefit me.	241	5.31 (1.87)	194	4.65 (1.88)
The lesson is enjoyable.	241	4.51 (1.69)	196	4.12 (1.87)

[a] Based on a scale where 1 = strongly disagree, 2 = disagree, 3 = moderately disagree, 4 = undecided, 5 = moderately agree, 6 = agree, and 7 = strongly agree.

An independent samples *t*-test was also used to test hypothesis three. Students in the lecture method of instruction reported a higher mean score (M = 4.94, SD = 1.09) than those in the cooperative learning session (M = 4.28, SD = 1.27). This difference was found to be significant, $t(438) = 5.78$; $p = .000$. This finding resulted in the null hypothesis being rejected ($p = .000$) (Table 5). Lecture was the preferred method of instruction based on perception response.

Table 5
t-*test for Perceptions in Methods of Instruction (*n *= 440)*

Instructional Methods	*n*	M^a	*SD*	*t*	*p*
Lecture	243	4.94	1.09	5.78	.000*
Cooperative Learning	197	4.28	1.27		

[a] Derived from grand mean [sum of all means divided by number of perception statements (19)], * $p < .05$

Conclusions, Implications and Recommendations

The majority of participants in the study were ninth grade (30.0%), Caucasian (72.0%) male (76.8%) students who received lecture based instruction (55.2%). Of the respondents, 55.0% of participants were traditional students.

Null hypothesis one failed to be rejected. The data revealed that the method of instruction received did not have a significant effect on test scores, $t(438) = .11$; $p = .91$. Traditional lecture method participants recorded a mean score of 1.76 (SD = 2.08) while cooperative learning method participants was M=1.74 (SD = 1.91). No significant difference was found in knowledge acquisition between the lecture and cooperative learning instruction. Although the study did not reveal significant difference between methods of instruction, it should be noted that improvements in knowledge acquisition was evident in both the lecture and the cooperative learning groups. Based on previous research (Haller et al., 2000; Newcomb et al., 2004), lecture and cooperative learning have both been identified as good teaching styles. Knowing that knowledge was gained through lecture and cooperative learning, lessons should incorporate both individual and group learning (Landrum & McDuffie, 2010). It is predicted that if the lesson taught was a science based lesson, students would have learned more from cooperative learning than lecture instruction. It was also noted that the cooperative learning lesson could have had a greater impact if classmates contributed information to each other. Cooperative learning requires students to contribute knowledge to classmates for learning to occur ("Cooperative learning," n.d.). However, students were from various grades which could have impacted the communication between members of cooperative learning groups. The educational effects of lecture and cooperative learning instruction appear to be far from settled and deserve further study.

To further demonstrate the basis of the study, participants' knowledge acquisition was measured based on student classifications. Analysis revealed a significant difference of knowledge acquisition between traditional and non-traditional students, $t(438) = 3.51$; $p = .001$. Traditional students received a knowledge acquisition mean gain score of 2.05 ($SD = 1.88$) and the non-traditional students obtained a mean gain score of 1.38 ($SD = 1.08$), resulting in null hypothesis two being was rejected. The results for hypothesis two showed significant difference between knowledge acquisition of traditional and non-traditional students; therefore, the researcher must assume that students who have experience, a background, and interests in agriculture and are FFA members are more engaged to learn in agricultural education classes. This conclusion was supported through research by Schunk et al. (2008), who discovered that instruction that takes advantage of students' background, interests, and experiences are more engaged in learning. The *FFA Doors for the Future* lesson appealed to traditional student's since the lesson covered agriculture and FFA concepts.

Findings of student perceptions of the method of instruction received showed a significant difference, $t(438) = 5.78$; $p = .000$. For the lecture group, a mean perception score of 4.94 ($SD = 1.09$) was reported, while the cooperative learning group had a mean perception score of 4.28 ($SD = 1.27$). The perception statement *I hate the lesson* had the highest mean score from both traditional lecture ($M = 5.81$; $SD = 1.59$) and cooperative learning ($M = 4.99$; $SD = 1.98$) groups. The lowest ranked item statement was, *the lesson amazed me*, with the students receiving the lecture method rating this statement with a mean of 3.72 ($SD = 1.79$); while students in the cooperative learning classes reporting a mean score of 3.21 ($SD = 1.81$). Null hypothesis three was rejected, resulting in lecture being the preferred method of instruction. Considering Newcomb et al. (2004) explained that lecture is the most common and overused teaching method in agriculture one explanation of this finding is that students were accustomed to lecture. Given these results, instructors could continue to use lecture as the main method of instruction as students view lecture more positively than cooperative learning. However, instruction should incorporate aspects of cooperative learning instruction as humans retain information using a variety of instructional methods (Landrum & McDuffie, 2010). With the wide variety of students who enroll in agricultural education courses, secondary agricultural education programs are challenged to meet the educational needs of students in order for each student to learn (Rollins, 1990). Teachers should develop lessons which encompass both lecture and cooperative learning to meet the educational needs of students as suggested by Landrum and McDuffie (2010).

Recommendations based on findings for this study included further research on types of cooperative learning instruction to facilitate learning is warranted. In addition, further research is needed in order to determine why students learn more from lecture than cooperative learning. Future studies should examine the implementation of different lessons with similar instruments. More-in-depth lessons or science based lessons would allow the incorporation of different instructional strategies utilizing higher order thinking skills to measure achievement between lecture and cooperative learning groups. Research results in these areas could impact the methods of instruction used in current and future classroom settings in agriculture.

The results revealed a significant difference on student knowledge acquisition of traditional and non-traditional students using the *FFA Doors for the Future* instructional materials. Future research should be conducted to determine if the difference in traditional and non-traditional students is in lecture or cooperative learning methods of instruction. More care should be taken in choosing an instructional unit to test student learning gain based on instructional techniques.

Finally, it is recommended that the instrument demographics should be reexamined in order to effectively classify students based on the definitions used in this study. Based on the review of literature, classification of students based on their agricultural and FFA background is not conclusive. Reviewing previous definitions of traditional and non-traditional students should be evaluated in order to adequately analyze and classify subjects to guide future studies.

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Discussant Remarks: Cliff Ricketts, Middle Tennessee State University

A Comparison of Lecture and Cooperative Learning

Overview

Agricultural Education programs continue to diversify and change, trying to meet the needs of students and academic program requirements. Furthermore, agricultural educators are constantly looking for new methods of instruction to engage both traditional and non-traditional high school agricultural education students who desire to have careers in the diverse areas found in agriculture. Students have less knowledge and hands on experiences about agriculture than previous generations. The lecture method has been the primary teaching method used in agricultural education classes, but with changing students, agricultural educators need to vary teaching practices to better meet the needs of the students. One way to vary teaching methods is by using cooperative learning where students work together in groups to learn and to teach one another until all group members successfully understand and complete the assignment. The purpose of this study was to determine if there was a difference in knowledge gained between students receiving the lecture method as opposed to the cooperative learning method, and difference in knowledge gained between traditional and non-traditional students in agricultural education programs.

Rationale

Agriculture is constantly changing as well as agricultural education students. Just as farms and ranches have decreased, several changes have also occurred in our Agricultural Educatlon programs. Students are more likely to be engaged in tasks that take advantage of their backgrounds, interest, and experiences. Thus, understanding how to best educate a highly diversified student population in today's schools is needed.

Research Methods, Reliability, and Validity

The target population was 440 students enrolled in high school agriculture courses at eight Arkansas secondary schools. The study used a quasi-experimental design. The design utilized a Nonequivalent Control Group Design with pretest-posttest. An alpha level was set *a priori* at 0.05. Instruments were developed based on current literature and reviewed by a panel of experts familiar with secondary agricultural education instruction to maintain face and content validity. Instrument reliability was tested for internal consistency. The Cronbach's Alpha statistic was .93. Data were analyzed using SPSS PASW Statistics 18 software package. Descriptive statistics were used to characterize the study population. Inferential statistics were used to complete analyses of pretest and posttests.

Findings

There was no significant difference in test scores between methods of instruction, but a significant difference between traditional and non-traditional students. Traditional students had a higher gain in knowledge acquisition than non-traditional students. Overall, students preferred the lecture method but both methods of instruction improved knowledge gained, thus, teachers should use both.

The Effect of Vee Maps and Laboratory Reports on High- and Low-Order Content–Knowledge Achievement in Agriscience Education

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Abstract

Instruction in the laboratory is essential to the success of a total agricultural education program. The development of students' critical thinking, argumentation skills, technical skills, reasoning ability, and engagement are all found within the agriscience laboratory. Yet, utilizing the laboratory setting to its maximum potential is challenging for the instructor. The development of sound research-based assessment tools that enhance high-order thinking and are easily incorporated are needed in secondary agriscience education. This quasi-experimental study investigated the effect of two formative assessment tools on student high- and low-order content knowledge achievement. The Vee map was compared to the standard laboratory report in six different secondary schools across the state of Illinois. Utilizing student pretest score as a covariate, there was a statistically significant difference between groups on the high-order thinking posttest. Further, the study indicated that nine weeks later students who utilized the Vee map retained more low- and high-order knowledge than those who utilized the standard laboratory report. This study recommends the use of the Vee map as an effective formative assessment tool that should be utilized in agriscience education.

Introduction/Literature Review

According to The Nation's Report Card (NCES, 2011), 68% of eleventh grade students scored below the proficient level when administered the National Assessment of Education Progress science assessment. The National Research Council (NRC) (2000) posited that hands-on laboratory activities should be incorporated in the science curriculum to increase student skill and content knowledge in science. Because agriculture is considered a science (Thoron & Myers, 2010a), and because an essential component of science education is the inclusion of laboratory exercises (NRC, 2000; NRC, 2006; Roth, 1990), then laboratory instruction is necessary for a quality agricultural education program (Baker, Thoron, Myers, & Cody, 2008).

Currently, most science laboratories are isolated from classroom instruction (NRC, 2006). In *America's Lab Report* (2006), the NRC argued that laboratory experiences and assessment of those experiences increase students' critical thinking, argumentation skills, technical skills, reasoning ability, and engagement. Each of these abilities can be increased by integrating laboratory activities with other science teaching methods. Further, laboratory experiences must emphasize the student–learning outcomes rather than the procedures (NRC, 2006). The science skills that are developed can be enhanced and transferred to new content areas.

Teachers struggle to assess student–learning outcomes during laboratory exercises (Roth, 1990). Teachers indicated that assessments of student learning in laboratory exercises take an excessive amount of time to complete (Lebowitz, 1998; Thoron, Swindle, & Myers, 2008). Moreover, agriscience teachers struggle with assessing student learning during laboratory investigations. Consequently teachers "end up reducing or even omitting lab performance when they determine students' grades" (Phipps et. al, 2006, p 346).

Teachers should consider using proven assessments when evaluating laboratory experiences. A variety of assessments can be used: concept maps, Vee maps, portfolios, written lab reports, or science fair projects (Phipps, Osborne, Dyer, & Ball, 2006; Warner & Myers, 2006). Further, formative assessments could be developed to increase student performance and scientific knowledge. The NRC (2000) described a change in not only assessing in the laboratory, but also a need for greater frequency in the utilization of the laboratory. The teaching method that brings laboratory investigations and formative assessment together is inquiry-based instruction (Thoron, 2010).

Thoron and Myers (2011) reported that students taught through inquiry-based instruction achieved higher content knowledge scores when compared to students taught through the subject matter approach. In addition to greater content knowledge scores, students have also been reported to increase argumentation and scientific reasoning skills when taught through inquiry-based instruction (Thoron, 2010). Further, inquiry-based instruction has been found to be an effective teaching strategy for special needs students (Easterly & Myers, 2011; Scruggs, Mastropieri, Bakken, & Brigham, 1993). However, inquiry-based instruction requires teacher preparation when being utilized as a teaching strategy (Easterly & Myers, 2011; Grady, Dolan, & Glasson, 2010; Shoulders & Myers, 2011; Thoron & Myers, 2011; Thoron & Myers, 2012; Thoron, Myers, & Abrams, 2011; Washburn & Myers, 2010).

Parr and Edwards (2004) stated that the use of inquiry-based learning opportunities that incorporate hands-on, active, and concrete experiences increased student achievement in agricultural education. Therefore, laboratory exercises should incorporate activities that promote active student interaction with real-life situations that allow students to gather data and develop skills (NRC, 2006; Phipps et. al, 2008). Furthermore, laboratory exercises should be utilized for students to comprehend adequately the science within the agriculture curriculum (Phipps et. al, 2008). Laboratory settings should be integrated in instructional units that are learner-centered, knowledge-centered, assessed through the promotion of learning, and community-centered (NRC, 2006).

A review of literature revealed little research that examines the use of laboratory activities in agricultural education. However, previous research stated that the use of Vee maps in agricultural education classes as a substitute for traditional laboratory reports increased science content knowledge (Thoron & Myers, 2010b; Thoron, Swindle, & Myers, 2008). Thoron and Myers (2011) found that the success of a Vee map is not influenced by a student's gender, ethnicity, or grade level. Moreover, the time committed to grading a Vee map is between 10 – 15 minutes, reducing the overall time teachers must commit to evaluating laboratory assessments (Thoron & Myers, 2010b; Thoron, Swindle, & Myers, 2008). Thoron, Swindle, and Myers (2008) presented anecdotal findings that students participating in the study favored being assessed by a Vee map over a traditional laboratory report. Thoron and Myers (2010b) found Vee maps to be a successful assessment tool in laboratory settings. However, further investigation is needed of the Vee map as a formal assessment of laboratory exercises (Thoron & Myers, 2010b; Thoron & Myers, 2011; Thoron, Swindle, & Myers, 2008).

The NRC (2006) argued that an assessment during laboratory instruction must increase the quality of a student's thinking and provide documentation for the teacher to view student progress. The NRC (2000) reported that when assessing inquiry-based instruction, assessment techniques should incorporate a broader perspective and gather higher ordered evidence that is embedded within inquiry-based lessons. Inquiry-based instruction enhances high-order thinking skills, because students are required to utilize the top three levels of Bloom's (1965) taxonomy (synthesize, analyze, and evaluate) (Lebowitz, 1998). Further, students have been found to develop higher order thinking when their assessment incorporated graphic organizers (Ivie, 1998; Thoron & Myers, 2010b). Therefore, Vee maps should be examined as a form of assessment for inquiry-based instruction in the laboratory setting. Vee maps could aid in developing high-order thinking skills when enhanced through the use of inquiry-based instruction.

Studies have found that both inquiry-based instruction (Thoron, 2010) and the Vee map have significantly increased student science content knowledge when compared to subject matter and a standard laboratory report respectively (Thoron & Myers, 2010b). Ivie (1998) argued that high-order thinking skills assist in constructing schemas that are retained longer. The National Research Agenda (Doerfert, 2011) called for research that evaluated the assessment of learning environments to prepare students to become productive citizens. Therefore, this study aimed to utilize the Vee map and a standard laboratory report as a formative assessment tool in coordination with inquiry-based instruction to determine the effects on student low- and high-order thinking.

Theoretical Framework

Ausubel's (1963a) assimilation theory of meaningful learning acted as a guide for this study. First, Ausubel (1960) believed that the learner has prior knowledge and utilizes this knowledge to influence meaningful learning. Ausubel emphasized that learners must build a new cognitive structure in the acquisition of new information. Ausubel (1963b) argued that learners need to reflect three distinct criteria to create meaningful learning and exhibit high-order thinking: 1) utilize abstract structures; 2) organize information into an integrated system; and 3) apply sound rules and logic.

Further, Ausubel (1963a) advocated for the use of advance organizers to develop meaningful learning and extend high-order thinking to other contexts. Ausubel stated that organizers are not simple introductory remarks or overviews of the learning in context. Finally, Ausubel (1960) contended this organizational structure will facilitate "relevant subsuming concepts" (p. 267). Ivie (1998) stated that using advance organizers that encourage students to operate at higher levels of abstraction will strengthen cognitive structures and learners will retain information longer.

This study incorporated Ausubel's (1963a) work through the use of the Gowin's (1979) Vee map. The Vee map is a tool specially designed to develop the scientific thinking skills of the learners (Gowin, 1979). Furthermore, the Vee map quantifies student experience through the use of graphic organizers and forces organization of information into an integrated system to better incorporate empirical data to form sound conclusions and recommendations. A full description of the Vee map is beyond the scope of this paper, for further understanding of the Vee map in detail please refer to Thoron and Myers (2010b).

Purpose and Objectives

The purpose of this study was to determine the effect of two formative assessment tools on student low- and high-order thinking (Bloom, 1956) through a researcher–developed assessment. Low- and high-order thinking is defined as students' performance on the researcher–developed assessment. All null hypotheses were tested at the .05 level of significance. The specific objectives guiding the study were to:

1. Ascertain the effects of the Vee map on low-order content knowledge thinking skills of high school agriscience students following (posttest) laboratory investigation on an assessment.

The null hypothesis, H_o: There is no significant difference in student low-order thinking on a posttest based on the formative assessment tool used (laboratory reports or Vee Map lab assessments) during laboratory instruction, when taught through inquiry-based instruction.

2. Ascertain the effects of the Vee map on low-order content knowledge thinking skills of high school agriscience students nine weeks following (post-posttest) laboratory investigation on an assessment.

The null hypothesis, H_1: There is no significant difference in student low-order thinking on a post-posttest based on the formative assessment tool used (laboratory reports or Vee Map lab assessments) during laboratory instruction, when taught through inquiry-based instruction.

3. Ascertain the effects of the Vee map on high-order content knowledge thinking skills of high school agriscience students following (posttest) laboratory investigation on an assessment.

The null hypothesis, H_2: There is no significant difference in student high-order thinking on a posttest based on the formative assessment tool used (laboratory reports or Vee Map lab assessments) during laboratory instruction, when taught through inquiry-based instruction.

4. Ascertain the effects of the Vee map on high-order content knowledge thinking skills of high school agriscience students nine weeks following (post-posttest) laboratory investigation on an assessment.

The null hypothesis, H_3: There is no significant difference in student high-order thinking on a post-posttest based on the formative assessment tool used (laboratory reports or Vee Map lab assessments) during laboratory instruction, when taught through inquiry-based instruction.

Methods

Population and Sample

The population of this quasi-experimental, pre, post, post-post design study was composed of learners at six Illinois high schools offering agriscience education ($N = 154$) Each participating high school agriscience program was required to have received professional development in the curriculum materials, teaching methodology (Inquiry-based instruction), web-based assessment tracker, and the formative assessment tool utilized during the investigation. Upon meeting these criteria, schools were purposefully selected on the ability to deliver content and facilities to enable online assessments. Learners were randomly selected to receive the formative treatment (Vee map or laboratory report). Researchers determined (Thoron & Myers, 2010) *a priori* that the intervention was not fully administered if a student missed 25% or more of instructional time.

Research Design

The independent variable in this study was the formative assessment used during laboratory instruction of the agricultural education classes. Treatment groups utilized a laboratory report outlined by Osborne (1994) in his text *Biological Applications in Agricultural Education* or the Vee map created by Gowin (1979). Both groups were taught the same material in an inquiry-based instructional approach. The dependent variable in this study was high- and low-order thinking skills (Bloom, 1956) through student content knowledge assessments. Covariates were used to adjust group means in order to compensate for previous knowledge in the subject matter. These covariate measures included a pretest for the unit of instruction. This study utilized a quasi-experimental design because of the purposefully selected instructors to deliver content. Students within intact groups were randomly assigned a Vee map or a standard laboratory report (Campbell & Stanley, 1963).

Campbell and Stanley (1963) noted regression as a concern but explained that the risk of regression during a pretest-posttest procedure can be minimized if learners are not selected on extreme scores. To address this concern the formative assessment was randomly assigned to the learner. The greatest threat of interaction in this design type is that the differences found in the posttest and post-posttest are due to preexisting group differences, rather than due to the treatment (Gall, Borg, & Gall, 1996). The use of multiple sites in this study reduced the risk of interaction of subjects, and the use of covariates of content–knowledge achievement pretest scores were used to statistically adjust the means on the posttest and post-posttest. Further, questions on the pre, post, and post-post tests were randomized to address the interaction concern.

Learners in the agriscience classrooms were all taught through inquiry-based instruction. Thoron and Myers (2011) found that students taught through inquiry-based instruction outperformed their counterparts when taught through this method. Learners completed the pretest assessment for the content that followed over the next fifteen days of classroom and laboratory instruction. Each learner completed a posttest immediately following the instruction, followed by a post-posttest nine weeks later.

Unit of Instruction Plans

Content selection was based on the units of instruction and the curriculum maps of the programs participating in the study. The content and context of the lessons were deemed appropriate for an earlier study conducted by Thoron (2010) and were utilized unaltered for the purposes of this study. The study utilized National Agriscience Content Standards and lessons adapted to inquiry-based instruction from the Center for Agricultural and Environmental Research and Training, Inc. (CAERT).

Instrumentation

This study utilized pre and posttest for the unit of instruction based on work by Thoron (2010). Thoron (2010) reported a reliability coefficient for the content–knowledge achievement instrument using Kuder-Richardson 20 (KR20) for dichotomous data at the coefficient alpha of .91. The questions on the pretest, posttest, and post-posttest were given in a randomized order. The posttest followed the pretest 15 instructional days (21 calendar days) after instruction began. The post-posttest followed the posttest 9 weeks (63 calendar days) after completion of instruction.

Fidelity of treatment

Audio recordings of class sessions were analyzed to ensure delivery of the content, per the recommendations of Boone (1988). Professional development was also delivered to the instructors through a one-day professional development workshop. Teachers were provided lesson plans, handouts, assessment instruments, worksheets, and supplemental items so they could effectively deliver the treatment.

Findings

The results addressed the objectives and hypotheses of the study in determining the influence of inquiry-based instruction and the Vee map, as an assessment tool, on students' high- and low-order thinking. The sample included 154 students from six Illinois high schools. A total of 23 students were removed from the study due to absences above the 25% threshold previously set by the researchers. This reduced the sample to 131 students. The Vee-Map treatment group had slightly more students (n = 70) due to the number of students in the selected classes (See Table 1).

Table 1
Treatment Group Participant Totals, Six Illinois High School Agriscience Programs (n=131)

Treatment Groups	*n* (students)
Vee-Map	70
Laboratory Report	61
Total	131

The majority of the participants in the study were male (61.8%), not eligible for free and reduced lunch (75.7%), and were not identified with an Individual Education Plan (IEP) (71.4%). A majority of participants were in the tenth grade of high school (88.5%), followed by eleventh grade (24.3%) (See Table 2).

Table 2
Demographics of the Treatment Groups & Total Study of Six Illinois High School Agriscience Programs (n = 131)

	Vee-Map *(n =70)*		Laboratory Report *(n = 61)*		Total *(n = 131)*	
	n	%	*n*	%	*n*	%
Gender						
Male	47	67.1	34	55.7	81	61.8
Female	23	32.9	27	44.3	50	38.2
SES Eligibility						
Eligible	17	24.3	20	32.8	37	28.2
Not Eligible	53	75.7	41	67.2	94	71.8
IEP						
Identified IEP	20	28.6	13	21.3	33	25.2
No IEP	50	71.4	48	78.7	98	74.8
Grade Level						
10^{th} Grade	63	90.0	53	86.9	116	88.5
11^{th} Grade	7	10.0	8	13.1	15	11.5

Note. Each student self-identified gender and grade level.

A pretest that included high- and low-order questions was administered to each participant prior to the onset of instruction. Pretest data were collected from 131 participants to ensure that each treatment group was balanced and to measure students' prior knowledge of the subject material. Based on the results of the pretest, the groups were deemed similar (See Table 3).

Table 3
Participant Mean Pretest Scores of Six Illinois High School Agriscience Programs (n = 131)

	Vee-Map (*n = 70)*		Laboratory Report (*n* = 61)		Total (*n* = 131)	
Instrument	*M*	*SD*	*M*	*SD*	*M*	*SD*
High-Order Questions	29.73	8.75	30.95	10.41	30.30	9.54
Low-Order Questions	36.09	9.00	37.43	10.93	36.71	9.93

High- and low-order questions were included on a posttest and post-posttest administered to participants. The post-posttest was administered nine weeks after the completion of the study. A covariate analysis technique was utilized to analyze the data. The pretest score was used as the covariate to control for knowledge gained prior to the treatment. Correlational statistics were conducted but are not reported in the manuscript.

The first objective sought to determine the effect that the treatment had on the students' high-order thinking skills on a posttest assessment. The analysis of the data for this objective was guided by the null hypothesis that there is no significant difference in students' high-order content knowledge skills following laboratory instruction. When examining high-order questions on the posttest, Vee map students reported a mean score of 83.03 (*SD* = 10.01) and traditional lab report students reported a posttest score of 78.28 (*SD* = 12.06). The difference in posttest scores of high-order questions was statistically significant, $F_{(1, 127)} = 6.10$, $p = .015$, $r^2 = .04$ (See Table 4). A statistically significant difference was found due to the treatment effect, thus the null hypothesis was rejected.

Table 4
Participant High-Order Mean Posttest Scores of Six Illinois High School Agriscience Programs (n = 131)

	Vee-Map (*n = 70)*		Laboratory Report (*n* = 61)		Total (*n* = 131)	
Instrument	*M*	*SD*	*M*	*SD*	*M*	*SD*
Posttest	83.03	10.01	78.28	12.06	80.82	11.22

Note: $F_{(1, 127)} = 6.10$, $p = .015$, $r^2 = .04$.

The second objective sought to determine the effect that the treatment had on the students high-order thinking skills on a post-posttest assessment. The analysis of the data for this objective was guided by the null hypothesis that there is no significant difference in students' high-order content knowledge skills nine weeks following laboratory instruction. The post-posttest high-order question scores of Vee Map students were 76.56 (*SD* = 10.17) and the control group reported a mean score of 56.84 (*SD* = 13.27). The difference in post-posttest scores of high-order questions was statistically significant, $F_{(1, 127)} = 90.72$, $p = <.001$, $r^2 = .42$ (See Table 5). A statistically significant difference was found due to the treatment effect, thus the null hypothesis was rejected.

Table 5
Participant High-Order Mean Post-posttest Scores of Six Illinois High School Agriscience Programs (n = 131)

	Vee-Map (*n = 70)*		Laboratory Report (*n* = 61)		Total (*n* = 131)	
Instrument	*M*	*SD*	*M*	*SD*	*M*	*SD*
Post-posttest	76.56	10.17	56.84	13.27	67.37	15.29

Note: $F_{(1, 127)} = 90.72$, $p = <.001$, $r^2 = .42$.

The third objective sought to determine the effect that the treatment had on the students' low-order thinking skills on a posttest assessment. The analysis of the data for this objective was guided by the null hypothesis that there is no significant difference in students' low-order content knowledge skills following laboratory instruction. When examining low-order questions on the posttest, Vee map students reported a mean score of 82.07 (*SD* = 12.11) and traditional laboratory report students reported a posttest mean score of 78.36 (*SD* = 12.74). The difference in posttest scores of low-order questions was not statistically significant, $F_{(1, 127)} = 2.62$, $p = .11$, $r^2 = .04$ (See Table 6). No statistically significant differences were found in the posttest assessment scores, thus the null hypothesis failed to be rejected.

Table 6
Participant Low-Order Mean Posttest and Post-posttest Scores of Six Illinois High School Agriscience Programs (n = 131)

	Vee-Map (*n* = 70)		Laboratory Report (*n* = 61)		Total (*n* = 131)	
Instrument	*M*	*SD*	*M*	*SD*	*M*	*SD*
Posttest	82.07	12.11	78.36	12.74	80.34	12.50

Note: $F_{(1, 127)} = 2.62$, $p = .11$, $r^2 = .04$.

The fourth objective sought to determine the effect that the treatment had on the students low-order thinking skills on a post-posttest assessment. The analysis of the data for this objective was guided by the null hypothesis that there is no significant difference in students' low-order content knowledge skills nine weeks following laboratory instruction. When examining low-order questions on the post-posttest, Vee Map students reported a mean score of 76.16 (*SD* = 10.01) while traditional laboratory report students reported a post-posttest score of 64.93 (*SD* = 11.77). A statistically significant difference was found between post-posttest scores on low-order question, $F_{(1, 127)} = 29.28$, $p = <.001$, $r^2 = .19$ (See Table 7). A statistically significant difference was found due to the treatment effect, thus the null hypothesis was rejected.

Table 7
Participant Low-Order Mean Post-posttest Scores of Six Illinois High School Agriscience Programs (n = 131)

	Vee-Map (*n* = 70)		Laboratory Report (*n* = 61)		Total (*n* = 131)	
Instrument	*M*	*SD*	*M*	*SD*	*M*	*SD*
Post-posttest	76.16	11.62	64.93	11.77	70.93	12.93

Note: $F_{(1, 127)} = 29.28$, $p = <.001$, $r^2 = .19$.

Conclusions

Based on the findings of this study the following conclusions can be made:

1. When coupled with inquiry-based instruction, the Vee map is a more effective formative assessment tool when compared to the standard laboratory report based on Bloom's (1956) high-order thinking;

2. When coupled with inquiry-based instruction, the Vee map is a more effective formative assessment tool when compared to the standard laboratory report based on student retention of knowledge.

Discussion/Implications

This study presented findings which indicated that the Vee map is a more effective assessment tool that leads to higher student achievement in the agriscience classroom. These results are consistent with the findings of Thoron and Myers (2010b). Ivie (1998) stated that high-order thinking skills are enhanced through the use of graphic organizers as a formative assessment tool. The graphic component of the Vee map aids in the development of student thinking skills.

The findings suggest that the utilization of formative assessment enhances student content knowledge through agriscience laboratories. This study supports the argument made by *America's Lab Report* (2006) that laboratory experiences and assessment increases students' critical thinking and technical skills. Warner and Myers (2006) presented the Vee map as an assessment tool that could be utilized in the laboratory setting. This study provides empirical data that support the use of Vee maps as a formative assessment tool in laboratory settings.

The findings of this study support Ausubel's (1963a) belief that meaningful learning is individually constructed by the learner and enhanced through the use of graphic organizers. The utilization of the Vee map as a formative assessment tool allows the learner to receive feedback (formative) from their instructor to create meaningful learning. The feedback provided by the instructor incorporated Ausubel's three distinct criteria of 1) utilizing an abstract structure (laboratories incorporating inquiry-based instruction); 2) organize information into an integrated system (Vee map); and 3) apply sound rules and logic (assessment).

Recommendations

Based on the findings of this study, four recommendations were made for teacher educators and curriculum developers in secondary school agriscience education: (a) based on the finding that the Vee map was more effective in developing high-order thinking skills the Vee map should be considered as an effective formative assessment in preparation of student development of such skills; (b) teacher educators should provide professional development on the effective use of Vee maps and other graphic organizers to be used during laboratory instruction to help students attain high-order thinking; (c) further investigations of the Vee map as a formative and summative assessment tool in various settings and contexts in the agricultural education profession should be examined to determine the effectiveness across learning styles, grade levels, and ability levels; and (d) continue to investigate, through quasi-experimental research, teaching methodologies and assessment tools that develop empirical evidence for use in the agriscience classroom and laboratory.

Based on the findings of this study, two recommendations were made for practitioners of agriscience education: (a) laboratory investigations that incorporate the Vee map enhances student high-order thinking skills on a standardized assessment; and (b) inquiry-based instruction and Vee maps when utilized together can lead to meaningful learning for students as they create their own graphic organizer to help them conceptualize information.

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The Effect of Vee Maps and Laboratory Reports on High- and Low- Order Content-Knowledge Achievement in Agriscience Education

Overview

Teachers should consider using proven assessments when evaluating laboratory experiences. A variety of assessments can be used such as concept maps, Vee maps, portfolios, written lab reports, or science fair projects. This study uses the Vee maps. The Vee map quantifies student experience through the use of graphic organizers and forces organization of information into an integrated system to better incorporate empirical data to form sound conclusions and recommendations. The development of students' critical thinking, argumentation skill, technical skills, reasoning ability, and engagement are all found within the agriscience laboratory. Therefore, the development of a sound research-based assessment tool that enhances high-order thinking and are easily incorporated and needed in secondary agriscience education, thus, Vee maps. Therefore, the purpose of the study was to test the effect of Vee maps and laboratory reports on high- and low-order content-knowledge achievement in agriscience education.

Rationale

Hands-on laboratory activities should be incorporated in the science curriculum to increase student skill and content knowledge in science. Because agriculture is considered a science and because an essential component of science education is the inclusion of laboratory exercises, then laboratory instruction is necessary for a quality agricultural education program. Laboratory experiences and assessment of those experiences increase students' critical thinking, argumentation skills, technical skills, reasoning ability and engagement.

Research Methods, Reliability, and Validity

The population of this quasi-experimental, pre, post, post-post design study was composed of learners at six Illinois high schools offering agriscience education. Covariates were used to adjust group means in order to compensate for previous knowledge in the subject matter. These covariate measures included a pretest for the unit of instruction. Students within intact groups were randomly assigned a Vee map or a standard laboratory report. The instrument yielded a reliability coefficient for the content-knowledge achievement instrument using a Kuder-Richardson 20 (KR-20) for dichotomous data at the coefficient alpha of .91.

Findings/Service to the Profession

When coupled with inquiry-based instruction, the Vee map was a more effective formative assessment tool when compared to the standard laboratory report based on Bloom's high-order thinking. The Vee map was also more effective for student retention. The authors are commented for researching the Vee map concept which is fairly new for most of us in the profession and according to this research it should be used more often.

Effects of Type of Reflection-In-Action and Cognitive Style on Student Content Knowledge: An Experimental Study

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Abstract

The purpose of this exploratory, experimental study was to determine the effects that the type of reflection-in-action and students' cognitive style had on content knowledge of pre-service agriculture teachers (N = 57) at Oklahoma University. Students' cognitive style was assessed using Kirton's Adaptation-Innovation Inventory. Students were classified as either more adaptive *or* more innovative. *Students were assigned randomly to either a verbal or written reflection-in-action group in the completely randomized 2x2 design. A Lab Aids® classroom kit, based on the principles of biofuels, served as the content for the treatment. The findings of this study indicated that cognitive style and type of reflection-in-action did not affect students' knowledge scores in an agriscience laboratory positively. As such, teachers can utilize either type of reflection-in-action without detriment to student learning. As this study was exploratory in nature, it is recommended that it be replicated with a larger sample size to increase generalizability. Additional research should focus on pairing students of similar and opposite cognitive styles to determine how their problem-solving ability and performance on tests is affected.*

This work has been supported, partially, by the NSF EPSCoR award EPS 0814361.

Introduction

Fundamentally, agricultural education has focused on helping students solve real-world problems by providing experiences that are both hands-on and minds-on (Moore & Moore, 1984; Parr & Edwards, 2004; Shoulders & Myers, 2012). Agricultural education's problem solving philosophy can be traced to John Dewey and his work on reflective thinking (Phipps, Osborne, Dyer, & Ball, 2008). In fact, the problem solving approach has evolved as the preferred teaching method in agricultural education (Phipps et al., 2008). The importance of solving problems continues to be relevant in today's educational climate, as problem solving skills have been identified as necessary for employment in various sectors of the agricultural industry (Robinson & Garton, 2008). Additionally, Shoulders and Myers (2012) stated, "Trends in the agriculture industry signal a need for agricultural education to teach scientific problem solving" (p. 124).

Since the genesis of agricultural education, the integration of science has been a topic of discussion and debate among educators. It has been suggested that students at the secondary level learn science better if it is taught in the context of agriculture (Parr & Edwards, 2004; Thompson & Balschweid, 2000). Further, empirical evidence exists that when science is taught in context of agriculture, students learn agriculture at a higher level (Haynes, Robinson, Edwards, & Key, 2012). In fact, Haynes et al. (2012) found a statistically significant effect in agricultural content knowledge in favor of those who were taught agriculture from a science-enhanced curriculum when compared to those who were not.

Teaching science in agriculture is not a new phenomenon. The content focus trends in agricultural education have evolved from as early as the 1900s to present day, coming full circle back to science integration (Wilson & Curry, 2011). There exists a growing call for the integration of science, technology, engineering, and mathematics (STEM), and the 2005 *Nation's Report Card* revealed that, although science and math scores show an increase in knowledge, "the large majority still fail to reach adequate levels of proficiency" (Kuenzi, 2008, p.1). Agricultural educators have made this initiative a priority at the local, state, and national levels (Doerfert, 2011). The focus of STEM principles taught in an agricultural context allows for "increased rigor and expectations" (Wilson & Curry, 2011, p. 140).

Dormondy (1993) conducted a national study of science crediting in agricultural education and reported that 34% of teachers from 33 states taught at least one agriculture course that counted as a secondary science credit. The National FFA Organization (n.d.) promotes the integration of STEM principles in the areas of SAE, Agriscience Fair, and career development events. There exists an obvious connection between science and agriculture. In fact, agriculture has been proclaimed to be "the world's oldest science" (Ricketts, Duncan, and Peake, 2006, p. 48).

Historically, teacher-centered instructional strategies, whereby the teacher acts as the authority figure and uses drill procedures to help students memorize information, were deemed the preferred method of delivering instructional content in common education (Moore & Moore, 1984). However, throughout the years, those strategies have been questionned. Student-centered methods of instruction, such as inquiry-based learning, problem solving, and experiential learning, have reversed the trend of teachers dominating the learning environment (Phipps et al., 2008). Student-centered methods put the students at the helm of their own learning while the teacher acts as a facilitator of the experience rather than an authority figure (Thoron & Myers, 2012). This method of delivery has been preferred in science because, when students believe they are in control of their own learning, they tend to exert greater effort in learning the material in a useful way and become better at solving problems (Parr & Edwards, 2004; Schunk, 2012).

Teaching methods, such as inquiry-based or experiential learning, that incorportate concrete, contextual experiences hold promise for increasing student achievement (Parr & Edwards, 2004). Agricultural education laboratories are natural settings for teachers to utilize instructional methods that encourage student to practice solving problems (Phipps et al., 2008). Agricultural laboratories, which can include food science, animal science, agricultural mechanics, horticulture, and aquaculture labratories, among others, provide a rich environment for inquiry-based learning and the application of instructional principles (Phipps et al., 2008). Inquiry-based instruction encompasses multiple dimensions of teaching and learning which demands that learners develop deep cognition while associating content knowledge to solving problems (Parr & Edwards, 2004). Incorporating laboratory experiments is a means of providing additional opportunities for teachers to increase the problem solving ability of students (Shoulders & Myers, 2012). Although opportunities exist for teachers to design rigorous laboratories that teach scientific problem solving (Parr & Edwards, 2004), little evidence exists on how they are used (Shoulders & Myers, 2012) or the effect that they have on student achievement.

Recent research suggests that the timing of an experience does not matter when measuring student learning by way of criterion-referenced tests; rather, what does matter is the type of reflection (Baker, Brown, Blackburn, & Robinson, 2012). If teachers desire to see effects on student performance, they must be present during the laboratory experience by constantly pushing students to reflect-in-action (Baker et al., 2012). Shoulders and Myers (2012) concluded, "Experiential learning in agricultural laboratories has been established as an ideal method to teach scientific content and problem solving skills to agriculture students . . ." (p. 135). Lamm et al. (2011b) added that cognitive style should always be considered as a variable of interest when the goal is to improve student achievement. Therefore, what effect does the type of reflection and preferred cognitive style of students have on their performance on a criterion-referenced exam?

Theoretical Framework

This study was framed around Kirton's (2003) Adaption-Innovation Theory (KAIT) and Kolb's (1984) experiential learning theory (ELT). The core of KAIT is that all individuals are creative and all solve problems. However, how people *prefer* to solve problems can differ (Kirton, 2003). These differences are referred to as cognitive style, which is defined as "the preferred way in which people respond to and seek to bring about change" (Kirton, 2003, p. 43). Kirton (2003) purposefully described the differences between cognitive style and cognitive capacity. Cognitive style is the preferred manner in which people approach problems, while cognitive capacity is composed of characteristics, such as intelligence or learned competencies. Cognitive style is a stable characteristic that does not deviate due to time or experiences.

Cognitive style is a continuum that ranges from "more adaptive" to "more innovative" (Kirton, 2003, p. 47). Those who are more adaptive prefer to solve structured problems and thrive when utilizing existing structure to solve problems. These problem solvers have a technical mindset and focus on the development of "better solutions" (Lamm et al., 2012, p. 20). Conversely, those who are more innovative prefer problems to be loosely structured and are less concerned with technical details; rather, they tend to produce ideas that push the boundaries of the current paradigm (Kirton, 2003). The ideas developed by those who are more innovative are aimed at producing "different solutions" (Lamm et al., 2012, p. 20).

Research has also supported the fact that relationships exist between experiential learning and cognitive style (Lamm et al., 2011b). The foundation of ELT is a four-step process where experiences are transformed into learning opportunities (see Figure 1). Specifically, the four steps in the learning process are concrete experience, reflective observation, abstract conceptualization, and active experimentation (Kolb, 1984). For learning to occur, learners must be guided through the full cycle; however, where the cycle begins for each student should not be a concern for teachers (Kolb, 1984). Lamm et al. (2011b) found that "those with a strong preference for abstract categorization (thinking) and active experimentation (doing) when learning had a very strong relationship with several critical thinking items" (p. 20). However, Baker et al. (2012) found no statistically significant difference in student content knowledge regarding the timing of when the lecture occurred in the experiential learning model.

Although all four stages of the experiential learning process are critical for learning, one of the most important is allowing students opportunities to reflect on the experience (Phipps et al., 2008). Reflection has been referred to as "a mechanism for the construction of knowledge from experience" (McAlpine & Weston, 2000, p. 371). Additionally, reflection allows students to re-live an experience in their own minds and "evaluate its relevance, nature, and complexity" (Phipps et al., 2008, p. 226). Specifically, teachers should ensure that students have the opportunity to reflect, whether in a group setting or individually (Phipps et al., 2008). Some students may feel more comfortable reflecting verbally in a social setting and others may prefer journaling as a means of reflection (Lamm et al., 2011a).

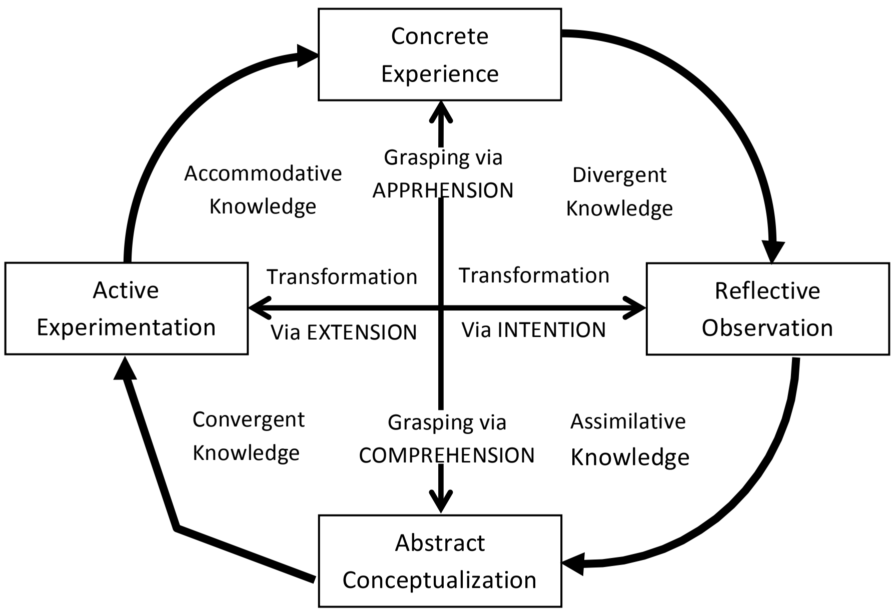

Figure 1. Model of Experiential Learning Process. Reprinted from *Experiential Learning: Experience as the Source of Learning and Development* (p. 42), by David A. Kolb, 1984, Englewood Cliffs, NJ: Prentice Hall, Inc. Copyright 1984 by Prentice-Hall, Inc. Reprinted with permission.

Schön (1983) described two types of reflection utilized by professionals to improve their practice, reflection-on-action and reflection-in action. Reflection-on-action describes reflective practices that occur following an experience. Reflection-in-action, however, occurs continuously during an experience (Schön, 1983). Baker et al. (2012) reported that students performed better on a criterion-referenced test when instructors guided them to reflect-in-action during an experience versus when allowed to reflect-on the experience.

A review of the literature revealed a gap related specifically to how different types of reflection-in-action affect student learning. Baker and Robinson (2010) reported that teachers play a crucial role in guiding students through the experiential learning cycle. The teacher facilitates reflection by "drawing out learners' interests, ideas, and previous knowledge" (Baker et al., 2012, p. 129). It is important to consider the effect that these two types of reflection have on student achievement because "one form of reflective practice may not fit the needs of all students" (Lamm, et al., 2011a, p. 132). Considering the importance of reflection in the experiential learning process, the principle question that arose from the review of the literature was, "What effect does type of reflection-in-action (individual and group) and cognitive style (adaptive and innovative) have on student content knowledge when teaching experientially?"

This research study relates to Research Priority Area 4: Meaningful, Engaged Learning in All Environments (Doerfert, 2011). Specifically, this research relates to sub-bullet two, "examine the role of motivation, self-regulation, metacognition, and/or reflection in developing meaningful, engaged learning experiences across all agricultural education contexts" (p. 9). Deepening the understanding of how types of reflection-in-action affect student achievement is a critical component in addressing the challenges presented for this research priority area.

Purpose and Objectives

The purpose of this study was to determine the effect that type of reflection-in-action and students' cognitive style had on content knowledge. In addition, this study sought to determine how the interaction of type of reflection-in-action and students' cognitive style affected content knowledge. The following research objectives guided the study.

1. Determine the interaction effect of type of reflection-in-action and student cognitive style on content knowledge.
2. Determine the effect of type of reflection-in-action on content knowledge.
3. Determine the effect of students' cognitive style on content knowledge.

The following null hypotheses guided the statistical analysis of the study.

$H_0 1$: There is no statistically significant difference between students' content knowledge due to the interaction of type of reflection-in-action and students' cognitive style.

$H_0 2$: There is no statistically significant difference in content knowledge of students due to the type of reflection-in-action received.

$H_0 3$: There is no statistically significant difference in content knowledge between students' cognitive style.

Methods and Procedures

This exploratory, experimental study employed a completely randomized factorial (CRF) 2x2 design (Kirk, 1995). CRF designs are utilized when the combined effects of two independent variables, as well as their combined effects, are of interest (Ary, Jacobs, & Razavieh, 2002). The independent variables of this research study were type of reflection-in-action, either verbal or written, and students' cognitive style, either adaptive or innovative (Kirton, 2003). The dependent variable was students' content knowledge in biofuels, as measured on a 25-item criterion-referenced test, developed by the researchers.

The population of interest was all students (N = 57) enrolled in a junior-level foundations course in agricultural education at Oklahoma State University. Because the population consisted of pre-service teachers, this study was presented to the students within the course topic of teaching in and managing an agriscience laboratory and was included in the course syllabus. Early in the semester, students were made aware of this research study and its possible implications to them as future teachers. Once Institutional Review Board (IRB) approval was granted, students' cognitive style was assessed using Kirton's (2003) Adaption-Innovation Inventory (KAI). Additionally, students were administered a 10-item pre-test to determine students' biofuels content knowledge prior to completing the laboratory experience. An independent samples *t*-test was calculated to determine if pre-treatment differences existed between groups. A statistically significant difference ($p = .718$) did not exist between the *more adaptive* ($M = 5.04$) students and the *more innovative* (M = 4.84) students in terms of biofuels content knowledge prior to the treatment. Once the pre-test was administered, students were presented a 30-minute lecture and discussion on the role and purpose of biofuels to ensure all students were familiar with basic concepts and terminology. Students were then assigned randomly by cognitive style to either the verbal or written reflection-in-action treatment groups.

Controlling threats to internal validity is a concern of researchers when designing experimental studies (Gay, Mills, & Airasian, 2009). A powerful control of threats to internal validity is random assignment to treatment groups (Gay et al., 2009). Random assignment to treatment groups has been called "the all purpose procedure for achieving pretreatment equality for groups" (Campbell & Stanley, 1963, p. 6). Campbell and Stanley (1963) described eight extraneous variables that can affect internal validity. These variables included history, maturation, testing, instrumentation, statistical regression, selection, experimental mortality, and selection-maturation interaction.

Specifically regarding this study, seven of the factors were either not applicable or were controlled for by random assignment. Experimental mortality, however, did impact this study, due in part to the lengthy treatment period. The treatment began on September 19, 2012, with the administration of the KAI. On September 24, 2012, students received the in-class lecture on biofuels and their purpose in agriculture. Students were randomly assigned to treatment groups and participated in biofuels laboratory exercises on September 26, 2012. Students were tested on their knowledge of biofuels as a result of their participation in the laboratory exercises on October 1, 2012 (see Figure 1). Then, finally, on October 7, 2012, the researchers shared the data with the students regarding the findings of the study.

Cognitive Style		Verbal Reflection- In-Action	Written Reflection- On-Action
	More Adaptive	Treatment Group A *n* = 16	Treatment Group B *n* =13
	More Innovative	Treatment Group C *n* = 9	Treatment Group D *n* = 10

All agricultural education students (*N* = 57) who were enrolled in a junior-level foundations course at Oklahoma State University were included in the study. However, if any student missed any of the class meetings in which the treatment was occurring, they were deleted from the study. As such, only 48 students participated fully in all experimental conditions. In all, nine students failed to complete all treatment levels. Gay et al. (2009) stated that experimental mortality becomes an issue when group characteristics are changed due to participant attrition. Therefore, a comparison of the whole class population and the participants was warranted. Regarding the gender of the entire class population, 28 (49%) of the students were male and 29 (51%) were female. Twenty-nine (51%) were *more adaptive*, 27 (48%) were *more innovative*, and one student never completed the cognitive style inventory. The gender of the participating group was 22 male (46%) and 26 female (54%), and the cognitive style composition of the participating group was 29 *more adaptive* (60%) and 19 *more innovative* (40%) (see Figure 1).

The agriscience laboratory experiment employed a kit designed by Lab-Aids® titled, *Incorporated Biofuels: Investigating Ethanol Production and Combustion.* Specifically, students completed investigation two, titled, *Comparing the Energy Stored in Two Fuels* (Lab-Aids® Kit 39S, 2007). In this investigation, students compared the energy levels of two fuels – ethanol and kerosene. Students formulated hypotheses based on their current knowledge and prior experiences and then completed the experimental investigation. The students used mathematical formulae and calculations for testing their hypotheses. The major scientific and mathematical concepts within this investigation included the chemical make-up of fuels, pollutants, experimental design and control, converting units of measurement, and averaging. Students in both groups were given laboratory protocols based on the Lab-Aids® investigation to ensure fidelity of the treatment.

Reflection Treatment

Lamm et al. (2011a) suggested that educators should be prescriptive in how they want students to reflect in writing. The authors recommended that educators should set aside time for reflective activities and that the questions should be clear and focused rather than loose and open-ended. Therefore, during the biofuels laboratory experiment, students in the written reflection-in-action group were provided laboratory protocols that guided them through their reflection of the activity. Students were required to stop working on the experiment and write a reflection, based on prescribed prompts, at seven points during the investigation, which equated to about every 15 minutes. Students were instructed to complete their written reflections individually.

In contrast, students in the verbal reflection-in-action group were not forced to stop and reflect in writing. Instead, the laboratory instructor asked probing questions throughout the investigation. These questions were similar to those of the written reflection-in-action group. The instructor asked questions purposefully, requiring students to stop working and reflect on the current situation verbally, as a group. The instructor utilized questioning techniques to ensure that all students had an opportunity to respond to questions. As such, this group was more social in nature when compared to the written reflection group. This strategy was employed in an effort to polarize the treatment groups as much as possible.

Cognitive Style Treatment

Cognitive style was also a variable of interest in the study. Data were collected using Kirton's (2003) Adaption-Innovation Inventory (KAI). The KAI is comprised of 32-items measuring people's preferred problem solving ability. According to Kirton (2003), scores may range between 32 and 160, with a theoretical mean of 96. Individuals who score a 95 or below are considered *more adaptive* and those who score a 96 or higher are considered *more innovative* (Kirton, 2003). The KAI was designed to be utilized with working adults; however, it has been used in a variety of additional contexts, including with teenagers and in educational settings (Kirton, 2003). Numerous studies have been conducted to establish the reliability of the KAI. Typical reliabilities have ranged from .74 to .86 for teenagers and .84 to .91 for working adults (Kirton, 2003). Because a variety of studies describe the reliability of the KAI, a pilot test was not conducted. Instead, post-hoc reliability estimates were conducted and yielded a Cronbach's alpha coefficient of .79 for this sample of undergraduate students, indicating the instrument was reliable for this population.

Content Knowledge as a Dependent Variable

The researchers developed a 25-item criterion-referenced test to assess biofuels content knowledge. Test items were based on content and questions found in the Lab-Aids ® curriculum. The Lab-Aids ® curriculum comes complete with a booklet filled with scripted laboratory exercises in which students are to complete. The booklet was used to develop questions for the biofuels criterion-referenced test. Once complete, a panel of experts assessed the face and content validity of the test. In particular, three pedagogical experts reviewed the test for ease of reading, semantics of questions, and general construction of the questions. An expert in biofuels reviewed the test for content appropriateness. All recommendations were accepted from the panel of experts prior to the release of the test to the participants.

Further, Wiersma and Jurs (1990) listed eight factors that should be accounted for by researchers to ensure reliability of criterion-referenced tests. Table 1 includes the factors as well as the researchers' attempts at addressing them. Because each of the eight factors described by Wiersma and Jurs (1990) were addressed, the test was deemed reliable.

Table 1

Examples of how the Eight Factors, Identified by Wiersma and Jurs (1990), Necessary for Establishing Reliability of Criterion-referenced Tests, were Addressed

Factor	How Factors were Addressed
1. Items should be homogeneous	Items included in the examination were of the same font size and style; thus, consistency was evident.
2. Items should be discriminating	A wide range of difficulty was included within the test, as directed by the content expert in biofuels.
3. A good quantity of items should appear	The original test included 25 items that consisted of multiple-choice, true/false, and essay questions.

4. Test should be of high quality	Attention was paid to the formatting of the test, as verified by the panel of experts. The test was copied on a laser printer.
5. Directions for students should be clear	Directions were read aloud and were also printed at the top of the booklets provided to students.
6. Test should be administered in a controlled setting	The test was taken in the same room in which students attend lecture, so as not to change the climate in which students were conditioned.
7. Include strategies to motivate students to participate	Students were informed that the findings of this study would benefit them as future teachers regarding how to teach in laboratory settings to students with different cognitive styles.
8. Directions for scorer should be clear and easy to interpret	An answer key was developed and provided to the scorer to ensure the questions were assessed accurately.

Popham and Husek (1969) argued that internal reliability estimates are not appropriate for criterion-referenced tests because the instrument compares individuals to specific criteria and not to other individuals. However, Kane (1986) stated that internal consistency is an important issue related to criterion-referenced tests. Specifically, Kane (1986) discussed that internal reliability coefficients above .50 indicate the instrument would reflect students' aggregated mean scores accurately. Therefore, the Kuder-Richardson (KR-20) formula was utilized to calculate an initial reliability coefficient of .61 for the 25-item criterion referenced test. An item analysis, however, revealed that 10 test items were not correlated with overall reliability of the test. Subsequently, those items were removed from the analysis, yielding an overall reliability coefficient of 0.68 for the remaining 15-item test.

A two-way independent analysis of variance (ANOVA) was employed to calculate the main and interaction effects of the independent variables (Field, 2009). ANOVA allows for the partitioning of variance associated with the treatment, as well as that associated with error (Ary et al., 2002). To determine the statistical significance of the research findings, an *a priori* alpha level was set at .05. The alpha level was utilized to determine whether or not to reject each null hypothesis (Kirk, 1995). Practical significance was determined by calculating effect size via partial eta squared (η^2). Kirk (1995) defined practical significance as whether the treatment effect is "large enough to be useful in the real-world" (p. 64). Interpretations of the partial η^2 statistic were made using the following guidelines: (a) 0.0099 indicating a *small* effect size, (b) 0.0826 indicating a *medium* effect size, and (c) 0.20 indicating a *large* effect size (Cohen, 1988).

Findings

Table 2 lists means and standard deviations by type of reflection-in-action and cognitive style. A total of 25 students participated in the verbal reflection-in-action group. The mean score of these students on the 15-item test used for analysis was 9.32 (*SD* = 2.46). Sixteen of those students were in the *more adaptive* category. These students' mean score on the 15-items used for analysis was 9.25 (*SD* = 2.54). Nine students were considered *more innovative*. The mean test score of this group was 9.44 (*SD* = 2.46).

A total of 23 students participated in the written reflection-in-action group. The mean score of these students on the 15-item test used for analysis was 9.78 (*SD* = 3.48) (see Table 2). The *more adaptive* students in this group scored an average of 9.38 (*SD* = 3.99), while the *more innovative* mean scored an average of 10.30 (*SD* = 2.79). Overall, the *more adaptive* students had a mean score of 9.31 (*SD* = 3.21) and the *more innovative* scored an average of 9.89 (*SD* = 2.60).

Prior to analyzing the data through ANOVA, the Levene's test of equality of error variances was employed to ensure the assumption of equal variances was not violated. The Levene's test was determined to be non-significant at the .05 level, $F(3, 44) = 2.55$, $p = .068$. ANOVA was then utilized to determine main and interaction effects (see Table 2). The interaction effect of type of reflection-in-action and cognitive style yielded an $F(1,44) = 0.16$, $p = 0.69$, and power = 0.06. The interaction effect was deemed non-significant and the researchers failed to reject the first null hypothesis. The partial η^2 for the interaction effect was .004, indicating negligible practical effect. An analysis of main effects was necessary because no interaction effect was detected (Kirk, 1995).

Table 2

Mean Knowledge Test Scores for Treatment Conditions Type of Reflection-in-Action and Students' Cognitive Style

Type of Reflection In-Action	Cognitive Style	*M*	*SD*	*n*
Verbal Reflection	More Adaptive	9.25	2.54	16
	More Innovative	9.44	2.46	9
	Total	9.32	2.46	25
Written Reflection	More Adaptive	9.38	3.99	13
	More Innovative	10.30	2.79	10
	Total	9.78	3.48	23
Total	More Adaptive	9.31	3.21	29
	More Innovative	9.89	2.60	19
	Total	9.54	2.97	48

Regarding type of reflection-in-action, the ANOVA yielded $F(1,44) = .30$, $p = 0.59$, and power = 0.08. Therefore, the main effect of type of reflection was determined to be non-significant; thus, the researchers failed to reject the second null hypothesis.Partial η^2 was calculated for the main effect of type of reflection-in-action and yielded an effect size of 0.09, resulting in a small practical effect. Further, there was no statistical significance of the main effect of cognitive style, $F(1, 44) = 0.38$, $p = 0.54$, power = 0.09. Therefore, the researchers failed to reject the third null hypothesis. The partial η^2 for the main effect of cognitive style was .007, indicating negligible practical effect.

Table 3

Analysis of Variance Summary Table

Source	*SS*	*df*	*MS*	*F*	*p*	*Partial* η^2
Reflection	2.80	1	2.80	.30	.59	.009
Cognitive Style	3.51	1	3.51	.38	.54	.007
Reflection* Cognitive Style	1.48	1	1.48	.16	.69	.004
Error	406.40	44	9.24			
Total	4784.00	48				

Conclusions

Although this study failed to yield any statistically significant differences in the variables of interest, it did yield important findings. Regarding the type of reflection in which students were exposed, the researchers were pleased to learn that, per Schön's (1983) reflection-in-action theory, the type of reflection did not affect test scores. Teachers, therefore, should not concern themselves about the way in which they guide students to reflect-in-action; rather, they should focus on providing options for students to reflect that will "accommodate a variety of learning styles when trying to guide students through the experiential learning cycle" (Lamm et al., 2011a, p. 132). The important thing is that teachers reflect during the experiences with their students (Baker et al., 2012), in whatever mode that suits them best.

The findings of this study also suggest that students' cognitive style has no effect on their ability to perform on a knowledge-based test. This finding supports Kirton's (2003) adaption-innovation theory that suggests that students' cognitive style is not an indicator of intelligence; rather, it is an indicator regarding their preference for solving problems. In this regard, it is comforting to know that students were able to solve problems in the laboratory similarly, regardless of their cognitive style.

Finally, there was a lack of simple main effects in the study. Specifically, cognitive style and the type of reflection-in-action did not interact with one another. This finding suggests that neither cognitive style nor type of reflection-in-action had a bearing on students' performance on the criterion-referenced test.

Recommendations for Research

The findings of this study indicate that cognitive style and type of reflection-in-action do not affect students' knowledge scores in an agriscience laboratory positively. However, because this study was exploratory in nature and employed a rather small sample size ($N = 57$), further research should occur (Kirk, 1995). It is recommended that the study be replicated with a larger sample size. Because the researchers cannot control the amount of students who enroll in the course, data should be collected over a series of years and reported once power is appropriate. The researchers used G*Power (Faul, Erdfelder, Lang, & Buchner, 2007) as a means for ensuring power for the study *a priori*. However, it was determined that, once the data were analyzed, power was low, indicating a high amount of error. Because power was weak, it is unclear if the test could have detected an effect, even if one existed (Field, 2009). Therefore, larger sample sizes are needed to confirm or refute the findings of this exploratory study.

Future studies should also compare how teaming students together in pairs of similar and opposite cognitive styles affects their problem solving ability and performance on tests. For instance, how do students who are paired together as similar preferred cognitive styles, such as adaptive-adaptive (A-A) and innovative-innovative (I-I), compare to each other? Likewise, what about students who are paired together according to dissimilar preferred cognitive styles, such as adaptive-innovative (A-I)? Do A-I pairs outperform A-A and I-I pairs on criterion-referenced tests and problem solving exercises? Further research should explore these phenomena because the findings have implications for how teachers pair students together in various team-centered activities, such as career development events.

Research should investigate the effect that cognitive style has on students' ability to solve problems accurately and efficiently. Do the *more adaptive* solve problems more efficiently than the *more innovative*? Research should also assess whether cognitive style influences students' ability to solve both ill-defined and structured problems regarding various real-life problems in the context of agriculture.

Finally, this study should be replicated at the secondary level to determine the effects it has on students in school-based programs. Parr and Edwards (2004) recommended that "more empirically-based research should be conducted to explore teachers' use of the problem-solving approach in the context of secondary agricultural education and subsequent student achievement in science" (p. 113). As such, replicating this study offers a means for achieving this purpose.

Recommendations for Practice

This study was conducted using pre-service teachers as a means to teach them about the experiential learning method through application of an agriscience laboratory experiment. As such, the researchers should continue to share the knowledge found in this study with current and future agricultural education majors in the teacher preparation program at Oklahoma State University. Further, because students are able to learn about a content area (biofuels) that is not taught in secondary agriculture programs in Oklahoma traditionally, future laboratory experiences, such as this one, should exist. Doing so will improve students' understanding of the content and pedagogy needed to teach it effectively.

Opportunities also exist for in-service training regarding the use of experiential learning as an effective pedagogy in teaching laboratory-based experiences (Baker et al., 2012). Specifically, summer workshops should be conducted that manipulate similar treatment variables with current agriculture teachers. This type of workshop would help expose agriculture teachers to important content that could be, and perhaps should be, taught in agricultural power and technology and natural resources courses.

Limitations

This study was limited in size and scope. In an ideal situation, the researchers would have recruited additional students to participate in the study to improve the study's power. However, the study was conducted as an activity included in the course syllabus to teach pre-service teachers more about scientific problem solving in a laboratory setting. As such, the researchers were restricted on sample size based on the number of students enrolled in the course.

Another limitation was the length of time in which students tested after participating in the treatment. Students finished the treatment on a Wednesday but did not take the test until the following Monday. This delay was due to the course schedule, as the course meets on Monday and Wednesday mornings. As such, it is fair to assume that mortality occurred in the treatment of the examination. Also, comparisons of gender and cognitive style were made to determine if the characteristic of the participating group differed from the entire class population. Although little differences existed between the groups based on gender, a higher proportion of the *more innovative* students failed to complete all treatment conditions, which could have affected the study's outcomes.

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Discussant Remarks: Cliff Ricketts, Middle Tennessee State University

Effects of Type of Reflection-In-Action and Cognitive Style on Student Content Knowledge: An Experimental Study

Overview

Historically, teacher-centered instructional strategies where the teacher acts as the authority figure and uses drill procedures to help students memorize information, were deemed the preferred method of teaching. However, throughout the years, those strategies have been questioned. Student-centered methods of instruction, such as inquiry –based learning, problem solving, and experiential learning have reversed the trend. Student-centered methods put the students at the helm of their own learning while the teacher acts as a facilitator of the experience rather than the authority figure. If teachers desire to see effects on student performance, they must be present during the laboratory experience by constantly pushing students to reflect-in-action. The cognitive style of the learner should always be considered as a variable of interest when the goal is to improve student achievement. Therefore, the purpose of this exploratory, experimental study was to determine the effects that the type of reflection-in-action and students' cognitive style had on knowledge of pre-service agriculture teachers.

Rationale

Refection has been referred to as a mechanism for the construction of knowledge from experience. Additionally, reflection allows students to relive an experience in their own minds and evaluate its relevance, nature and complexity. Specifically, teachers should ensure that students have the opportunity to reflect, whether in a group setting or individually. The teacher facilitates reflection by drawing out learners' interests, ideas, and previous knowledge.

Research Methods, Reliability and Validity

Fifty seven students' cognitive style was assessed using Kirton's Adaptation-Inventory. Students were classified as either a verbal or written reflection-in-action group in the completely randomized 2 X 2 design. A commercial classroom kit, based on principles of biofuels, served as the treatment. An independent samples t-test was calculated to determine if pre-treatment differences existed between groups. Previous studies of the KAL had been conducted to establish the reliability which ranged from .74 to .86 for teenagers and .84 to .91 for working adults. Post-hoc reliability estimates were conducted and yielded a Cronbach's alpha coefficient of .79. The Kuder-Richardson showed 10 questions to be unreliable so a re-test was done using only 15 questions which yielded an overall reliability coefficient of 0.68. A two-way independent analysis of variance (ANOVA) was employed to calculate the main and interaction effects of the independent variables.

Findings

The findings of the study indicated that cognitive style and type of reflection-in –action did not affect students' knowledge scores in an agriscience lab positively, thus, any type of reflection is worthy.

The Influence of Active Teaching Strategies on Self-Efficacy Scores Across Learning Styles

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Abstract

Self-efficacy is a person's belief in his or her abilities to achieve a desired outcome. The purpose of this study was to determine the extent to which preservice teacher self-efficacy and performance are enhanced by the inclusion of active learning strategies across various learning styles. The influence of active learning strategies on students' self-efficacy was determined before, during, and after implementation of the active learning strategies, as influenced by student learning styles. Over the course of a semester, student self-efficacy increased with the attainment of subject matter knowledge and the incorporation of active learning strategies in the learning process, regardless of learning style. However, in the short run, differences in self-efficacy scores were noted between Concrete Sequential and Abstract Random learning styles.

Introduction/Theoretical Framework

For many preservice students, one of the most frightening aspects of becoming a teacher is the belief that, at some point in their teacher preparation program, they will be expected teach subject matter that they know little or nothing about. These individuals believe that their performance will be limited in some way. For others, however, they can hardly wait to tackle the challenges of teaching. They believe that no matter what obstacles they encounter, they can (and will) perform at an elevated level and experience a high degree of success. As most experienced and successful teachers know, this belief in their own ability is critical to their success in the classroom. Teachers who are confident that they can master any situation tend to experience success; and in turn, their students also experience success (Roberts, Harlin, & Ricketts, 2006). By contrast, those who lack this confidence often struggle in the classroom, along with their students (Guskey & Passaro, 1994; Knobloch & Whittington, 2002).

Three concepts combine to form the theoretical framework for this study. The first of these is the concept of self-efficacy, as defined by Bandura (1977) and Yilmaz (2009). Bonwell and Eison (1991) offer the basis for the second component of the framework – that of active learning. The third component of the theoretical framework is anchored in the concept of learning styles, specifically as defined by Gregorc (1982a).

According to Bandura (1997), people with high assurance in their own talents approach difficult tasks as challenges to be mastered, rather than threats to be avoided. They set challenging goals for themselves and relish in the successful achievement of those goals. In the face of failure, they amplify their commitment and increase their efforts. They also quickly recover their sense of efficacy after a failure (Bandura, 1997). By contrast, people who doubt their capabilities shy away from tasks in which they believe they may experience failure. When faced with difficult tasks, they focus on their deficiencies rather than on their strengths. They give up quickly in the face of adversity. Because they view insufficient performance as a lack of their own skill, they quickly lose faith and give up rapidly (Bandura, 1997).

The concept of self-efficacy lies at the center of Bandura's social cognitive theory (Bandura, 1977). Yilmaz (2009) defined self-efficacy as an individual's perception of his or her own capabilities for organizing and successfully executing the courses of action required to attain designated types of performance. According to Yilmaz, teachers who develop a higher level of self-efficacy are more efficient in the classroom and have a teaching life that yields greater impact than does that of teachers with a lower level of self-efficacy (Yilmaz, 2009).

Rotter (1966) first proposed the concept of self-efficacy, with the Research and Development organization (RAND) refining the concept to include teachers' performance (Armor et al., 1976). According to researchers at the RAND organization, teacher self-efficacy can be defined as the extent to which teachers believed control of reinforcement lay within themselves or in the environment around them (Tschannen-Moran, Woolfolk Hoy, & Hoy, 1998). Other researchers offer definitions that have expanded that proposed by RAND. Berman, McLaughlin, Bass, Pauly, and Zellman (1977) defined teacher self-efficacy as the extent to which teachers believe they can affect student performance. With this is mind, a teacher's sense of self-efficacy has been consistently recognized as an important attribute of effective teaching and has been positively correlated to teacher and student outcomes (Swackhamer, Koellner, Basile & Kimbrough, 2009).

Teacher preparation programs can play a vital role in the development of a teacher's self-efficacy. However, most preservice teachers in the field of agricultural education do not feel adequately prepared in their subject matter content to enter the teaching profession (Whittington, McConnell, & Knobloch, 2006). In a study by Fritz and Miller (2003), student teachers in agriculture reported to their supervisors and fellow students that they were most concerned about self-adequacy in subject matter, discipline, and administration. Mastering subject and concepts related to the classroom was an emotional experience that shaped the teacher's *personal* self-efficacy and ultimately their sense of *professional* self-efficacy (Williams, 2009).

Tschannen-Moran and McMaster (2009) found that, once in a classroom, a student teacher's self-efficacy improved. They reported that the professional development format that supported mastery experiences through follow-up coaching had the strongest effect on self-efficacy and implementation of new strategies. Furthermore, teachers who experienced no follow-up coaching experienced a decrease in their self-efficacy.

Based upon the work of Knobloch and Whittington (2002), teaching experience helps build self-efficacy. Likewise, motivated and confident teachers are more effective than unmotivated, unsure teachers (Miller, Kahler, & Rheault, 1989).

Bandura (1977) noted that teachers who believe strongly in their teaching efficacy tend to rely on means of persuasion rather than authoritarian control. As such, teacher efficacy impacts student performance. As reported in several studies, when teachers possess a higher level of teacher efficacy, their students achieve more, exhibit greater motivation, and have a higher level of self-efficacy themselves (Guskey & Passaro, 1994; Knobloch & Whittington, 2002).

When relating high self-efficacy in teachers to student outcomes, the results were not confined to only a particular school setting. Higher achievement was also reported for students in schools that were located in predominantly rural settings and also for those in urban settings; and in schools with a majority of African-American students and in schools with a majority of Caucasian students – if those schools had teachers with high levels of self-efficacy (Swackhamer et al., 2009).

Bandura (1977) tied self-efficacy to an individual's belief that he or she can organize and execute courses of action that produce given results. This view ties self-efficacy to outcomes – a social cognitive theory.

According to Bandura (1977), self-efficacy is different from other concepts of self (i.e., self-worth, self-esteem, or self-concept), in that self-efficacy is tied to a particular task. According to DeWitz, Wooslsey, and Walsh (2009), all the variables of self-efficacy are significantly and positively correlated with purpose in life. Thus, individuals possessing a high level of self-efficacy are far more likely to recognize and feel strongly about their purpose in life. Therefore, teachers who have a high self-efficacy pursue their purpose of becoming an educator with more confidence and drive. In this light, Bandura's theory suggests that different characteristics, such as learning styles and teaching and learning strategies, may affect a person's sense of self-efficacy.

The concept of "active learning" resulted from the work of theorists promoting discovery learning (Mayer, 2004). While founded in this concept, active learning is an umbrella term that can incorporate many teaching methods. Bonwell and Eison (1991) define active learning as any instructional activity that causes students to do something and think about what they are doing. In doing so, Bonwell and Eison are implicit in relating the concept of active learning to that of experiential learning. Agricultural education practitioners embrace this relationship as part of the FFA Motto: "Doing to Learn" (National FFA Organization, 2006).

In the 1980s Jean-Pol Martin popularized a variation of the existing active learning strategies by using a process called "learning by teaching" as a way to engage students both behaviorally and cognitively (Grzega & Schoener, 2008). This strategy allowed students to teach content to each other and, in the course of teaching the subject matter, became actively involved in the curriculum itself. An integration of cognitivism and behaviorism, the strategy offers a reasoned framework for theory and practice today (Bonwell & Eison, 1991). Dyer (1995) noted that active learning strategies were one of only a few teaching methods that can effectively be used with students of all learning styles.

The remaining component of the theoretical framework that guided this study lies in the research base on learning styles. Gregorc (1982a) postulated that learners have "styles" that can be divided into four groups: Concrete Sequential (CS), Abstract Sequential (AS), Abstract Random (AR), or Concrete Random (CR) learners. Within these groupings, Gregorc noted that there are two types of mediation abilities: perception and ordering. Gregorc defined perceptual abilities as the means through which individuals grasp information. These abilities lie on a continuum of concreteness and abstractness at opposite ends. Once information is gathered, it must be ordered. Gregorc proposes that the ways in which individuals arrange, systematize, and reference information are referred to as ordering abilities. Like mediation abilities, ordering abilities also form a continuum with the poles of sequence and randomness at the two ends. For example, some individuals file materials neatly (alphabetically, by color, etc.), whereas others stack materials in piles. Others may scatter materials wherever there is an open space with no apparent specific ordering process. However, all of these patterns are actually filing “systems” that work for the respective style of learning (Gregorc, 1985).

According to Gregorc (1982a), CS and AR learners represent the two extremes in learning styles. CS learners view experiences in an ordered and sequential manner. They tend to be very focused, self-assured, and take control of a situation. Likewise, they are inherently structured and task-oriented. CS learners also use reason and logic and prefer an environment that is mentally stimulating. Abstract Random (AR) learners have thinking processes anchored in feelings and emotions. They enjoy environments that are colorful and varied. AR learners are often unsure of themselves and their abilities to control a situation. Change presents a problem for them.

Dyer (1995) noted that each preferred learning style has a matching preferred method of instruction. By utilizing appropriate teaching methods matched with student learning styles, Dyer and Osborne (1996) noted that student learning could improve.

One teaching method that addresses each of Gregorc’s various learning styles is active learning (Dyer, 1995). In this type of learning method, students are intimately involved in their learning experience by actively participating in the various components of learning. According to Chickering and Gamson (1987), active learning is the use of higher-order critical thinking tasks and strategies, such as analysis, synthesis, and evaluation. This implies that students who are simply present and listening to a class lecture are not actively learning. In this context active learning can be described as instructional activities that require less instruction on behalf of the instructor, and more activities involving individual and peer-to-peer interaction and cognitive skills. For example, activities such as journaling and group work, which require students to present information, are useful active learning strategies.

Although inferences can be drawn from the research base that supports the thesis that active learning in the context of a teacher preparation program should positively influence the self-efficacy of all students, a gap exists in the research base that addresses the influence of learning styles on the development of students’ self-efficacy levels. Likewise, the research base fails to either confirm or deny the presence of interaction effects between learning styles and self-efficacy. For example, although active learning strategies are recommended for all students, CS, CR, and AS learners tend to be less social than are AR learners. As such, active learning techniques used in a classroom may be perceived to render an “unsafe” environment, as defined by Reardon and Derner (2004), for CS, CR, and AS learners, resulting in lower levels of participation by students with these learning styles. This study seeks to explore this possibility.

Purpose/Objectives

The purpose of this study was to determine the extent to which self-efficacy is enhanced by the inclusion of active learning strategies by students with opposing learning styles, with CS learners on one end of the spectrum and AR learners on the opposite end. The objectives of the study were to:

1. Identify the influence of in-class instruction on self-efficacy scores over the duration of a semester.
2. Determine the influence of active learning strategies on self-efficacy scores.
3. Identify the influence of learning styles on self-efficacy scores.

Methods/Procedures

This study was conducted using a pretest-posttest control-group design. The sample for this study was 61 students enrolled in university teaching methods courses that were delivered over a period of five years. Students generally completed these courses the semester prior to beginning their student teaching internships.

According to Swackhamer et al., (2009), content courses that are designed to support a teacher's development of content knowledge and pedagogy can be a valuable way to increase levels of self-efficacy. Participants in this study completed two content courses before entering their student teaching internship semester. Prior to enrollment in their teaching methods courses, students in this study completed 50 hours of pre-service observation in schools. In addition, students complete a teaching methods course immediately prior to beginning their internship. At the end of the course, students complete four laboratory teaching assignments that served as one of the active learning treatments for this study. Throughout this course students were assigned activities that use such learning strategies as group presentations, individual and group activities, weekly journal entries, traditional classroom instruction and three lab practicum field experiences.

The Teachers' Sense of Efficacy Scale (TSES) – Short Form was used to gather data concerning student self-efficacy scores. Each participant completed the TSES at three different times during their teaching methods course. Participants first completed the TSES as a pre-test on their first day of enrollment in the course, a second time at the conclusion of their in-class instruction (the 10th week of the course), and a third time after completion of their four lab practicum field experiences (the 16th week of the course). The authors of this standardized instrument reported that the TSES possesses a reliability rating of r - .90 for the short form and appropriate face and content validity (Tschannen-Moran, & Woolfolk Hoy, 2001).

Student learning styles data were collected using the *Gregorc Style Delineator* (Gregorc, 1982b). The Delineator was used to determine student learning style at the beginning of the teaching methods course. The instrument utilizes a word matrix to assess the preferred learning style of each respondent. Gregorc established and reported the validity and reliability of the instrument. Internal consistency, via test-retest methodology, has been reported using standardized alphas ranging from .89 to .93. The Delineator divides 40 words into 10 sets of four words each, whereby respondents rank their reaction to each word (1 = least like, 4 = most like). Respondent scores may range from 10 – 40 in a given style category. A score of 26 or greater is indicative of a respondents' preferred learning style category (e.g., Concrete Sequential [CS], Abstract Random [AR], Concrete Random [CR], and Abstract Sequential [AS]). All data were analyzed using descriptive statistics.

Results/Findings

The first objective of the study was to identify the influence of traditional in-class instruction on student self-efficacy scores. To determine this influence, students were administered the Teachers' Sense of Efficacy Scale prior to the treatment. Students' mean pre-treatment self-efficacy scores were 83.4 (of a possible 108 points). After receiving the first treatment consisting of traditional in-class instruction, the self-efficacy instrument was administered a second time in an attempt to measure the influence of the treatment. Students' mean post-treatment self-efficacy scores increased slightly to 84.5 after this treatment (see Figure 1).

The second objective of the study was to determine the influence of active learning strategies on self-efficacy scores. At the conclusion of the first treatment (in-class instruction), a second treatment was administered that included laboratory field experiences in which students completed four laboratory teaching assignments; 50 hours of classroom observation; and completed activities that included interviewing stakeholders, preparing instructional programs of activities, coaching FFA Career Development Events, etcetera. With each task, students were instructed to actively apply the subject matter previously learned in the first treatment. After completing these active laboratory experiences, the self-efficacy scale was administered a third time. Mean scores again increased slightly across the population from 84.5 to 85.5 (see Figure 1).

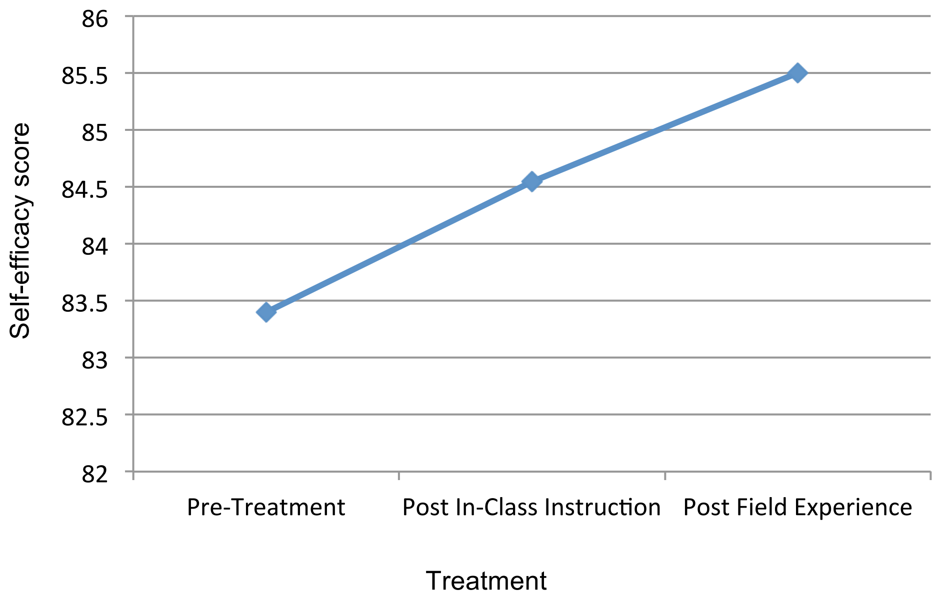

Figure 1. Mean self-efficacy scores of students at three stages of instruction.

The third objective of the study sought to determine the influence of learning styles on self-efficacy scores. The learning style instrument indicated that the population consisted of 36 learners with Concrete Sequential characteristics and 25 learners with Abstract Random characteristics ($N = 61$). Several learners possessed multiple styles, but in each case CS and AR were the predominate style. Data gathered at each of the three data gathering points described previously were cross-referenced and analyzed by the learning styles of the participants (see Table 1). No learners in the population were determined to be predominately AS or CR learners.

Table 1

Mean Student Self-efficacy Scores by Treatment

		Learning Style Mean	
Evaluation Point	Self-efficacy Mean	Concrete Sequential	Abstract Random
Pre-treatment	83.4	82.6	84.2
Post-treatment 1- In-class Instruction	84.5	86.5	82.2
Post-treatment 2 - Field Experience	85.5	84.0	87.0

Prior to any treatment being administered, CS learners exhibited lower self-efficacy mean scores (*M* = 82.6) than did AR learners (*M* = 84.2). After the first treatment (in-class instruction), CS learners' self-efficacy mean scores increased from 82.6 to 86.5. However, AR learners' self-efficacy mean scores decreased from 84.2 to 82.2. After the second treatment (exposure to active learning strategies), AR learners' self-efficacy mean scores increased from 82.2 to 87.0. By contrast, CS learners' self-efficacy mean scores decreased from 86.5 to 84.0 (see Figure 2).

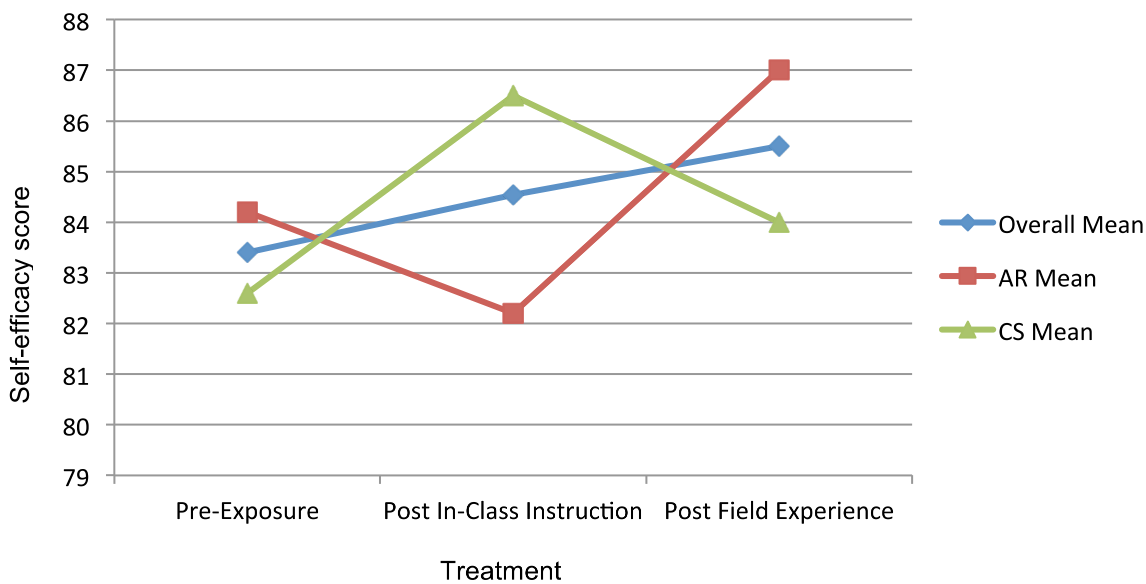

Figure 2. Self-efficacy scores across student learning styles.

Conclusions/Recommendations/Implications

It should be noted that this was a clinical study that involved intact classes of students, limiting the analysis of data to descriptive statistics. Generalization of the findings of this study beyond this population should be made with this limitation in mind.

The first objective of the study was to identify the influence of traditional in-class instruction on student self-efficacy scores. Based upon the differences between students' pre-test scores and their post in-class treatment scores, it appears that in-class instruction has only a minor influence on students' self-efficacy scores. However, as is shown by the findings in the third objective of this study, other variables seem to be influencing students' ability to fully utilize the treatment.

Overall, college students in this study exhibited varying degrees of self-efficacy, ranging from average to above average scores, in response to in-class instruction. However, mean self-efficacy scores increased only from 83.4 to 84.5 on a 108-point scale. This finding suggested the possibility that an interaction effect may be taking place between student self-efficacy scores and their learning styles.

The second objective of the study was to determine the influence of active learning strategies on self-efficacy scores. As with in-class instructional strategies, mean scores again increased only slightly from 84.5 to 85.5 across the population. This would again imply that active learning strategies have little influence on student self-efficacy scores - or that other variables are influencing the results.

In similar study by Housand (2009), active learning was found to be a critical component of education because it increased student performance. Housand's study helps to support the findings that active learning techniques are crucial to developing a high self-efficacy among teachers. These findings can be supported by a study focused on the effects of problem-based learning, a form of active learning, on the self-efficacy scores of students. The students who participated in a problem based learning approach collaborated on tasks and developed a final project which resulted in students with higher self-efficacy scores (Mills, 2009).

The third objective of the study sought to determine the influence of learning styles on self-efficacy scores. Of note, the overall increase in self-efficacy scores only increased by an average of two points on a possible 108-point scale after the treatments of in-class instruction and laboratory field experiences, indicating only a slight increase in students' self-efficacy. However, as noted in Figure 2, an interaction effect existed between learning style and self-efficacy score. While the study resulted in a slight overall rise in the combined self-efficacy scores for AR and CS learners at the conclusion of the treatment, the interaction effect of learning style on self-efficacy limited the overall mean score of the influence of the treatment on the mean scores.

After the pretest was administered, the first post-test revealed an increase in mean self-efficacy scores for CS learners, but a drop in self-efficacy scores for AR learners. These results may be attributed to the fact that, as the teaching methods course progressed and students learned the subject matter (how to manage a teaching and learning environment), CS learners became more confident in their ability to perform the tasks required of a teacher. However, AR learners became less confident in their ability to perform those tasks. Interestingly, after students began applying the material learned in the course in an active learning situation, CS learners' mean self-efficacy scores decreased, whereas AR learners' mean self-efficacy scores increased.

Both of the aforementioned phenomena can be explained with knowledge of the characteristics of the CS and AR learning styles. CS learners want structure in their learning. They prefer a controlled environment and tend to be more self-confident in their ability to control any situation if they have a sound base of knowledge from which to draw. By contrast, AR learners tend to rely more on their own ability to relate to individuals and less on their knowledge base. By placing virtually all of the emphasis for success on a structured format (as delivered during in-class instruction), AR learners are likely to question their ability to mentally access the database and come up with a solution to whatever problem that may arise when they begin teaching.

After the active learning phase of the project, CS learners felt less confident in their ability to master given situations. Active learning placed them in situations where they used subject matter from the in-class portion of the course alongside more reflective situations that often do not follow a sequential type of solution. Abstract Random learners, on the other hand, became more confident in their ability to come up with their own solutions (either by using subject matter either learned in class or on their own). This confidence was reflected by higher self-efficacy scores of AR learners. These findings resulted in a conclusion that students' sense of self-efficacy may be affected by different learning strategies and classroom techniques in the short-run, but student learning style may be a limiting factor in the development of students' self-efficacy as it pertains to teaching.

From a practical application viewpoint, it may be important for teacher preparation programs to use a combination of teaching techniques and learning strategies that promote high levels of self-efficacy for each type of learner in the classroom. This entails the inclusion of both an adequate knowledge base of successful teaching techniques, accompanied by active learning strategies that allow the development of higher self-efficacy among students of the two learning styles represented in this study. Additional research that identifies both the limitations on the development of self-efficacy and on strategies for increasing self-efficacy of preservice teachers is warranted. It is also recommended that for programs using a similar model of preservice teacher preparation as the one used in this study, students be provided a support system early in their internship programs. Bellah and Dyer (2009) reported that teachers who were not provided follow-up support in implementing new teaching strategies were often not able to use the strategies, even though ample instruction had been given in the use of the strategies. It may be possible that AR learners in this study were entering student teaching with higher levels of self-efficacy than their actual skills would merit, whereas CS learners were experiencing lower self-efficacy scores than their skills merited.

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Discussant Remarks: Cliff Ricketts, Middle Tennessee State University

The Influence of Active Teaching Strategies on Self-Efficacy Scores Across Learning Styles

Overview

Self-efficacy is a person's belief in his or her abilities to achieve a desired outcome. It is a higher form of self-confidence to accomplish an objective. In other words, teachers who are confident that they can master any situation tend to experience success. Also, their students also experience success. Some learning theories suggest that different characteristics, such as learning styles and teaching strategies, may affect a person's sense of self-efficacy. Active learning causes a student to do something and think about what they are doing such as experiential learning. Active learning is also a modern day term for "Doing To Learn". Therefore, the purpose of this study was to determine the extent to which pre-service teacher self-efficacy and performance are enhanced by the inclusion of active learning strategies across various learning styles.

Rationale

Although inferences can be drawn from the research base that supports the thesis that active learning in the context of a teacher preparation program should positively influence the self-efficacy of all students, a gap exists in the research base that addresses the influence of learning styles on the development of students' self-efficacy levels.

Research Methods, Reliability , and Validity

The study was conducted using a pretest-posttest control-group design. The sample for the study was 61 students enrolled in university teaching methods courses that were delivered over a period of five years. The authors of the Teachers' Sense of Efficacy Scale (TSES) reported a reliability rating of r - .90 for the short term and appropriate face and content validity. Student learning styles data were collected using the Gregore Style Delineator which established and reported the validity and reliability of the instrument. Internal consistency, via test-retest methodology, has been reported using standardized alphas ranging from .89 to .93.

Findings/Service to the Profession

The findings resulted in a conclusion that students' sense of self-efficacy may be affected by different learning and classroom techniques in the short-run, but student learning style may be a limiting factor in the development of students' self- efficacy as it pertains to teaching. This study has reinforced to the profession the importance of know the learning style and personality type of the teachers and the students since the two are correlated. Concrete Sequential learners tend to have a Choleric/Authoritarian personality type/leaderships style while Abstract Random learners have a Phlegmatic/Laissez-faire personality/leadership style. Concrete Sequential learners want structure and a controlled environment while Abstract Random learners relish relationships and like to come up with their own solutions.

Session D: Education Technology

Discussant: Dr. Barbara Kirby

Student and Faculty Perceptions of ICT Use in Undergraduate Agriculture Courses
Donald M. Johnson, Leslie D. Edgar, Casandra K. Cox
Discussant Remarks

Students' Mobile Technology Behavioral Intentions: The Influence of Self-efficacy, Level of Self-directedness, and Grade Point Average
Robert Strong, Travis L. Irby, Larry M. Dooley
Discussant Remarks

The Effects of GPA and Gender on Students' Acceptance of Mobile Learning in a Critical Issues in Agricultural Leadership Course
Sarah P. Ho, Dr. Robert Strong, Dr. Summer F. Odom
Discussant Remarks

An Evaluation of Usability of a Virtual World for Students Enrolled in a College of Agriculture
Theresa Pesl Murphrey, Tracy A. Rutherford, David L. Doerfert, Leslie D. Edgar, and Don W. Edgar
Discussant Remarks

Student and Faculty Perceptions of ICT Use in Undergraduate Agriculture Courses

Donald M. Johnson, University of Arkansas
Leslie D. Edgar, University of Arkansas
Casandra K. Cox, University of Arkansas

Abstract

Students and faculty in a land-grant college of agriculture were surveyed to determine their perceptions of current and future Information and Communication Technology (ICT) use in undergraduate agriculture courses. There was a large, positive relationship ($r = .83$*) between student and faculty perceptions of the extent to which 40 specific ICT tasks were required in undergraduate courses. Students and faculty ranked the same five ICT tasks (receive email, send email, search the Internet, submit assignments as email attachments, and use Blackboard© to acquire course information) as being the most frequently required. Students and faculty agreed that all database tasks and many of the intermediate to advanced spreadsheet, word processing, graphics, Internet, and miscellaneous tasks were seldom required in undergraduate agriculture courses. While a majority of students and faculty indicated that future ICT use should be maintained at the current level in each of seven broad ICT areas, there were significant (*$p < .05$*) differences between faculty plans and student recommendations for future use of the Internet, databases, computer graphics, and specialized applications. Students were undecided to moderately positive about their course-related ICT experiences. These results indicate a need to better integrate intermediate and advanced ICT tasks into undergraduate courses.*

Introduction

Claro et al. (2012) defined literacy in Information and Communication Technology (ICT) as "the capacity to solve problems of information, communication and knowledge in digital environments" (p. 1043) and indicated that ICT literacy requires both functional skills (mastery of ICT applications) and higher-order (synthesis and evaluation) cognitive skills. According to these researchers, mastery of functional skills is a prerequisite for ICT literacy since these serve as problem solving tools in digital environments. Thus, according to Claro et al. (2012), ICT literacy is not possible without functional ICT skills.

Researchers have noted that proficiency with ICT is a requirement for success in most well-paying careers (Grant, Malloy, & Murphy, 2009; Levy & Murnane, 2004; Stone & Madigan, 2007). Bresnahan, Brynjolfsson, and Hitt (2002) found that ICT skills played a large and widespread role in shifting relative wages among U.S. workers since 1980, with higher pay going to individuals with greater ICT skill levels. Both Graham (2001) and Shrestha (2009) noted that most college of agriculture graduates needed ICT skills to enter and advance in their professional careers.

Many in higher education believe students enter college already proficient in ICT skills and use (Kaminski, Switzer, & Gloeckner, 2009). However, research does not support this belief (Cox, Munise, Edgar, & Johnson, 2011; Edgar, Johnson, & Cox, 2012; Grant et al., 2009; Kaminski et al., 2009; Lee, 2003; Palaigeorgiou, Siozos, Konstantakis, & Tsoukalas, 2005; Pouratashi & Rezvanfar, 2010; Tesch, Murphy, & Crable, 2006; Van Braak, 2004; Verhoeven, Heerwegh, &

De Wit, 2010; Wallace & Clariana, 2005). These and other researchers have found that, while students perceived themselves to be ICT literate, most could not successfully complete fairly basic ICT tasks. Ratliff (2009) posited that many students have the 'wrong' type of ICT skills for academic purposes. According to Ratliff, "students may be experts with chatting, Twittering, or social networking, but inexperienced in attaching a document to an email or creating an essay with word processing software" (p. 1). Other researchers have supported this finding (Edgar, Edgar & Killian, 2009; Settle, Telg, Baker, Irani, Rutherford, & Rhoads, 2011; Rhoades, Irani, Telg, & Myers, 2008).

Several recent studies support Ratliff's (2009) conclusions concerning student ICT skills. Verhoeven et al. (2010) discovered that students' use of basic ICT skills changed little once they started at the university. The researchers noted that many students still did not know how to make graphs or do simple calculations in spreadsheets, automatically create a table of contents for a report, or make a presentation with PowerPoint or similar program. Tesch et al. (2006) found that 10% or fewer entering business students at Xavier University could correctly use absolute cell addresses in Excel® or properly insert a clip art image into a Word® document. Students at Northwest Missouri State University scored a mean of 53% correct on a basic competency assessment designed to allow them to test out of a required ICT literacy course (Hardy, Heeler, & Brooks, 2006). Of 164 students completing the exam, only three students (1.8%) achieved a score of 80% or higher and were able to test out of the course. The researchers concluded that "a majority of the students have not mastered computer concepts, word processing skills, spreadsheet skills, presentation skills, or database skills" (Hardy et al., 2006, p. 59).

The lack of ICT knowledge, competencies, and skills is not limited to students entering college. Kaminski et al. (2009) found that Colorado State University students' perceived ICT competency actually decreased over their college careers. Shrestha (2009) found that while graduating seniors in the College of Agriculture and Natural Resources at Michigan State University believed their academic majors had helped them develop technical skills required in their anticipated careers, they felt their programs had not been effective in developing their ICT skills.

Summers and Vlosky (2001) indicated both agriculture students and faculty agreed that course-related ICT use was "very important to students' future competitiveness in the job market" (p. 84). Graham (2001) found that agricultural employers rated word processing, Internet, spreadsheet, database, graphics, accounting systems, and computer-assisted drafting (CAD) as important ICT skills. More recently, Alston, Cromartie, Wakefield, and English (2009) found that agricultural employers rated spreadsheets, word processing, Internet, accounting systems, and presentation graphics as 'very important' ICT skills and database use and CAD as 'somewhat important' ICT skills. Although desired ICT skills were not evaluated at specific task levels, these studies provide faculty with important information on broad areas of ICT use that should be emphasized in undergraduate agriculture courses.

Selwyn (2007) noted that "despite huge efforts to position computer technology as a central tenet of university education, the fact [remains] that many students and faculty make only limited formal academic use of ICT during their teaching and learning" (p. 84). Kaminski et al. (2009) concluded, "We [Colorado State University faculty] are not engaging our learners in advanced uses of technology for communication, sharing information, and problem solving" (p. 232).

Kuth and Vesper (2001) studied 125,000 graduates from 205 institutions and concluded that students making larger gains in ICT skills during college scored higher on each of 27 academic and social outcome measures when controlling for socioeconomic status. Based on these results, researchers recommended that all entering students become proficient in ICT early in their college careers and that universities examine how students use computers in their courses. Requiring ICT use in courses is an especially important. Although Kaminski et al. (2009) noted an overall decline in self-perceived ICT skills from freshman to senior year, the researchers noted an increase in perceived skills in the two ICT areas most frequently required in courses: presentation software (PowerPoint©) and Internet use. This reinforces a common-sense notion that both initial learning and continued, periodic use of ICT skills are required in order to develop ICT skills necessary for career success.

Theoretical Framework

The Technology Acceptance Model (TAM) is a theoretical framework that can be used to assess how classroom teachers are integrating ICT into their curriculum (Davis, 1986). TAM posits that acceptance and use of ICT depends on an individual's perceptions of the usefulness and ease of use of the technology (Davis, 1986). TAM, based on a proven framework – the theory of reasoned action (TORA) (Fishbein & Ajzen, 1975), provides the rationale for many assumptions seen in TAM (Davis, 1993). Fishbein and Ajzen (1975) noted that attitudes are a function of beliefs, and those beliefs lead to behavioral intentions. TAM extended the TORA model by looking at two specific attitudes important in technology adoption – perceived usefulness and perceived ease of use (Davis, 1993).

In a study of business professionals, Davis (1993) found that "usefulness" exerts more than twice the influence on technology adoption than does "attitude" and "usefulness", and exerts more than four times the influence on attitude than does "ease of use". Davis (1993) viewed computer usage to be motivated extrinsically, by having concern over gain in performance and associated rewards. Yi and Hwang (2003) added a list of motivational factors to the concept of self-efficacy with respect to understanding users' behavior in accepting technology. The research contended that an individual who has a strong sense of capability in dealing with computers is more likely to accept new technology, such as ICT. TAM research has been extensively conducted to look at how certain technology systems are being perceived and used. Davis (1993) found, in a study of 112 users regarding two-end user systems, that "TAM fully meditated the effects of system characteristics on usage behavior" (p. 475). This study found that perceived "usefulness" was 50% more influential on attitude than "ease of use" in determining usage.

Venkatesh and Davis (2000) proposed an extension of the TAM to include seven additional factors affecting technology acceptance through their impact on either perceived usefulness or intention to use technology (Figure 1). Venkatesh and Davis successfully validated their extended TAM in longitudinal studies of technology adoption in four businesses. Across organizations, the seven additional factors explained 40-60% of the variance in perceived usefulness and 34-52% of the variance in intentions to use new technologies.

For the current study, the Job Relevance (JR) factor in the extended TAM was of particular interest. Venkatesh and Davis (2000) found that JR acting alone explained 40% of the variance in intention to use technology. Given that guiding student learning through the completion of required curricular activities is the primary 'job' of teaching faculty, the perceived relevance of ICT should be manifested in ICT tasks required in undergraduate agriculture courses as perceived by both faculty and students.

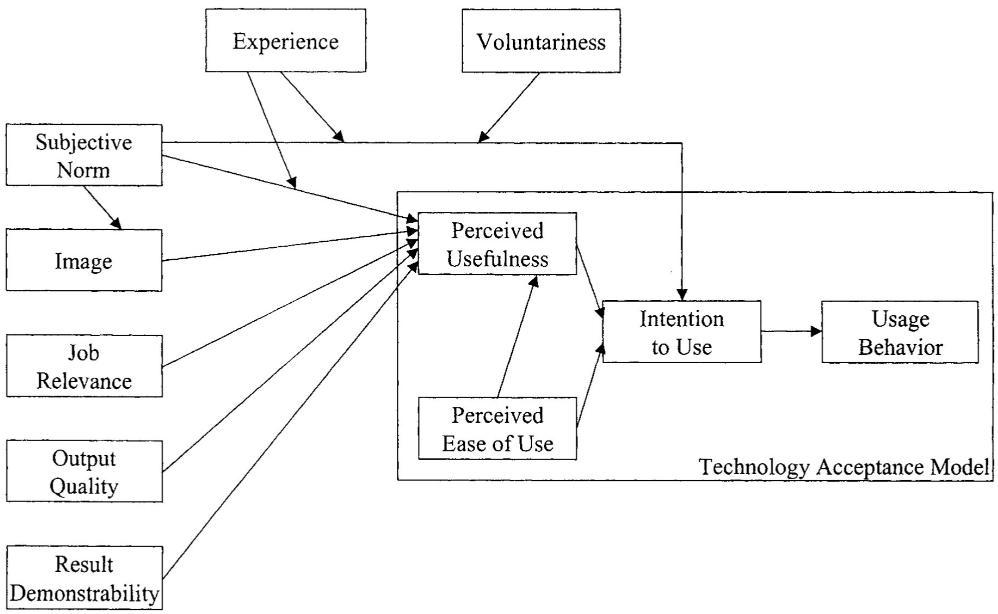

Figure 1. Extension of the Technology Acceptance Model (Venkatesh & Davis, 2000, p. 194)

The *National Research Agenda* developed by the American Association for Agricultural Education (Doerfert, 2011) calls upon agricultural education and communication faculty to "create programs that develop skills and competencies necessary . . . in the agriculture-related workforces in society" (para. 3). Through this charge and via the idea that postsecondary education programs should be producing students able and adept in ICT use, it is critical for educators to determine effective ways to increase ICT skills in college students prior to them entering professional careers. This study provides important data documenting the perspectives of both students and faculty concerning ICT use in undergraduate agriculture courses at one land-grant university. This information can serve as a framework both for improving the ICT skills of agriculture graduates at this university and promoting similar efforts at other universities.

Purpose and Objectives

The purpose of this study was to examine ICT tasks required in undergraduate agriculture courses at a land-grant university. Specific objectives were to:

1. Determine and compare the perceptions of students and faculty concerning ICT tasks required in undergraduate agriculture courses;

2. Determine and compare student and faculty perceptions of future ICT use in undergraduate agriculture courses; and

3. Determine student perceptions of factors related to ICT use in undergraduate agriculture courses.

Methods

The student population consisted of all undergraduate agriculture majors enrolled in junior- or senior-level agriculture courses (*N* = 1,914) at the University of [State] during the spring 2012 academic semester. Students enrolled in a stratified (by academic department), random sample of 12 upper-division courses were selected to participate in the survey. Upper-level courses were selected to ensure that respondents would be primarily juniors and seniors and would have completed a number of undergraduate agriculture courses prior to participating in the research. The researchers administered the instrument during the first two weeks of the spring semester. Prior to distributing the instruments in each course, the researchers explained the purpose of the study and informed students that participation was voluntary and that all responses would be anonymous. In order to eliminate unqualified and duplicate respondents the following were instructed to not complete the instrument: (a) new transfer students, (b) first-semester agriculture majors, and (c) students who had already completed the instrument in another class. The 12 selected courses had a total duplicated enrollment of 398 students and 235 students provided usable responses, resulting in a nominal, unadjusted response rate of 59%. Due to the anonymous nature of student responses, no follow-up of non-respondents was possible.

The population of faculty consisted of all instructors (*N* = 64) teaching one or more undergraduate agriculture course at the University of [State] during the fall 2009 semester as identified by official university records. The entire population of instructors was surveyed during the spring 2010 semester and 57 (89.1%) provided usable responses.

Although data were collected at different times for faculty (spring 2010) and students (spring 2012), meaningful comparisons were possible for two reasons. First, a longitudinal study [author names deleted, 2012] of faculty in this college found minimal changes in required ICT use in courses between 1999 and 2009 and a majority of faculty did not foresee changing their course ICT requirements during the next two to three years. Second, while faculty responses were based on required ICT use in specific courses taught during a specific semester, students were asked to respond based on the extent to which specific ICT tasks had been required in all agriculture courses completed over their academic careers. Given the relative stability of faculty course-specific ICT requirements and students' more global assessment of required course ICT use across courses, the two groups provided unique, but complementary, perspectives on ICT use in undergraduate agriculture courses at this land-grant university.

Instrumentation

The faculty instrument was administered on-line in January 2010 and assessed required ICT use in a specifically identified course taught by each instructor during the fall 2009 semester. The instrument consisted of three parts. Part I listed 40 specific ICT tasks (divided into seven ICT areas) and asked respondents to indicate ("Yes" or "No") whether students enrolled in the identified course were required to complete each task. Part II listed seven broad areas of ICT use and asked faculty about their plans for required student use over the next two to three years with response options of decrease use, maintain current level of use, or increase use. Part III contained four items concerning respondents' academic rank, teaching experience and appointment, and self-perceived ICT skills relative to other agriculture faculty.

A panel of nine faculty members (one from each department in the college), including three faculty teaching the college ICT literacy course, examined the instrument and judged it to possess face and content validity. Five agriculture faculty at two land-grant universities completed paper versions of the instrument (at two to seven week intervals) to determine instrument stability (reliability). Part I and Part II had test-retest agreement percentages of 95% and 86%, respectively. The reliability of Part III was not assessed, since, according to Salant and Dillman (1994), responses to non-sensitive demographic items "are subject to little measurement error" (p. 87).

The student instrument, based on the faculty instrument, was formatted as a printed booklet and contained four parts. Part I listed the same 40 specific ICT tasks (divided into seven ICT areas) as in the faculty instrument and asked respondents to indicate the extent to which each task was required in undergraduate agriculture courses (using a 1 to 5 Likert-type scale where 1 = "Never" and 5 = "Always") they had completed. Part II listed the same seven broad areas of ICT use and asked respondents to indicate, for each, whether future course ICT task use should decrease, maintain at the current level, or increase. Part III contained 15 statements concerning factors related to student ICT use in undergraduate agriculture courses that students evaluated on a 1 to 7 Likert-type scale (1 = "Strongly Disagree" and 7 = "Strongly Agree"). Part IV consisted of four demographic items concerning respondent's age, transfer status, major, and self-perceived ICT skills relative to other agriculture majors.

The student instrument, based on the previously validated faculty instrument, was evaluated by a panel of experts ($N = 3$) in survey research and ICT instruction and was judged to possess face and content validity. The student instrument was pilot-tested with five undergraduate agriculture students not participating in the main study; these students successfully completed the instrument and indicated they had no difficulty in understanding the instructions, items, or response options. To assess instrument stability (reliability), the instrument was administered a second time (14 to 21 days later) to the same five students and the following reliability coefficients were obtained: Part I ($r = .65$), Part II ($r = .90$), and Part III ($r = .71$). Although the reliability coefficients for Parts I and III were lower than anticipated, McDowell (2006) indicated reliabilities of $r > .50$ are acceptable when the purpose of the research is to make group rather than individual comparisons. The reliability of the demographic items in Part IV was not assessed (Salant & Dillman, 1994).

Results

The typical student was a junior (37.3%) or senior (39.1%) majoring in animal science (33.6%), agricultural business (22.3%), or agricultural education, communication, and technology (17.6%). Almost two-thirds (62.2%) had begun their academic careers at the University of [State]. When comparing their own ICT skills to their classmates, 6.9% rated themselves as below average, 59.5% rated themselves as average, and 33.6% rated themselves as above average.

Faculty responses were received from instructors teaching courses in all nine academic departments in the college. The largest percentage of courses represented was at the junior level

(40.4%), followed by courses at the senior (31.6%), freshmen (15.8%), and sophomore (12.3%) levels. The typical faculty respondent held the rank of professor (61.2%), had 10 or more years of university teaching experience (69.4%), and held a teaching appointment of 33% or less (67.4%). When faculty compared their own ICT skills to their colleagues, 65.3% rated themselves as average, 34.7% rated themselves as above average, and 8.2% rated themselves as below average.

Required ICT Use

Faculty reported requiring about 8 (*M* = 8.46; *SD* = 6.20) different ICT tasks in undergraduate agriculture courses. The six tasks faculty reported requiring in more than one-half of all courses (Table 1) were receive email (80.7%), send email (73.7%), search the Internet (64.9%), submit assignments as email attachments (57.9%), use Blackboard© to acquire course information (54.4%), and type a lab or project report (52.6%). Faculty indicated that 28 of the 40 ICT tasks were required in fewer than 25% of classes, while18 were required in fewer than 10% of classes. The less frequently required ICT tasks included all database tasks and many intermediate to advanced spreadsheet, word processing, graphics, Internet, and miscellaneous tasks.

Student means for four specific ICT tasks were above 4.0, indicating that students perceived these tasks as being required "very often" to "always" in the undergraduate courses they had completed. These tasks were receive email (*M* = 4.70; *SD* = 0.55), send email (*M* = 4.49; *SD* = 0.74), use Blackboard© to acquire course information (*M* = 4.33; *SD* = 0.77), and search the Internet (*M* = 4.11; *SD* = 0.87). Mean student ratings for 31 of the 40 ICT tasks were less than 3.0, indicating students used them "sometimes" in undergraduate agriculture courses; 14 of the 41 tasks received mean rating of less than 2.0 indicating they were "rarely" or "never" required. The least frequently required tasks as perceived by students included all database tasks and many of the intermediate to advanced spreadsheet, word processing, graphics, Internet, and miscellaneous tasks.

Table 1

Frequency and Ranking of Required ICT Tasks as Reported by Faculty and Students

	Faculty (*n* = 57)		Students (*n* = 235)		
ICT Task (*ICT Area*)	% Requiring	Rank	*M*[a]	*SD*	Rank
Receive electronic mail *from* instructor (*Email*)	80.7	1	4.70	0.55	1
Send electronic mail to instructor (*Email*)	73.7	2	4.49	0.74	2
Search Internet for information on a specific topic (*Internet*)	64.9	3	4.11	0.87	4
Submit course assignments as electronic mail attachments (*Email*)	57.9	4	3.73	1.12	5
Use Blackboard to acquire course information (*Internet*)	54.4	5	4.33	0.77	3
Type a lab or project report (*Word Processing*)	52.6	6	3.26	1.12	7
Download data to disk or hard-drive from the Internet (*Internet*)	40.4	7	2.88	1.27	11.5T
Create materials using presentation graphics software (e.g. PowerPoint) (*Graphics*)	33.3	8	3.23	1.11	8

Access a course web site (*Internet*)	31.6	9	3.28	1.17	6
Enter data into an existing spreadsheet (*Spreadsheet*)	29.8	10	2.74	1.11	14
Type a formal research paper (*Word Processing*)	28.1	11.5T	2.88	1.19	11.5T
Conduct a literature search using Agricola, ERIC, FirstSearch or similar database (*Miscellaneous*)	28.1	11.5T	1.19	1.10	39
Create charts and/or graphs using a spreadsheet (*Spreadsheet*)	22.8	13	2.57	1.10	16
Create a new spreadsheet (*Spreadsheet*)	22.3	14	2.67	1.15	15
Use spreadsheet functions (e.g. IF, MAX, MIN, etc.) (*Spreadsheet*)	17.5	15	2.40	1.11	17.5T
Write a single spreadsheet formula that performs a series of mathematical operations (*Spreadsheet*)	15.8	16	2.28	1.12	19
Write a spreadsheet formula that performs a single mathematical operation (*Spreadsheet*)	15.4	17	2.40	1.13	17.5T
Use Blackboard to submit assignments (*Internet*)	14.0	18	3.05	1.18	9
Use Internet-based communications to contact your instructor and/or classmates (e.g. IM, Facebook, Wiki, Blog) (*Internet*)	12.3	19	2.99	1.30	10
Participate in an email course discussion group or list serve (*Email*)	10.5	20.5T	2.86	1.23	13
Participate in an Internet-based threaded discussion group for class (*Internet*)	10.5	20.5T	2.08	0.97	23T
Type a business letter (*Word Processing*)	8.8	23T	2.19	1.18	20.5T
Download freeware (*Internet*)	8.8	23T	2.02	1.02	26
Use spreadsheet database functions (e.g. sort, query, etc.) (*Spreadsheet*)	8.8	23T	2.08	0.99	23T
Make drawings using computer-assisted drafting program (e.g. AutoCAD, TurboCAD, AutoSketch, etc.) (*Graphics*)	8.8	23T	1.53	0.84	34
Create visual illustrations using graphic-design programs (e.g. Adobe Illustrator, Adobe Photoshop, etc.) (*Graphics*)	8.8	23T	1.98	1.12	27
Use a computer simulation program (*Miscellaneous*)	7.0	27	1.30	0.59	38
Prepare a brochure or newsletter using word processing software (*Word Processing*)	3.5	30.5T	2.19	1.18	20.5T
Create a web page (*Internet*)	3.5	30.5T	2.08	0.97	23T
Enter data into an existing database	3.5	30.5T	2.04	1.01	25
Create a new database (*Database*)	3.5	30.5T	1.66	0.89	32
Sort and/or query a database (*Database*)	3.5	30.5T	1.68	0.88	31
Create a database report (*Database*)	3.5	30.5T	1.57	0.83	33

Write a computer program (*Miscellaneous*)	3.5	30.5T	1.17	0.53	40
Create a spreadsheet macro (*Spreadsheet*)	1.8	37.5T	1.97	1.00	28
Create PivotTables (*Spreadsheet*)	1.8	37.5T	1.52	0.81	35
Prepare a brochure or newsletter using layout program (Adobe In-Design) (*Graphics*)	1.8	37.5T	1.85	0.99	29
Transfer files from a personal computer to a mainframe computer (or vice versa) using file transfer software (e.g. Telnet or Ftp SshClient) (*Miscellaneous*)	1.8	37.5T	1.71	0.97	30
Use a financial management program such as Quicken (*Miscellaneous*)	1.8	37.5T	1.39	0.72	37
Do database programming (*Database*)	0.0	40	1.49	0.76	36

[a]Means are based on a Likert-type scale where 1 = never, 2 = rarely, 3 = sometimes, 4 = very often, and 5 = always.

Students and faculty tended to agree on the relative extent to which the 40 ICT tasks were required in undergraduate agriculture courses. Although rank-orders differed slightly, both groups identified the same five ICT tasks (send email, receive email, search the Internet, submit assignments as email attachments, and use Blackboard© to acquire course information) as being the most frequently required. Likewise, there was agreement between students and faculty on 10 of the 13 least frequently required ICT tasks. The Spearman rank-order rho correlation coefficient indicated a large, positive relationship ($r = .83$) between faculty and student perceptions of the relative frequency with which these ICT tasks were required.

Future ICT Use

Both faculty and students were asked about future ICT use in undergraduate agriculture courses. Faculty were asked about their plans for changes in required student ICT use in seven ICT areas during the next two to three years; students were asked to recommend changes in the same seven areas of ICT use. For each group, the response options were “decrease use”, “maintain current level of use”, or “increase use”. Because of the small expected cell sizes, *Fisher’s exact test* was used to determine if faculty and students differed significantly ($p < .05$) in their plans (faculty) and recommendations (students) for future ICT course use. Since *Fisher’s exact test* calculates p directly, without reliance on the χ^2 distribution, only p values are reported for the tests of significance in Table 2 (Darlington & Carlson, 1987).

A majority of faculty and students responded with plans (faculty) or recommendations (students) to maintain the current level of course use in each ICT area. There were no significant differences between faculty plans and student recommendations for use of word processing, electronic mail, or spreadsheets. However, there were significant differences between faculty plans and student recommendations for use of the Internet, databases, computer graphics, and specialized applications. The percentage of faculty planning to increase Internet use (32.6%) was significantly higher than the percentage of students recommending increased use (17.2%). Conversely, the percentage of faculty planning to maintain the current level of required use of databases, computer graphics, and specialized applications was significantly higher than the percentage of students making this recommendation. For databases, this difference consisted of students recommending both decreased use (14.4%) and increased use (29.2%). For computer graphics and specialized applications the difference consisted of students wanting to decrease use, 10.3% and 12.0%, respectively.

Table 2

Faculty Plans and Student Recommendations for Changes in ICT Use in Undergraduate Agriculture Courses

	Faculty (n = 57)			Students (n = 235)			
ICT Area	Decrease (%)	Maintain (%)	Increase (%)	Decrease (%)	Maintain (%)	Increase (%)	*Fisher's exact p*
Word processing	0.0	77.6	22.4	0.9	85.0	14.2	.310
Electronic mail	0.0	82.0	18.0	1.7	81.6	16.7	.926
Internet	2.0	62.0	36.0	0.4	82.4	17.2	.002
Spreadsheets	4.1	63.3	32.6	11.6	56.5	31.9	.289
Databases	2.1	85.4	12.5	14.2	56.6	29.2	<.0001
Computer graphics	0.0	70.8	29.2	10.3	57.5	32.2	.023
Specialized applications	0.0	75.0	25.0	12.0	60.5	27.5	.012

Student Perceptions of ICT Use

Students agreed that computer assignments were appropriate in undergraduate agriculture courses and moderately agreed that requiring student computer use should be a priority; however they were undecided if faculty made student computer use a priority or encouraged students to use computers (Table 3). Students agreed that the computer skills required in undergraduate agriculture courses would adequately prepare them for the workforce; however, they had only neutral to moderate agreement with the statement, "Agriculture courses well-prepare students in computer and information technology" (M = 4.52, SD = 1.36).

Students agreed they personally had the computer skills necessary for success in undergraduate agriculture courses. Interestingly, the item, "I have excellent computer skills," received a somewhat lower mean rating than the statement, "I have the computer skills necessary to be successful in agriculture courses," with means of 5.10 (SD = 1.42) and 5.75 (SD = 1.06), respectively. Students also rated their peers' computer skills (M = 4.53; SD = 1.14) lower than their own. Students moderately agreed that every agriculture student should own a laptop computer and complete a computer applications course early in their academic career.

Table 3

Student Perceptions of Factors Related to ICT Use in Undergraduate Agriculture Courses

Statement	n	M^a	SD
I have the computer skills necessary to be successful in agriculture courses.	235	5.75	1.06
I believe the computer skills required in agriculture coursework will adequately prepare me for the workforce.	235	5.21	1.29
Agriculture students should complete a computer applications course early in their college career.	233	5.17	1.74

I have excellent computer skills.	234	5.10	1.42
I believe every agriculture student should own a laptop computer.	232	5.10	1.71
Most other students in my agriculture courses have excellent computer skills.	232	4.53	1.14
Agriculture courses prepare students well in computer and information technology.	233	4.52	1.36
My agriculture instructors make it a priority to include computer tasks in courses.	233	4.25	1.40
My agriculture instructors encourage me and other students to use personal computers in courses.	233	4.25	1.44
Requiring student computer use in agriculture courses should **not** be a priority.	232	3.13	1.74
Computer assignments are **not** appropriate in agriculture courses.	235	2.20	1.34

[a]Based on a scale where 1 = strongly disagree, 2 = disagree, 3 = moderately disagree, 4 = undecided, 5 = moderately agree, 6 = agree, and 7 = strongly agree.

Discussion, Conclusions, and Recommendations

This study assessed ICT skills – email, Internet, word processing, computer graphics, spreadsheets, and databases – required in undergraduate agriculture courses at a land-grant university. As reported by faculty, the typical undergraduate agriculture course required students to complete a mean of 8.46 (*SD* = 6.20) unique ICT tasks in fall 2009, with six specific tasks being required in 50% or more of all courses. These six ICT tasks were receive email, send email, search the Internet, submit course assignments as attached email files, use Blackboard© to acquire course information, and type a lab or project report. Less than one-half of courses required students to complete any tasks related to spreadsheets, computer graphics, miscellaneous use, or databases. By and large, students were not required to complete ICT tasks designed to extend class discussion and participation beyond the classroom, such as (a) use of course listserves, (b) discussion groups, or (c) wikis, blogs, and Facebook©. Undergraduate agriculture courses at this university tended to require limited student ICT use with most required tasks being drawn from a narrow range of fairly low-level ICT skills.

Students reported the most frequently required ICT skills were receive email, send email, use Blackboard© to acquire course information, search the Internet, and submit course assignments as electronic mail attachments. These five ICT tasks were also ranked as the top five skills by faculty.

The major finding of this study is that both faculty and students at this land-grant university agreed that intermediate and advanced ICT tasks were seldom required in undergraduate agriculture courses. This is especially noteworthy given the innovative educational uses of ICT in disciplines as diverse as agricultural communications (Leggette, Rutherford, Sudduth, & Murphrey, 2012), agricultural economics (Leonard & Patterson, 2004; Schurle, Stroade, & Grunewald, 2004), agricultural technology (Johnson, 2004), animal and poultry science (Bagley & Johnson, 2007; Kloepper, Zweiacher, Curtis, & Evert, 2010), horticulture (Rhoades et al., 2009), landscape architecture (Lee, 2009), and plant science (Maixner, Noyd, & Krueger, 2010). In addition to these discipline-specific examples of ICT use, opportunities exist for the educational use of technologies such as social media (Settle et al., 2011), podcasting (Lee & Chan, 2006), and simulations (Leggette et al., 2012). Yet, few agriculture faculty or undergraduate students in this land-grant university reported more than basic levels of ICT use.

By and large, faculty members planned to maintain their current levels of required ICT use in these courses during the next two to three years. Few faculty members planned to decrease use in any ICT area, while moderate increases were anticipated in each area. Thus, in the near future, required student use of ICT is likely to increase at a fairly slow rate. Opportunities for faculty development should be provided in areas of ICT interest where competencies and skills are lacking in an effort to increase adoption of course-relevant ICT tasks.

Less than half (47.4%) of students enrolled in agricultural courses during the spring of 2012 believed their ICT skills prepared them for the workforce. Additionally, only 51% of students believed that agriculture courses promoted professional ICT skills. Findings from this study support the need for University administrators and faculty to value and implement ICT skill development beyond the basics. If agriculture students are to gain the level of ICT proficiency desired by graduates (Shrestha, 2009) and employers (Graham, 2001), it seems reasonable that students must first learn these skills and then be required to practice their use in appropriate courses throughout their undergraduate careers (Kuth & Vesper, 2001).

According to the extended TAM (Venkatesh & Davis, 2000), the ICT tasks required in courses should, in large measure, be determined by faculty perceptions of the relevance (Job Relevancy) of these tasks. However, examination of the most commonly required tasks (as reported by faculty and students) indicated required ICT tasks primarily serve to facilitate course transactions (e.g. send and receive email, search the Internet, use Blackboard©) rather than to extend the course or enrich course content. Significantly, those technologies that extend the classroom in both time and space, such as listserves, threaded discussion groups, and Internet-based social networking, were among the least commonly required ICT tasks.

Nationally, institutions should ensure / enact policy regarding teacher and student competencies in ICT. ICT skills of importance and value should be integrated into course syllabi and instruction in an effort to create successful outcomes in teaching and learning that are content specific and can better prepare students for the workforce. Additionally, ICT tasks should be selected based on teaching and learning strategies appropriate for each course. Integration of ICT skills can be simple. In many courses students may already be completing assignments that can be logically connected to needed ICT skills.

While all instructors should be encouraged and assisted in integrating appropriate ICT requirements into their courses, required "ICT intensive" courses should be developed at either the department or college level. Assignments in these courses should be designed to require a variety of higher-level ICT tasks appropriate for the subject matter. The details of this or similar plans should be determined by the faculty, possibly through an ad hoc committee established for this purpose or by the college curriculum committee. If necessary, instructors should be trained on the importance of these skills in the workplace. Finally, agricultural employers should be surveyed to determine the specific ICT competencies potential employees should possess.

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Discussant Remarks

Students' Mobile Technology Behavioral Intentions: The Influence of Self-efficacy, Level of Self-directedness, and Grade Point Average

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Abstract

As mobile technology is saturating all sectors and generations in our society, we must pay attention to its effect on students and faculty across the U.S. The study was framed with self-efficacy theory, self-directed learning theory, and the unified theory for acceptance and use of technology. The purpose of this study was to assess undergraduate students' behavioral intention towards mobile technology acceptance. The population was undergraduate students (N = 687) in a department of agricultural education at a land-grant university. Random sampling was employed to assist the researchers in answering the study's objectives and to generalize findings to the target population. Survey research was employed as the data collection method and descriptive statistics, correlations, and multiple regression were implemented to analyze the data. Three hundred forty-four students were surveyed and 88.10% (n = 303) of the sample responded to the survey. Self-efficacy, level of self-directedness, and GPA explained 32% of the variance of students' behavioral intention to use mobile technology. The data suggested students are accepting the use of mobile technology in academic settings to enhance learning. Institutions may improve student learning and achieve strategic objectives through disseminating institutional information with mobile technology.

Introduction

Motiwalla (2007) identified mobile learning as the use of mobile technology to grant students the flexibility to access educational content regardless of time or location. The increasing use of mobile technologies to deliver educational content is changing the landscape of our educational system. Mobile technology has the ability to facilitate learners' learning process and create new and innovative learning opportunities (Jeng, Wu, Huang, Tan, & Yang, 2010). Students in this traditional age group arrive at universities with an abundance of experience with mobile technology. Smartphones are a mobile technology tool that is pervasive among college students and is showing a continuous increase in saturation (McContha, Praul, & Lynch, 2008). There is a difference in technology acceptance in the classroom between students who are required to use mobile devices and those who use the devices on their own (Moran, Hawkes, & El Gayar, 2010). Perkins and Saltsman (2010) reported saturation of mobile devices among faculty and students is imperative for the implementation of mobile learning.

A better understanding of mobile technology is particularly important at the post-secondary level. Higher education institutions need to consider the extent to which mobile technologies offer the ability to enhance student learning and teaching practices (Dale & Pymm, 2009). Designing mobile technology into the curriculum has great potential for higher education as a whole to not only extend its reach but also serve its current students. Lowenthal (2010) suggested mobile technology offers universities benefits such as increasing enrollment and broadening the student population both demographically and geographically. The continued growth and development of mobile learning is dependent on student acceptance of this technology as a classroom tool. Student perceptions and adoptions processes should be considered when designing a mobile learning program (Park, Nam, & Cha, 2012).

Students have had positive viewpoints towards mobile technology. Koole, McQuilkin, and Ally (2010) found students placed great importance on mobile technology devices permitting them the freedom to use the instructional tools they preferred. Case studies indicated student confidence in the usefulness and acceptance of a mobile learning environment (Martín & Carro, 2009). Clough, Jones, McAndrew, and Scanlon (2008) found smartphone users exhibited excitement towards informal learning activities.

Researchers are grappling with the implications of mobile learning. The key issue has become not whether mobile technologies should be used in educational settings but how these technologies are employed (Wang, Shen, Novak, & Pan, 2009). Mobile devices enable perpetual learners unprecedented access to learning (Gu, Gu, & Laffey, 2010). The critical question remains how to best use mobile technology in teaching and learning (Koszalka & Ntloedibe-Kuswani, 2010). Elias (2011) found the challenge of using mobile technology will force educators to rethink their teaching approaches. The novelty of mobile technology requires new ideas in regards to planning for its implementation. Sølvberg and Rismark (2012) suggested that mobile technology calls for new paradigms about learning to capture the interrelatedness between times, places, topics, technologies, and student learning.

While there is a lack of current research on intentions toward mobile technology among undergraduate agricultural education students, studies examining mobile technology in extension have been conducted. LaBelle (2011) studied the potential of developing smartphone applications in order to disseminate extension information. Carter and Hightower (2009) recommended research is needed on the use of mobile technology in extension programs due to the potential of expanding extension programs around the globe.

Priority 2 of the *National Research Agenda* for the American Association of for Agricultural Education (Doerfert, 2011) recommended researchers "develop and validate systems-based models that will advance our understanding of information and technology diffusion and its practice" (p. 8). While agricultural education researchers have examined factors that influence student learning in online courses (Murphrey, Arnold, Foster, & Degenhart, 2012; Roberts & Dyer, 2005; Strong, Irby, Wynn, & McClure, 2012), a lack of literature related to agricultural education students' acceptance of mobile technology exists. This study was conducted to expand agricultural education literature regarding students' acceptance of mobile technology and to address recommendations from the *National Research Agenda.*

Theoretical Framework

The theories used to scaffold this study were Bandura's (1993) self-efficacy, Grow's (1991) self-directed learning, and Venkatesh, Morris, Davis, and Davis' (2003) unified theory of acceptance and use of technology. Bandura indicated self-efficacy was the degree an individual's convictions regarding their capacity to inspire control over their own echelon of performance and over events that shape their lives. Self-efficacy influences an individual's drive to participate in an area of interest (Tschannen-Moran & Hoy, 2001). People with low self-efficacy tend to avoid difficult tasks, seeing these tasks as threats, while people with high self-efficacy approach identical tasks as something to be mastered and to gain a sense of accomplishment (Bandura). Self-efficacy impacts the extent individuals reflect, develop judgments, motivate themselves, and work (Bandura, 1997).

Self-efficacy theory has been employed to frame agricultural education studies. Stripling and Roberts (2012) used self-efficacy as the framework in a study of Florida preservice agricultural education teachers' math ability. Self-efficacy framed a study on Oklahoma agricultural education teachers' use of interactive whiteboards (Bunch, Robinson, & Edwards, 2012). Strong and Harder (2011) utilized self-efficacy to frame a study with Florida Master Gardeners.

Grow (1991) developed the staged self-directed learning model (SSDL) to explain the extent learners progress through stages of self-direction. The fundamental concept of SSDL model is focused on students contrasting aptitudes to respond to teaching that requires self-direction. An instructor can assist or hamper a student's development regarding enhanced self-direction (Grow, 1991). The SSDL delineated methods for teachers to actively groom students to progress into a self-directed learner. Teachers should work to meet numerous responsibilities because students inherently are in different stages of self-direction (Grow, 1991).

SSDL uses four stages to explain a student's level of self-direction. S1 students are dependent on the teacher throughout the learning process and prefer a teacher that is an authority (Grow, 1991). Students in the S2 category are interested in the learning process and prefer an instructor that is a motivator. Students in the S3 category are involved in the learning process and prefer a teacher that is a facilitator. S4 students have reached the highest level of self-direction and prefer an instructor that is a delegator. The fundamental aspect of the SSDL is for students and teachers to be at equivalent stages in the model in order for self-directed learning to develop (Grow, 1991).

Agricultural education researchers have previously studied populations' level of self-directedness. The level of Mexican farmers' self-directedness studied during rural development workshops (Tuttle, Lee, Kohls, Hynes, & Lindner, 2004). Stafford, Boyd, and Lindner (2003) examined Texas 4-H members' levels of self-directed learning. Louisiana agriscience teachers' level of self-directedness was assessed during a professional development session (Kotrlik, Redmann, Harrison, & Handley, 2000).

Davis (1989) developed the technology acceptance model (TAM), from the theory of reasoned action, as an information systems model indicating individuals' acceptance and use of technology. Venkatesh et al. (2003) expanded on Davis' (1989) TAM and constructed the Unified Theory of Acceptance and Use of Technology (UTAUT). UTAUT explains individuals' behavioral intentions to use an information system and subsequent usage behavior through four key constructs: performance expectancy, effort expectancy, social influence, and facilitating conditions.

Venkatesh et al. (2003) reported performance expectancy is the degree an individual believes using an information system will help enhance job performance, and effort expectancy is the measure of ease associated with the use of an information system. Social influence is the extent to which the user perceives the importance of using the system from others, while facilitating conditions is the extent to which the user believes that the necessary infrastructure is in place to use an information system. UTAUT can explain as much as 70% of the variance in behavioral intention to use a system (Venkatesh et al., 2003).

Researchers have employed the UTAUT in a variety of studies. Murphrey, Rutherford, Doerfert, Edgar, and Edgar (2012) used the UTAUT to frame a study examining the technology acceptance of Second Life™, social networking, Twitter™, and content management systems with agricultural education students. Lowenthal (2010) utilized the UTAUT to investigate the behavioral intention of students to use mobile technology for learning. The UTAUT was the theory employed in a study finding that age and gender moderated the effects of student use of mobile technology (Wang, Wu, & Wang, 2009). Chiu and Wang (2008) studied students' acceptance of web-based learning and used the UTAUT as the skeleton of the study. Faculties' level of mobile technology acceptance has been examined with the UTAUT. Anderson, Schwager, and Kerns (2006) utilized the UTAUT to study College of Business faculties' acceptance of tablet PCs to assist in teaching courses.

The UTAUT can assist researchers in determining the extent of students' acceptance and usage of mobile technology in courses (Garfield, 2005). Further research is needed to develop an understanding of the extent UTAUT can explain student acceptance of mobile technology at educational institutions (Straub, 2009). Learner acceptance progresses at different rates with new technology (Stockwell, 2008). Researchers should continue to examine the role of participant acceptance and usage of technology in educational contexts (Venkatesh, 2006).

Purpose of Study

The purpose of this study was to assess undergraduate students' behavioral intention towards mobile technology acceptance in agricultural education courses at [university]. More specifically, the study sought to:

1. Describe students' level of performance expectancy, effort expectancy, and behavioral intentions with mobile technology;
2. Examine the relationship between level of self-directedness, self-efficacy and behavioral intention; and
3. Understand the effects of personal characteristics, level of self-directedness, and self-efficacy on behavioral intention towards mobile technology acceptance.

Methodology

The study used quantitative research to answer the research questions. Quantitative research is developed prior with standardized measurement and utilizes deductive reasoning to examine theories, numerical data, cause, and effect (Fraenkel, Wallen, & Hyun, 2012). The population of this study was (N = 687) undergraduate students enrolled in leadership oriented agricultural education courses at [university]. The independent variables in this study were gender, grade classification, grade point average, employment status, self-efficacy, level of self-directedness, performance expectancy, and effort expectancy. Behavioral intention to use mobile technology was the dependent variable in this study.

A combined 36 item instrument including a modified version of Tschannen-Moran and Hoy's (2001) Teacher Sense of Efficacy Scale, Richards' (2005) self-directed learning instrument, Venkatesh et al.'s (2003) UTAUT scale, and questions related to personal characteristics was used to collect data in order to answer the study's research objectives. Content validity of the combined instrument was assessed by distance learning researchers at [university]. The internal consistency of each construct was reliable (Cronbach, 1951), and judged acceptable to dispense in order to answer the study's research questions.

Tschannen-Moran and Hoy's (2001) Teacher Sense of Efficacy Scale was used to assess the self-efficacy aspect of students' usage of mobile technology. The Teacher Sense of Efficacy Scale was created using Bandura's (1993) self-efficacy theory (Tschannen-Moran & Hoy). The instrument used a nine-point summated scale for each item with anchors:1 = *nothing*, 3 = *very little*, 5 = *some influence*, 7 = *quite a bit*, and 9 = *a great deal* (Tschannen-Moran & Hoy). The self-efficacy construct was assessed *ex post facto* for internal consistency and a reliability coefficient of .95 for self-efficacy was produced in this study.

Richards (2005) developed a self-directed learning instrument aligned with Grow's (1991) Staged Self-Directed Learning Model to examine students' level of self-directedness. The self-directed learning instrument included 24 items and included anchors: 1 = *Strongly Disagree*, 2 = *Disagree*, 3 = *Agree*, and 4 = *Strongly Agree*. Richards' (2005) self-directed learning instrument produced a reliability coefficient of $\alpha = .94$ in this study.

The UTAUT scale was developed by Venkatesh et al. (2003) to assess the mobile technology preferences. Performance expectancy, effort expectancy, and behavioral intention were the UTAUT constructs examined in this study. Mobile technology preference was measured on a seven-point summated scale: 1 = *strongly disagree*, 2 = *moderately disagree*, 3 = *somewhat disagree*, 4 = *neutral (neither disagree nor agree)*, 5 = *somewhat agree*, 6 = *moderately agree*, and 7 = *strongly agree* (Venkatesh et al., 2003). Constructs of the UTAUT were calculated *ex post facto*. Performance expectancy earned a reliability coefficient of .92, effort expectancy = .91, and behavioral intention = .97 in this study.

Survey research was utilized to collect data from the sample. The researchers constructed a web-based questionnaire in Qualtrics™. The Tailored Design Method (Dillman, Smyth, & Christian, 2009) for constructing and distributing an electronic questionnaire was implemented for this study. A random sample ($n = 344$) of the population ($N = 687$) was implemented to address the study's objectives. The sample received an email notification and two days later received an email that included a link to the questionnaire in Qualtrics™. Two separate emails, both a week apart, were sent to non-respondents. Three hundred three ($n = 303$) participants responded yielding a response rate of 88.10%. According to Babbie (2010), researchers that achieve greater than an 85% response rate do not have to examine nonresponse error. The results can be generalized to undergraduate students in the [department] at [university].

The data was analyzed through the use of descriptive statistics, correlation coefficients, and multiple regression analysis. Descriptive statistics were utilized to analyze the level of students' self-efficacy, level of self-directedness, performance expectancy, effort expectancy, attitude toward using technology, and behavioral intention. Descriptive statistics allowed the researchers to describe the data in numerical form (Fraenkel et al., 2012).

Correlation coefficients were used to analyze the relationship between level of self-directedness, self-efficacy and behavioral intention. Fraenkel et al. (2012) suggested correlational research uses data to determine the degree of a relationship between two or more variables. Correlations signify the direction and magnitude of variable relationships between -1.00 and +1.00 (Davis, 1971).

Multiple regression analysis was used to understand the effects of personal characteristics, level of self-directedness, and self-efficacy on behavioral intention towards mobile technology acceptance. Fraenkel et al. (2012) indicated multiple regression assists researchers in determining a link among a criterion variable and two or more independent variables. $Y = a + b_1X_1 + b_2X_2 + b_3X_3$ is the illustration for a multiple regression model coefficient.

All participants were undergraduates (*N* = 303, 100%). Most of participants were male (*n* = 196, 65.10%), seniors (*n* = 195, 65.00 %), worked part-time (*n* = 146, 48.70%), and had a GPA (grade point average) between 2.99 and 2.50 (*n* = 121, 40.30%). Due to the study being conducted in a single department at [university], findings were limited in scope and not generalizable beyond the target population. However, the results do offer researchers and practitioners insights on factors that influenced agricultural education students' behavioral intention of accepting and using mobile technology.

Findings

The first objective of the study was to describe students' level of performance expectancy, effort expectancy, and behavioral intentions with mobile technology (see Table 1). Kurtosis and skewness of the data were not an outcome as the data was normally distributed. Therefore, the descriptive statistics of the UTAUT, self-efficacy, and level of self-directedness were presented versus data frequencies. Effort expectancy earned the highest score (*M* = 5.24, *SD* = 5.02) of the constructs in the UTAUT. Students' self-efficacy with mobile technology scored (*M* = 5.31, *SD* = 1.65), and the level of students' self-directedness earned (*M* = 2.33, *SD* = .42).

Table 1

Descriptive Statistics for the UTAUT (N =303)

Constructs	*N*	*M*	*SD*
Effort Expectancy	303	5.24	1.35
Performance Expectancy	303	5.06	1.37
Behavioral Intention	303	5.02	1.52

Note. Scale: 7 = *Strongly Agree* , 6 = *Moderately Agree*, 5 = *Somewhat Agree*, 4 = *Neutral (Neither Agree or Disagree)*, 3 = *Somewhat Disagree* , 2 = *Moderately Disagree*, 1 = *Strongly Disagree*.

The second objective of the study was to examine the relationship between students' personal characteristics, the level of self-efficacy, level of self-directedness, and behavioral intention (see Table 2). Self-efficacy had a Moderate ($.50 \geq r \geq .69$) correlation to behavioral intention ($r = .58$). Level of self-directedness ($r = .33$) had a Low ($.30 \geq r \geq .49$) correlation to behavioral intention. Though Negligible ($.10 \geq r \geq .29$), GPA was the only personal characteristic that had a significant correlation ($r = .28$) to behavioral intention.

Table 2

The Relationship between Self-Efficacy, Level of Self-directedness, GPA, and Behavioral Intention

	Behavioral Intention		
Constructs	*N*	*r*	*p*
Self-Efficacy	301	.58	.00*
Level of Self-directedness	296	.33	.02*
GPA	299	.28	.03*

Note. Magnitude: $.01 \geq r \geq .09$ = Negligible, $.10 \geq r \geq .29$ = Low, $.30 \geq r \geq .49$ = Moderate, $.50 \geq r \geq .69$ = Substantial, $r \geq .70$ = Very Strong (Davis, 1971).

*$p < .05$.

The third objective of the study was to understand the level of self-directedness, effects of self-efficacy, and personal characteristics on behavioral intention towards mobile technology acceptance. The regression model was significant and indicated a good fit, with $F = 5.48$, $p < .05$. GPA, self-efficacy, and level of self-directedness were significant $p < .05$ on behavioral intention. GPA was the sole personal characteristic that was significant on behavioral intention.

As self-efficacy increased one unit, behavioral intention increased .29 (see Table 3). As level of self-directedness increased one unit, behavioral intention increased .22. As GPA increased one unit, behavioral intention increased .11. The regression model for this study was illustrated as: behavioral intention = .24 + .29 self-efficacy + .22 level of self-directedness + .11 GPA. Overall, the model accounted for a (32%) variance in undergraduate agricultural education students' behavioral intention to accept and use mobile technology.

Table 3

Summary of Multiple Regression Analysis of Self-Efficacy, Level of Self-directedness, GPA and Behavioral Intention (N = 296)

	B	*SE B*	*p*
Intercept	.24	.28	
Self-Efficacy	.29	.05	.00
Level of Self-directedness	.22	.09	.01
GPA	.11	.17	.04

Note. $R^2 = .33$; *Adjusted* $R^2 = .32$

Conclusions

The findings of this study are limited to the population of undergraduate agricultural education students at [university] but could be used to inform undergraduate students in various and other curricula. The use of mobile technology could change the way students approached learning. Undergraduate agricultural education students agreed they would use mobile technology and the tool would contribute to their learning. It is understandable to observe GPA having a significant correlation to behavioral intention as grades have driven intention for undergraduate students more so than graduate students in numerous studies.

While the data suggested students with high self-efficacy and self-directedness are more likely to use mobile technology to learn, students with less self-efficacy and lower levels of self-directedness are less likely to use mobile technology to learn. If mobile technology has any effect on learning for students with less self-efficacy and lower levels of self-directedness, is still unknown. This group of students may have had less self-efficacy and lower levels of self-directedness regardless of whether or not mobile technology is present in the learning process and design of the course.

Implications

The results of the study build upon our knowledge base of Bandura's (1993) self-efficacy, Grow's (1991) self-directed learning, and Venkatesh et al.'s (2003) UTAUT. Self-efficacy and self-directedness were significantly correlated with behavioral intention. Results indicated the combined theories, Bandura (1993), Grow (1991), and Venkatesh et al. (2003), accounted for variance in students' behavioral intention towards mobile technology acceptance.

Highly efficacious individuals are likely to confront new tasks (Bandura, 1993). Students with high self-efficacy may see mobile technology as engaging in a new task, therefore supporting their higher levels of behavioral intention. Moreover, they may assume the use of a technology tool where there is extreme comfort as non-threatening and therefore making the task much easier to accomplish. Bandura found individuals with low self-efficacy are likely to avoid endeavors perceived as difficult. Students with lower self-efficacy scores could perceive mobile technology as a difficult endeavor or just not worth the effort, therefore accounting for a lower level of behavioral intention towards acceptance of the technology.

Grow (1991) found students prefer specific types of instruction depending on their level of self-directedness. Students at a higher stage of self-directedness may view mobile technology as a good instructional complement explaining their higher levels of behavioral intention to accept the technology. Students with high levels of self-directedness are also much more apt to adopt new strategies than students with lower self-directedness. Students with lower levels of self-directedness (Grow) could also identify mobile technology as a poor instructional fit explaining their lower levels of behavioral intention to accept the technology.

The greater the behavioral intention the more likely an individual will accept an information system (Venkatesh et al., 2003). Behavioral intention in accepting mobile technology was dependent on the student's level of self-efficacy and self-directedness. Venkatesh et al. (2003) found that the UTAUT could explain as much as 70% of an individual's acceptance of mobile technology. The researchers' regression model explained 32% of the variance in the behavioral intention construct towards mobile technology acceptance.

Recommendations

Agricultural education faculty need to take into account students' self-efficacy, level of self-directedness, and GPA when using mobile technology as an instructional tool. While this research was limited to Agricultural education faculty, it is assumed other Social Science faculty conducting this research would find similar results. Instructors can work to increase students' efficacy and self-directedness therefore increasing behavioral intention towards mobile learning acceptance. The inclusion of mobile technology in courses is critical for faculty and students to partake in mobile learning opportunities (Perkins & Saltsman, 2010). Courses with assignments that include student presentations and group projects can motivate students to submit their assignment on a Tablet PC or smartphone device. Jeng et al. (2010) indicated mobile technology can construct innovative learning experiences. Granting students the ability to submit assignments on a mobile technology device may not only improve students' efficacy and self-directedness with mobile technology and produce much more robust results, but also provide the instructor more time in class to expand teaching opportunities by saving time allotted for student and group presentations in class. Student's familiarity with the technology tool can also enhance the learning experience as they investigate various ways to present the material. Instructors can also increase students' efficacy and self-directedness with mobile technology by permitting students to present their assignments in class on mobile technology versus PowerPoint slides. The acceptance and usage of mobile technology is ubiquitous among college students (Park et al., 2012).

Mobile technology acceptance and usage of faculty in Colleges of Agriculture and Life Sciences and potentially other Social Science faculties should be examined. Researchers cannot make the assumption that mobile technology may be omnipresent within Colleges of Agriculture and Life Sciences faculty, and that faculty have the behavioral intention to use mobile technology as a tool to teach students content from a respective course. Faculty in agricultural education and other Social Science departments' acceptance and use of mobile technology should be studied also to expand the literature and knowledge base of agricultural education as an academic discipline. Developing an understanding of techniques that may enhance our knowledge of the diffusion and practice of technology will assist our academic discipline to move forward (Doerfert, 2011). The information may benefit instructors to be more proficient in teaching with instructional delivery devices (Gu et al., 2010) that parallel student's lives anytime, anyplace (Elias, 2011).

Instructors should examine the levels of self-efficacy and level of self-directedness of students before introducing mobile learning. It would be of great interest to replicate this study with graduate students as self-directedness and self-efficacy is more prevalent in that age range of students and other Social Science departments. Understanding the role self-directedness (Grow, 1991) and self-efficacy (Bandura, 1993) plays in students' decision to adopt mobile technology should assist instructors in their decision to implement mobile technology, regardless of academic discipline. This study should be replicated with two groups, one using mobile technology and one not to see if there was any difference. The data may assist university administrators, researchers, and instructors in developing an understanding of the extent mobile technology can enhance student learning (Dale & Pymm, 2009) and help institutions broaden enrollment and expand their reach and scope (Lowenthal, 2010).

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Discussant Remarks:

The Effects of GPA and Gender on Students' Acceptance of Mobile Learning in a Critical Issues in Agricultural Leadership Course

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Abstract

To meet the demands of a technology-driven society, higher education adopted innovative teaching strategies and devices to influence student learning. Agricultural leadership educators have studied technology use, preferences, and level of acceptance from instructor and student perspectives. This quantitative study investigated the effects of personal characteristics on students' likely acceptance of mobile learning. Students (n=84) enrolled in a critical issues in agricultural leadership course at Texas A&M University completed a 28 item questionnaire to assess their level of performance expectancy, effort expectancy, behavioral intention, and self-efficacy toward mobile learning. A majority of students agreed mobile learning would be easy to use, be used in the near future, contribute positively to their performance, and influence their learning in school. Significant differences were found between gender and GPA in regard to performance and effort. Findings in this study indicate students are ready and accepting of mobile learning as a viable tool for learning; however agricultural leadership educators should be aware that successful technological incorporation includes feasibility and the alignment with course learning outcomes. Further research should include replication with a larger sample size, investigation of the impact of mobile learning in the classroom, and examination of the relationship between mobile learning use and leadership skills and competencies.

Introduction

Over the last several decades the number of technological advancements has grown exponentially. Individuals use technology to stay abreast with current events, communicate with others, and as forms of entertainment. Businesses rely on technology to conduct meetings, gain competitive advantages, and monitor their market shares. Students are no exception. Students are attached to digital cameras, cell phones, PDAs, video, mp3 players, and i-Devices. These tools are used to gather information, play games, shop, socially network, and learn (Hanson, Drumheller, Mallard, McKee, & Schlegel, 2011).

Higher education has quickly adopted innovative teaching strategies and technological devices to influence student learning (Laird & Kuh, 2005; Renes & Strange, 2011; Sherer & Shea, 2011). The millennial generation, also known as the "connected" generation, presents educators with new challenges of engagement and high impact learning. To meet the changes in students' technological savvy, educators developed distance learning programs, redesigning the educational environment. With the advent of eLearning, whole degree programs are offered online. More recently, colleges and universities rely on social media, the use of applications, and creating practical simulations in Second Life (Allen, Abrams, Meyers, & Shultz, 2010; Leggette, Rutherford, Sudduth, & Murphrey, 2012).

In agricultural and leadership education, several scholars have researched technological use, perceptions, and efficacy from instructor and student perspectives. The future use of technology in the agricultural classroom was perceived favorably from the instructor's perspective (Alston, Miller, & Williams, 2003). Rhoades, Friedel, and Irani (2008) surveyed undergraduate students concerning their use of technology in and out of the classroom and their preferences for increased use in podcasts, ePortfolios, RSS (Rich Site Summary) feeds, iPods or mp3 players, and blogs. A recent study assessed students' varying acceptance of Second Life, Twitter, and content management systems (Murphrey, Rutherford, Doerfert, Edgar, & Edgar, 2012). A majority of students using tablet computers in agriculture and biology courses reported positive impacts on their learning environments (Shuler, Hutchins, & LaShell, 2010).

Using technology in the classroom also prepares students for the demands of their future careers. Boyd and Murphrey (2002) found computer-based simulations have the potential to increase student's learning of leadership concepts. Agricultural education undergrads indicated Web-enhanced courses taught them real-world skills in technology use, provided problem solving opportunities, and enabled collaborative online communication forums (Alston & English, 2007). Another study found a video production assignment "allowed [students] to learn both in a different way and also learn skills that could be used as a leader in the future" (Guthrie, 2009, p. 134). Thus, educators should remain cognizant of the career skills and abilities innovative teaching strategies and delivery tools provide for enhanced practical learning.

Leadership is a relational process between two or more members of a group working toward goal attainment (Bass, 1990). Leaders across all contexts adjust their leadership style to meet the needs of their followers, and style flexibility is a critical component of situational leadership, leader-member exchange, and transformational and transactional leadership. In organizations, leaders use a variety of facilitation strategies, support and training, and technology incorporation methods to meet the needs of organizational members. A few studies have empirically researched leadership and its effect on information technology acceptance and use. The five-factor model of personality, a trait approach to leadership, was found to be a useful predictor of users' attitudes and beliefs toward technology (Devaraj, Easley, Crant, 2008). Schepers, Wetzels, and Ruyter (2005) found that the transformational leadership style positively influences followers' perceived usefulness of technology. Charismatic leadership was also found to positively influence follower performance expectancy and effort expectancy scores related to technology (Neufeld, Dong, & Higgins, 2007).

Despite the number of studies of instructional strategies and device acceptance, little research exists in the literature investigating mobile learning in agricultural leadership education. Mobile learning is the use of mobile technology, in the form of a smartphone or tablet device, to allow learners the ability to access educational context at any time or place (Peng, Su, Chou, & Tsai, 2009). Mobile learning can engage students in the classroom to work with one another and collect and evaluate information instantly. Mobile technologies can create more collaborative learning environments (Alexander, 2004).

The *National Research Agenda* for the American Association for Agriculture Education (Doerfert, 2011) called for continued research on meaningful, engaged learning in all environments, preparing students to "meet the challenges required of the complex environments in the 21st century" (p. 21). As leaders in the classroom, agricultural leadership educators should investigate innovative means to engage students and create impactful learning experiences.

Mobile learning may be a means to create more significant learning experiences. This study served to investigate students' likely acceptance of mobile learning as a viable educational mode in an agricultural leadership education course.

Theoretical Framework

The theoretical framework for this study was based on technology acceptance and self-efficacy. Davis (1989) developed the theory of reasoned action to explain individual's acceptance and use of technology. Venkatesh, Morris, Davis, and Davis (2003) constructed the Unified Theory of Acceptance and Use of Technology (UTAUT) to expand the theory of reasoned action by delineating individual's behavioral intention to use technology. The four factors of the UTAUT are performance expectancy, effort expectancy, social influence, and facilitating conditions. The social influence and facilitating conditions factors embody behavioral intention.

Performance expectancy is the extent an individual believes using technology will improve their likelihood to accomplish an objective (Venkatesh et al., 2003). The level of ease associated with the use of technology is the effort expectancy factor. Social influence is the degree an individual perceives the value of using a specific piece of technology over another. Venkatesh et al. (2003) indicated facilitating conditions is the degree an individual believes the infrastructure exists to use the technology.

Venkatesh et al.'s (2003) UTAUT has been used to frame numerous studies associated with students' acceptance and usage of technology. The UTAUT was utilized as the theoretical framework for Lin and Anol's (2008) study of students' acceptance and use of instant messaging to deliver course content. Shin, Shin, Choo, and Beom (2011) employed the UTAUT as the framework in their study with students' acceptance of smartphones as learning devices. The UTAUT was incorporated to study the adoption of technology for informal learning environments (Straub, 2009). A few studies using the UTAUT investigated the influence of demographic variables such as gender, age, and prior technology experiences. Marchewka, Liu, and Kostiwa (2007) implemented the UTAUT to support a study of college students' acceptance and usage of course management software. The study found that age and gender did not have a significant effect on Blackboard usage. Pardamean and Susanto (2012) framed their study on mathematics students' acceptance of blog technology with the UTAUT. The researchers found no significant differences between males and females or the level of experience for blogging acceptance. Murphrey et al. (2012) used the UTAUT to frame their study of students' acceptance of Second Life, Twitter, and content management systems. The study found female students accepted the technologies more than males.

Self-efficacy theory was developed by Bandura (1977) to explain an individual's perceived capacity to reach a specific outcome. Self-efficacy is derived from four types of experiences: performance accomplishments or personal mastery; vicarious experience or observation of other's mastery; verbal persuasion through other's positive feedback; and emotional arousal or how one feels. Bandura found that individuals with developmental experiences increase the likelihood of higher self-efficacy and will encourage themselves to seek out challenging objectives. Individuals with low self-efficacy tend to avoid perceived difficult endeavors. Self efficacy is a predictor of individual's potential to seek out and accomplish internal or external responsibilities. Tschannen-Moran and Woolfolk Hoy (2001) suggested studying individual's self-efficacy is a simple line of inquiry but powerful in terms of how data may be used to assist in improving current and future teaching strategies.

Diverse leadership researchers have incorporated self-efficacy as the theory to scaffold studies. Increased self-efficacy can enhance students' transformational leadership skills (Fitzgerald & Schutte, 2010). McCormick (2001) used self-efficacy to frame a study focusing on effective leadership traits. Self-efficacy was implemented as the theoretical framework in a study of students' emotional intelligence (Villanueva & Sánchez, 2007). Walumbwa, Mayer, Wang, Wang, and Workman (2011) implemented self-efficacy theory to examine the role between ethical leadership and employee performance. Self-efficacy was identified as a factor in follower's leadership effectiveness (van Knippenberg, van Knippenberg, De Cremer, & Hogg, 2004). Choi, Price, Vinokur (2003) studied the effect of self-efficacy's role in different leadership teams. The study investigated the participant characteristics and found no effects of age, gender, or race.

Purpose and Objectives

The purpose of this exploratory descriptive study was to examine the level of mobile learning acceptance of undergraduate students enrolled in a critical issues in agricultural leadership course in the Agricultural Leadership, Education, and Communications department at Texas A&M University. More specifically, the study addressed the following objectives:

1. Describe agricultural leadership students' level of performance expectancy, effort expectancy, behavioral intention, and self-efficacy focused on mobile learning; and

2. Determine relationships between performance expectancy, effort expectancy, behavioral intention, and self-efficacy based on student characteristics (gender, grade classification, GPA, and employment status).

Methodology

Survey research was the approach for this study. The target population was all undergraduate students in the agricultural leadership degree program at Texas A&M University. The accessible population was students (*N* = 99) enrolled in a critical issues in agricultural leadership course at Texas A&M University. Although a census study, the course selection was used as a slice in time (Oliver & Hinkle, 1981) sampling of students due to the variability in participant demographics and representativeness of the target population. Fraenkel, Wallen, and Hyun (2012) suggested census studies enable researchers to eliminate potential sampling errors and to generalize findings to a target population.

The critical issues course is an introductory class for new students entering the agricultural leadership program at Texas A&M University. The purpose of the course is to help students identify personal goals and learning skills that promote academic and career success in college. Students also research the skills and competencies employers seek in new hires. They identify, name, and describe career settings for a degree in agricultural leadership; plan a course of study; and create developmental plans for fulfilling professional and personal goals.

This study implemented the UTAUT scale created by Venkatesh et al. (2003) to assess mobile learning acceptance. The UTAUT constructs examined in this study were performance expectancy, effort expectancy, and behavioral intention. Mobile learning acceptance was measured on the UTAUT's seven-point summated scale: 1 = *strongly disagree*, 2 = *moderately disagree*, 3 = *somewhat disagree*, 4 = *neutral (neither disagree nor agree)*, 5 = *somewhat agree*, 6 = *moderately agree*, and 7 = *strongly agree*.

A modified version of the Teacher Sense of Efficacy Scale (TSES) developed by Tschannen-Moran and Woolfolk Hoy's (2001) was used to assess students' self-efficacy of mobile learning. Tschannen-Moran and Woolfolk Hoy developed the Teacher Sense of Efficacy Scale based upon Bandura's (1977) self-efficacy theory. The TSES utilized a nine-point summated scale for each item with anchors: 1 = *nothing*, 3 = *very little*, 5 = *some influence*, 7 = *quite a bit*, and 9 = *a great deal*. Participants' gender, grade classification, grade point average, and employment status were the personal characteristics examined by the researchers.

The researchers employed a 28 item combined instrument including the UTAUT scale, TSES, and questions related to participants' personal characteristics. Content validity of the combined instrument was assessed by a team of researchers from Texas A&M University. The reliability coefficients for each construct were calculated *ex post facto*. The internal consistency of the performance expectancy construct was $\alpha = .94$, effort expectancy $\alpha = .92$, behavioral intention $\alpha = .98$, and self-efficacy $\alpha = .95$. Each construct had acceptable reliability coefficients (Cronbach, 1951).

To address objective one of the study, descriptive statistics were implemented to describe agricultural leadership students' level of performance expectancy, effort expectancy, behavioral intention, and self-efficacy. Agresti and Finlay (2009) postulated that descriptive statistics uncover characteristics of dissimilar groups in order to measure their attitudes toward a distinctive factor. Descriptive statistics are techniques to arrange, summarize, calculate, and describe a dataset.

The second objective of the study was to determine if significant differences existed between performance expectancy, effort expectancy, behavioral intention, and self-efficacy based on student characteristics (gender, grade classification, GPA, and employment status). Agresti and Finlay (2009) indicated a *t*-test reveals whether the difference between two means is statistically significant. The researchers employed *t*-tests to determine if significant differences existed among gender and performance expectancy, effort expectancy, behavior intention, and self-efficacy. Differences between GPA and performance expectancy, effort expectancy, behavior intention, and self-efficacy were assessed with *t*-tests due to two dominant student GPA categories.

Eighty-four ($n = 84$) participants responded to the questionnaire resulting in an 84.48% response rate. The majority of respondents were male ($n = 53$, 63.10%), juniors ($n = 46$, 54.76%), worked part-time ($n = 46$, 55.4%), and had a GPA between 2.99 and 2.50 ($n = 33$, 39.80%). The limitations of this study are the population as they were students enrolled in a single course in the Agricultural Leadership, Education, and Communications department at Texas A&M University. However, the results do offer agricultural leadership education academics insight on factors that affect students' acceptance and use of mobile learning.

Findings

The data is presented as means and standard deviations as the data was normally distributed indicating kurtosis and skewness were not apparent in the dataset. The first objective of the study was to describe agricultural leadership students' level of performance expectancy, effort expectancy, behavioral intention, and self-efficacy. The item earning the highest mean for the performance expectancy construct was "Using mobile learning enables me to accomplish tasks more quickly" (*M* = 5.40, *SD* = 1.67). "If I use mobile learning, I will increase my chances of getting a good grade" (*M* = 4.81, *SD* = 1.60) earned the lowest performance expectancy score (see Table 1).

Table 1

Descriptive Statistics for the Performance Expectancy Construct (N = 84)

Items	*N*	*M*	*SD*
Using mobile learning enables me to accomplish tasks more quickly.	84	5.40	1.67
I would find mobile learning useful in school.	84	5.26	1.75
Using mobile learning increases my productivity.	84	5.01	1.57
If I use mobile learning, I will increase my chances of getting a good grade.	84	4.81	1.60

Note. Overall: *M* = 5.13, *SD* = 1.50. Scale: 7 = *strongly agree*, 6 = *moderately agree*, 5 = *somewhat agree*, 4 = *neutral*, 3 = *somewhat disagree*, 2 = *moderately disagree*, 1 = *strongly disagree*.

Table 2 illustrates the descriptive statistics for the effort expectancy construct of the UTAUT. The highest means occurred for the items "It would be easy for me to become skillful at using mobile learning" (*M* = 5.26, *SD* = 1.52) and "Learning to operate mobile learning is easy for me" (*M* = 5.21, *SD* = 1.64). The lowest mean was associated with the item "My interaction with mobile learning would be clear and understandable" (*M* = 4.95, *SD* = 1.64).

Table 2

Descriptive Statistics for the Effort Expectancy Construct (N = 84)

Items	*N*	*M*	*SD*
It would be easy for me to become skillful at using mobile learning.	84	5.26	1.52
Learning to operate mobile learning is easy for me.	84	5.21	1.64
I would find mobile learning easy to use.	84	5.08	1.68
My interaction with mobile learning would be clear and understandable.	84	4.95	1.64

Note. Overall: *M* = 5.12, *SD* = 1.47. Scale: 7 = *strongly agree*, 6 = *moderately agree*, 5 = *somewhat agree*, 4 = *neutral*, 3 = *somewhat disagree*, 2 = *moderately disagree*, 1 = *strongly disagree*.

Table 3 illustrates the descriptive statistics for the behavioral intention construct of the UTAUT. The item earning the highest score was "I predict I will use mobile learning in the next 12 months" (*M* = 5.24, *SD* = 1.63). "I intend to use mobile learning in the next 12 months" earned the lowest score (*M* = 4.99, *SD* = 1.63) in the behavioral intention construct.

Table 3

Descriptive Statistics for the Behavioral Intention Construct (N = 84)

Items	*N*	*M*	*SD*
I predict I will use mobile learning in the next 12 months	84	5.24	1.63
I plan to use mobile learning in the next 12 months.	84	5.11	1.56
I intend to use mobile learning in the next 12 months.	84	4.99	1.63

Note. Overall: *M* = 5.10, *SD* = 1.55. Scale: 7 = *strongly agree*, 6 = *moderately agree*, 5 = *somewhat agree*, 4 = *neutral*, 3 = *somewhat disagree*, 2 = *moderately disagree*, 1 = *strongly disagree*.

Describing students' level of self-efficacy was a part of the first objective (see Table 4). The two items earning the highest scores were "How much does mobile learning help you to follow course objectives?" (*M* = 5.96, *SD* = 2.10) and "How much can you do with mobile learning to learn effectively?" (*M* = 5.90, *SD* = 1.67). "How much does mobile learning help you value learning?" (*M* = 4.87, *SD* = 1.85) earned the lowest score within the self-efficacy construct.

Table 4

Descriptive Statistics for the Self-efficacy Construct (N = 84)

Items	*N*	*M*	*SD*
How much does mobile learning help you to follow course objectives?	84	5.96	2.10
How much can you do with mobile learning to learn effectively?	84	5.90	1.67
How much does mobile learning help you assist your peers with educational content?	84	5.43	2.16
How much does mobile learning help you focus on educational content?	84	5.40	2.10
How much does mobile learning help you use evaluation strategies?	84	5.33	1.90
Does mobile learning help you evaluate your own learning?	84	5.26	2.10
How much does mobile learning motivate you to learn educational content?	84	5.07	1.83
How much does mobile learning get you to believe you can do well in school?	84	4.93	1.76
How much does mobile learning help you value learning?	84	4.87	1.85

Note. Overall: *M* = 5.35, *SD* = 1.65. Scale: 9 = *a great deal*, 7 = *quite a bit*, 5 = *some influence*, 3 = *very little*, 1 = *nothing*.

The second objective of the study was to determine if significant differences existed between personal characteristics and performance expectancy, effort expectancy, and self-efficacy. There was a significant difference in gender, F (1, 81) = 6.84, $p < .05$ and effort expectancy (see Table

5). The effect size was medium ($\eta^2 = .30$). Tukey's post hoc analysis was conducted to determine if differences existed in gender. There was a significant difference ($p < .05$) between females ($M = 5.71$, $SD = 1.15$) and males ($M = 4.85$, $SD = 1.54$).

There was a significant difference in gender, $F(1, 81) = 4.30$, $p < .05$ and performance expectancy. The effect size was small ($\eta^2 = .24$). Tukey's post hoc analysis was performed to determine if differences emerged in gender. There was a significant difference ($p < .05$) between females ($M = 5.61$, $SD = 1.27$) and males ($M = 4.90$, $SD = 1.57$).

There was a significant difference in gender, $F(1, 81) = 3.99$, $p < .05$ and self-efficacy. The effect size was small ($\eta^2 = .23$). Tukey's post hoc analysis was implemented to determine if differences occurred in gender. There was a significant difference ($p < .05$) between females ($M = 5.85$, $SD = 1.56$) and males ($M = 5.10$, $SD = 1.66$).

Table 5

Results for t-tests with Effort Expectancy, Self-efficacy, Performance Expectancy and Gender (N = 83)

Constructs	*N*	*M*	*SD*	*F*	*p*	Effect Size
Effort expectancy						
Females	30	5.71	1.15	6.84*	.01	.30
Males	53	4.85	1.54			
Performance expectancy						
Females	30	5.61	1.27	4.30*	.04	.24
Males	53	4.90	1.57			
Self-efficacy						
Females	30	5.85	1.56	3.99*	.04	.23
Male	53	5.10	1.66			

Note: *$p < .05$.

There was a significant difference in GPA, $F(1, 69) = 3.89$, $p < .05$ and performance expectancy (see Table 6). The effect size was negligible ($\eta^2 = .17$). Tukey's post hoc analysis was employed to determine if differences existed in GPA. There was a significant difference ($p < .05$) between students with GPAs from 3.49 to 3.00 ($M = 5.53$, $SD = .62$) and students with GPAs from 2.99 to 2.50 ($M = 4.91$, $SD = 1.32$).

There was a significant difference in GPA, $F(1, 69) = 3.64$, $p < .05$ and effort expectancy. The effect size was negligible ($\eta^2 = .14$). Tukey's post hoc analysis was conducted to determine if differences existed in GPA. There was a significant difference ($p < .05$) between students with GPAs from 3.49 to 3.00 ($M = 5.59$, $SD = .86$) and students with GPAs from 2.99 to 2.50 ($M = 4.73$, $SD = 1.32$).

Table 6

Results for t-tests with Performance Expectancy, Effort Expectancy, and GPA (N = 71)

Constructs	*N*	*M*	*SD*	*F*	*p*	Effect Size
Performance expectancy						
3.49 to 3.00	32	5.53	.62	3.89*	.03	.17
2.99 to 2.50	39	4.91	1.39			
Effort expectancy						
3.49 to 3.00	32	5.59	.86	3.64*	.04	.14
2.99 to 2.50	39	4.73	1.32			

Note: $*p < .05$.

Conclusions

This study examined undergraduate agricultural leadership students' perspectives of mobile learning. For the construct of performance expectancy, a majority of students agreed that mobile learning would contribute positively to their performance. A majority of students studying critical issues in agriculture agreed that mobile learning is at a level that would be easy to use. The construct of behavioral intention indicates whether or not students intended to use mobile learning in the near future, and students agreed they intended to use mobile learning soon. A majority of students believed mobile learning could influence their learning in school.

Females had higher levels of agreement with mobile learning and believed mobile learning would contribute positively to their performance, would be easy to use, and believed that mobile learning could positively influence their learning. Students earning higher GPAs believed mobile learning would enhance their performance and be easier to use in courses as compared to students' perceptions with lower GPAs. While the limitations of this study are the dataset and population from a single course, the results do offer insight on factors that influence the mobile learning perceptions and beliefs of students studying critical issues in agriculture.

Implications

The framework for this study was Venkatesh et al.'s (2003) Unified Theory of Acceptance and Use of Technology (UTAUT) and Bandura's (1977) self-efficacy theory. The UTAUT attempts to explain the factors involved in an individual's behavioral intention to use technology. Findings from this study indicated that students in a critical issues in agricultural leadership course were willing and able to utilize mobile learning in an educational context. Students indicated mobile learning could positively influence their performance. Mobile learning allows students to access content for educational purposes at any point in time or place (Peng et. al, 2009). With the immediate accessibility of information through a mobile device, students can quickly access pertinent information to support in-class learning resulting in improved classroom participation and productivity. Agricultural leadership students also believed mobile learning is easy to use, and stated their intention to use mobile learning soon. Students believed they could develop mobile learning skills and learning to use mobile learning is straightforward.

Self-efficacy theory posits an individual with high self-efficacy will view difficult tasks as something to accomplish rather than avoid (Bandura, 1977). In this study, agricultural leadership students suggested mobile learning could influence their learning. Students with high mobile learning self-efficacy believed mobile learning could be used to accomplish more complex tasks in the classroom. Likewise, students believed the use of mobile learning could motivate them to learn effectively, assist them in learning leadership concepts, and help them teach their peers about leadership. The results of this study infer the majority of agricultural leadership students in a critical issues course would persevere and engage in mobile learning successfully.

When it comes to smartphones and tablet devices, students are knowledgeable and their use is becoming a norm in this day and age (Hanson et. al, 2011). Students witness their peers, family, and faculty using mobile technology in their everyday lives and for various purposes. Self-efficacy is determined not only by personal competence but through critical evaluation from other credible sources, individuals' emotional reactions to a task, and direct observation of task completion (Bandura, 1977). Thus, before implementation, agricultural leadership educators should consider student's accessibility to mobile learning devices and their emotional responses when using such technology. Educators should also evaluate their personal mastery and their ability to model mobile learning effectively.

Recommendations

This study expands our understanding of the relationships between students' acceptance of mobile learning and their personal characteristics. Agricultural leadership students indicated their acceptance and readiness for mobile learning use. This supports research that indicated agricultural students' preference for increased use of technology (Rhoades et. al, 2008). Practitioners should consider incorporating mobile learning in the classroom but be aware that successful technological incorporation includes feasibility and the alignment with course learning outcomes. Although viewed favorably, Alston et al. (2003) stated that agricultural educators found cost of technology as a potential barrier to the future use of instructional technology. The potential barriers to mobile learning implementation should be evaluated within agricultural leadership programs, respectively. Furthermore, agricultural leadership educators should be aware that differences exist among gender and use of mobile learning. Differences also exist between GPA and mobile learning acceptance. Consideration should be given to the purposeful design of course content using mobile learning for diverse audiences.

Despite potential barriers, agricultural leadership educators should provide higher level learning outcomes to challenge students in their thinking. Mobile learning may be a way to enhance this learning. The use of tablet devices and smartphones can create positive learning environments giving students the opportunity to increase interactions with their classmates and the instructor to collaboratively solve complex problems (Shuler et. al, 2010). Priority 4 of the *National Research Agenda* informs agricultural leadership practitioners to create opportunities that increase career preparedness through high impact learning outcomes (Doerfert, 2011). Several studies aforementioned indicated the importance of leadership development through the use of innovative teaching strategies (Alston & English, 2007; Boyd & Murphrey, 2002; Guthrie, 2009). Instructional delivery methods in agricultural leadership courses impact a student's learning environment and their capacity to develop leadership proficiency. The use of mobile learning in the classroom could be a potential teaching approach in agricultural leadership education preparing students for personal and occupational success.

Given the limitations of the research design, the study should be replicated with a larger sample of agricultural leadership students. Replication with a randomized sample of students can provide additional insights and allow the researcher to generalize to the target population

(Fraenkel et al., 2012). While significant differences were found among the variables of gender and GPA, more research should look into why these differences exist. Further research should also be conducted to empirically investigate the impact of mobile learning in the classroom environment and evaluate the readiness and acceptance of mobile learning from the practitioner's perspective. Additionally, attention should be directed to research the relationship between mobile learning use and leadership skills and competencies. Leadership is an applied discipline (Bass, 1990). Students learn from the ability to directly transfer classroom knowledge to leadership experiences. Mobile learning could be one method agricultural leadership educators use in connecting students to different contexts of leadership and aid in bringing in examples from outside the classroom.

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Discussant Remarks

An Evaluation of Usability of a Virtual Environment for Students Enrolled in a College of Agriculture

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Abstract

Applications of educational technology are continuing to expand and multi-user virtual environments (e.g., Second Life™) are the latest technology. Understanding the usability of virtual environments can enhance educational planning and effective use. Usability relates to the quality of the interaction between an individual and the item being assessed. The purpose of this study was to assess the usability of "AgriCulture Island" in Second Life™ in order to identify issues agricultural students could encounter and thus enhance the understanding of the severity of those issues and how those issues could be addressed. This study's conceptual framework allowed the identification of constructs that further defined and clarified usability as it related to assessing a virtual environment. Mixed methods including pre/post questionnaires, observations, and a focus group were utilized to document and describe usability. The study engaged 12 participants during summer 2012 from a College of Agriculture. Findings revealed that participants were more accepting of Second Life™ after exposure and all participants indicated that the experience felt "real" and they could sense other people in the environment. Observation data provided a robust picture of the interaction of participants with the virtual environment. Elements including assistance needs, satisfaction, confusion, and deviation from task were documented. The importance of understanding the usability of educational technology cannot be underestimated. This study adds to the body of literature related to educational technology and provides research-substantiated recommendations for use.

Introduction & Conceptual Framework

The potential for the use of technology to facilitate learning is continuing to expand due in part to increased interest in online learning. Born and Miller (1999) reported that while perceptions of online degree programs varied, faculty were supportive of the development of increased numbers of online courses. Specific to this discipline, Roberts and Dyer (2010) reported that more than two-thirds of agricultural education departments provided courses via distance education. Leggette, Witt, et al. (2012) reported that the use of Second Life™ (a multi-user virtual environment) was able to encourage experiential learning in both resident and distance learners. These studies illustrate continued efforts towards the profession's National Research Agenda priority of creating "meaningful learning environments" (Doerfert, 2011, p. 9).

Narrowing this research priority to online learning environments, it has been documented that students receive several benefits from taking courses online, including developing and refining computer skills and evaluating Internet resources (Alston & English, 2007). "[F]eedback and immediacy, communication and interaction, and social presence" have been identified as elements preferred by students participating in online courses (Murphrey, Arnold, Foster, & Degenhart, 2012, p. 24). As such, distance education can benefit from the use of technologies such as Second Life™ (SL) to reduce the disconnect felt by students in online classes by bringing the classroom wherever they are (Ritzema & Harris, 2008). "The promise of SL in education revolves around community, and the connecting of individuals through a new, avatar-driven interface…offer[ing] an immediacy of experience and companionship" (Yee & Hargis, 2010, p. 205).

Virtual Environments – Second Life™

The use of a virtual environment enables an instructor to be "…able to offer a completely in-world learning experience and attract students from across the world, as well as secure an instructor from a different part of the country (or world)" (Yee & Hargis, 2010, p. 213). "…[I]nstead of participating in a distance classroom by watching videos and submitting homework by email, SL enables students to attend lectures in a 3D classroom, sharing this environment with the other fellows" (De Lucia, Francese, Passero, & Tortora, 2009, p. 232).

The three-dimensional nature of virtual environments such as SL can enable "effective tools for social interaction," becoming especially realistic regarding the "type of inter-personal interactions available" (Sreedharan, Zurita, & Plimmer, 2007, p. 227). The emphasis on social interaction and the ability of SL to provide social interaction was also present in the literature (Boulos, Hetherington, & Wheeler, 2007; De Lucia et al., 2009).

A 2009 study revealed that "the virtual environment successfully supports synchronous communication and social interaction" (De Lucia et al., p. 232). In fact, "…it has been demonstrated that better participation in computer conferences can be encouraged through online activity which is purposeful, authentic and embedded deeply with the program" (Boulos et al., 2007, p. 240). In a study conducted by Murphrey, Rutherford, Doerfert, Edgar, and Edgar (2012), it was reported that "it will be critical to present the technology in a way that enables students to easily comprehend the educational benefits of using the technology" (p. 68). Further, "[i]f universities implement virtual worlds such as SL, they need to consider faculty and student adoption, effectiveness of SL in education, availability of hardware and software, and cost" (Leggette, Rutherford, Sudduth, & Murphrey, 2012, p. 35). Understanding and recognizing the usability of a virtual environment can enable educational planning and thus, directly impact student engagement and learning.

Although literature regarding the educational value of SL is limited, much potential exists with this technology (Leggette, Rutherford, et al., 2012). Agricultural educators as a whole have not taken advantage of virtual environments such as SL, but these tools offer many opportunities and benefits to education that other disciplines such as chemistry and English have utilized (Leggette, Rutherford, et al., 2012). For example, students in an agricultural crisis communications course "found [Second Life™] to be a valuable educational tool" (Leggette, Witt, et al., 2012, p. 132).

Defining Usability

While it is important for students to see value in educational technology that is selected for use, it is also critical that the technology be determined to be usable because "usability" will impact the education process. The initial review of literature revealed the need to expand the study's conceptual framework to include the overarching concept of usability in the context of educational technology. This was accomplished through an extensive review of the literature that allowed the identification of constructs to further define and clarify usability as it related to assessing a virtual environment. Graphical user interfaces (GUIs) have proven usability evaluation methods, but due to the vast differences between GUIs and virtual environments (VEs), these methods may not, and are most likely not, suitable for studying VEs (Bowman et al., 2002).

Usability relates to the quality of the interaction between an individual and the item being assessed. Bowman, Gabbard, and Hix (2002) cited Hix and Hartson (1993) and Shneiderman (1992) when they defined usability as "'ease of use' plus 'usefulness,' including such quantifiable characteristics as learnability, speed and accuracy of user task performance, user error rate, and subjective user satisfaction" (p. 404).

A usability study conducted by Ritzema and Harris (2008) reported that 76.5% of participants found SL to be moderately easy to use, ranking the program "three or less" (p. 115) on a scale of one (easy) to five (difficult). Respondents to other studies reiterated the idea that SL would be valuable to learning environments, especially those that emphasize experiential learning (De Lucia et al., 2009; Jarmon, Traphagan, Mayrath, & Trivedi, 2009). Additionally, training and support for users, personalization options, and flexibility of SL also contributed to positive experiences with the interface (Cych & Maloney, 2010; Grunwald, Ramasundaram, Bruland, & Jesseman, 2007; Hewitt, Spencer, Mirliss, & Twal, 2009).

Previous studies revealed that students indicated that using SL as part of their coursework was difficult, some of which was due to usability issues (Sanchez, 2007). Three major factors that can inhibit participation in SL include technology constraints, time limitations, and lack of training/education in the use of SL (Cych & Maloney, 2010; De Freitas, 2008; Hewitt et al., 2009). The current study reported here sought to further evaluate the use of SL and investigate its usability for students in agricultural education.

Multiple concepts emerged to further define and explain the concept of usability. Bowman et al. (2002) identified overarching aspects to include "navigation, selection, or manipulation" (p.420). Satisfaction (Bowman et al., 2002; Fernandes, Ferreira, Cunha, & Morgado, 2010; Slone, 2009) was identified as a critical element of usability by multiple authors. In addition, Bowman et al. (2002) identified elements of usability that included the ability to learn, task accuracy, speed of task completion, and error count. Task difficulty was one of three parts of usability as described by Smith and Mayes (1996) (as cited in Fernandes et al., 2010). Slone (2009) reported topics that included "(a) visibility of system status, (b) match between the system and the real world, (c) user control and freedom, (d) consistency and standards, (e) error handling, (f) recognition rather than recall, (g) flexibility, (h) privacy, (i) minimalist design, (j) help and documentation, (k) skills, and (l) pleasurable and respectful interaction with the user" (p. 181). Fernandes et al. (2010) reported topics that included "effectiveness, efficiency, and satisfaction" (p. 2). "Task analysis is a critical activity in usability engineering" (Bowman et al., 2002, p. 417). Thus, elements of confusion and deviation from the task were included in concepts to be observed.

Purpose and Objective

The purpose of this study was to assess the usability of *AgriCulture Island* in SL in order to identify usability issues agricultural students could encounter and add to the understanding of the severity of those issues and how the issues could be addressed. *AgriCulture Island* is a unique space within SL that was created with the purpose of providing course-related simulations. The SL environment is, by design, accessible by anyone with an SL account. As such, *AgriCulture Island* was intentionally designed to prevent outside individuals and organizations from accessing the simulation and maliciously impacting the learning experience. To improve the authenticity of the simulation, a United States coastal county that represented the diversity of agriculture in both urban and rural settings was selected as a design model. This allowed the SL designers to draw upon current, historical, and statistical (e.g., United States Census Bureau) data sources in creating the environment and setting the stage for each simulation.

Research objectives of the study included (a) determine agricultural students' perceptions of *AgriCulture Island* in SL prior to interacting or using SL, (b) determine agricultural students' perceptions of *AgriCulture Island* in SL after interacting or using SL, (c) document aspects of *AgriCulture Island* in SL that decrease satisfaction, and (d) identify elements of *AgriCulture Island* in SL that require explanation and training to encourage usability. All further references to SL in the context of the study refer to the setting of *Agriculture Island* within the SL environment.

Methods and Procedures

A one-group pretest-posttest design that utilized a mixed-methods data collection strategy aligned with the objectives of the study was selected for this study. From this design, data collection involved four steps: (1) pre-assessment, (2) observation of the use of SL, (3) post-assessment, and (4) group discussion with participants. Quantitative data collection methods included pretest and posttest questionnaires and observation counts during the treatment while qualitative methods included rich treatment observation notes and the posttest focus group session. Institutional Review Board approval was received to conduct the research.

As shared by Kantner and Rosenbaum (1997), a greater number of evaluators allow an increased number of issues to be identified and also "provide[s] a better indication of their severity" (p. 154). Therefore, multiple evaluators were utilized in this study. Additionally, observation of individuals performing identical tasks in a controlled environment allowed the collection of measurable data (Kantner & Rosenbaum, 1997) because laboratory testing collects actual user experiences.

Participants were recruited from an agricultural communications and journalism course at Texas A&M University during the summer of 2012. A recruitment letter explaining the purpose of the study was sent out and respondents volunteered to participate. The study engaged 12 participants. The number of participants was based upon the work of Fernandes et al. (2010) who reported that defining the number was "a matter of intense discussion in the usability community" ("Test Participants", para. 3) and suggested that assessing perceptions of usability could be accomplished with smaller numbers of participants (i.e., 5-10) unless the goal is to run statistical tests.

Prior to the student participants entering the room, computers were tested to ensure that the virtual environment (i.e., SL) program was working correctly with an operational headset and microphone. Participants first completed a pretest questionnaire administered in the room. The questionnaire collected data on the participant's background and demographic information, technology use (i.e., number of online courses taken, hours spent using a computer weekly, and self-classification of computer ability), perceptions and opinions of SL, and technology acceptance.

The research team consisted of a facilitator to guide participants through the treatment task list, three assistants to answer questions and assist participants as needed, and three observers to record information about participants as they completed the required tasks. Each observer was assigned four participants to observe. Participants were instructed to raise their hands if they had a question and an assigned assistant responded to their questions. Observers were provided with a chart to record all observations based on the conceptual framework.

Computers utilized for the treatment portion of the study were numbered and participants were identified by computer number rather than their name. This provided anonymity for the participants. After completion of the pretest questionnaire, participants completed a list of basic activities utilizing an avatar created in SL. See Table 1 for listing of tasks completed by participants.

Table 1

Description of Tasks Observed During Usability Evaluation of Agriculture Island in SL

Tasks
(1) Set up or log on to avatar account
(2) Teleport to first location
(3) Put on clothing with "edit my outfit" command
(4) Teleport to specific location
(5) Walk to hospital, enter hospital, take elevator to second floor
(6) Navigate out of hospital to front steps
(7) Run from hospital to school gym
(8) Fly from school gym to City Hall
(9) Enter City Hall; sit in chair
(10) Use cameras and "view" command to view own avatar sitting"
(11) Take photo of own avatar sitting
(12) Get information from file cabinet
(13) Go to Extension office

(14)	Have conversation with another avatar
(15)	Logoff from Second Life™

Observers noted each participant's performance on each task with respect to specific criteria based on the study's conceptual framework. Observation categories along with how they were operationally defined can be viewed in Table 2.

Table 2

Observation Terms Used During Usability Evaluation of Agriculture Island in SL

Observation Item	Definition
Number of requests for assistance	number of user requests for help to complete a task
Observed satisfaction	smiling, nodding, and/or positive comments
Observed confusion and/or disappointment	frowning, making negative comments, and/or long pauses
Observed deviation from task list	user doing a task, either more advanced or rudimentary, that is not one of the tasks listed on the instruction sheet
Navigation	ability of user to find and go to a location by walking, running, and flying
Selection	ability of user to put clothing on their avatar and accept items
Manipulation	ability of user to manage on-screen windows that appear and use cameras
Task is accurate and complete	observe that the user completed a task correctly
Time spent to complete task	write down time that user began and finished each task
Speed	observe if user completed the task list earlier than others, around the same time as others, or later than others

After completion of the task list, participants completed a posttest questionnaire that sought their opinion of task difficulty, their opinion of SL, and their opinion related to technology acceptance using a Likert-type scale ranging from one (easy) to five (difficult). In addition, each of the three observers recorded their thoughts and observations in both text and using audio reflection in order to capture a robust description. The audio reflections were then reviewed and comments were noted for each task within the observation sheets.

Finally, participants gathered for a short focus group discussion about their experience. The questions for discussion included “What was your overall reaction to using SL?” and “What recommendations would you have for instructors utilizing this technology?”.

It is very important that the “experimental application/interface must be robust and bug-free, so that the session does not have to be interrupted to fix a problem” (Bowman et al., 2002, p. 407). Thus, it was important to conduct the usability study after the environment under study had been used by multiple individuals to ensure an error-free environment. In fact, the environment evaluated as part of this study had been used by three separate sets of students prior to the study.

Findings

Description of the Participants

Participants were predominantly white (91.7%) and female (66.7%). The majority of them were 21-30 years of age (75.0%) with the remaining 25% being 18-20 years of age. All participants were enrolled in an undergraduate program in a college of agriculture.

Regarding technology use, all but one participant (91.7%) had taken at least one online course prior to the study and five participants (41.7%) had taken five or more online courses in the past. All participants classified themselves as “intermediate” computer users. Participants reported spending much time using computers weekly with 58.3% reported spending 6-10 hours per week on the computer and 33.3% said they spent more than 10 hours per week using computers.

No participants reported having an opinion about SL prior to the study. Two-thirds indicated that they “do not know enough about it” to have an opinion and the remaining one-third had heard of the program but again reported that they “do not know enough about it” to form an opinion. Ten of the 12 participants had no opinion when asked for their overall opinion of SL. The remaining two were “neutral.” However, 75.0% of the participants thought that SL would have a sense of social presence.

Post-Assessment Responses

Although 25% of participants still held a “neutral” opinion of SL after using the program, the remaining respondents had some degree of a positive opinion. Three individuals (25%) had a “somewhat positive” overall opinion, four (33.3%) had a “positive” opinion, and two (16.7%) had a “very positive” overall opinion of SL after completing the task list. All participants indicated that SL had a sense of social presence.

Based on responses to the post-assessment, the most difficult task for participants was to “navigate to a certain location by running” (Task 7) with an average difficulty of 2.83. The easiest task was to “set up avatar or log onto your avatar” (Task 1) with an average difficulty of 1.17. The overall ranking of tasks from easiest to most difficult was: set up/logon to avatar, have conversation, navigate by flying/locate information (both 2.33), navigate by walking, and navigate by running. The only task that was ranked "difficult" by a participant was having a conversation (1 person). A review of responses to Likert-type questions related to technology acceptance associated with SL (see Table 3) revealed that participants were more accepting after exposure.

Table 3

*Pre and Post Assessment Responses related to Technology Acceptance During the Usability Evaluation of Agriculture Island in SL (*N*=12)*

Statement	Disagree		Somewhat Disagree		Neutral		Somewhat Agree		Agree		Strongly Agree	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
My interaction with virtual worlds would be clear and understandable.	0	0	0	0	5	4	5	4	2	3	0	1
It would be easy for me to become skillful at using virtual worlds.	0	0	0	1	0	2	4	4	8	4	0	1
I would find virtual worlds easy to use.	0	1	0	1	1	1	8	4	3	4	0	1
Learning to operate virtual worlds is easy for me.	0	2	0	1	6	3	6	2	0	3	0	1

Note: No responses fell in the "strongly disagree" category, therefore that category was not included in the table.

Observations Recorded During Task Completion

A summary of all observations was compiled and reviewed by the researchers. Categories of "assistance needed," "satisfaction," "confusion," and "deviation from task" were the most noted areas observed. A summary of instance counts and number of students involved is provided in Table 4.

Table 4

*Instances Counts Observed for Each Task During the Usability Evaluation of Agriculture Island in SL (*N*=12).*

Task Description	Assistance	Satisfaction	Confusion	Deviation	Time to Complete
	# instances: # students				# min: # students
1.Set up or log on to avatar account	13: 8	3: 3	2: 2	5: 5	5 min: 1 6-7 min: 7 11-12 min: 4
2.Teleport to first location	13: 9	6: 5	9: 9	5: 5	2 min: 3 4-5 min: 6 7-9 min: 3
3.Put on clothing with "Edit my outfit" command	14: 9	5: 4	3: 3	6: 6	6-7 min: 8 8 min: 2 10 min: 2
4.Teleport to Store	2: 2	5: 3	3: 3	5: 5	1-3 min: 8 4 min: 4
5.Walk to hospital, enter hospital, take elevator to second floor	2: 1	2: 2	6: 6	2: 2	1-2 min: 4 3-5 min: 8
6.Navigate out of hospital to front steps	1: 1	-	-	2: 2	1 min: 11 2 min: 1

7.Run from hospital to school gym	13: 7	4: 4	5: 5	9: 7	1-3 min: 4 4-5 min: 4 6-7 min: 4
8.Fly from school gym to City Hall	-	3: 3	4: 4	1: 1	1-2 min: 9 3 min: 3
9.Enter City Hall; sit in chair	4: 4	3: 3	3: 3	2: 2	1-3 min: 12
10. Use cameras and "View" command to view own avatar sitting	5: 3	1: 1	2: 2	2: 2	1 min: 9 2 min: 3
11. Take photo of own avatar sitting	-	1: 1	-	1: 1	1-2 min: 12
12. Get information from file cabinet	11: 8	-	6: 6	2: 2	1-2 min: 6 3 min: 6
13. Go to Extension office	6: 5	2: 2	5: 5	2: 2	2-3 min: 12
14. Have conversation with another avatar	4: 2	3: 3	1: 1	5: 5	1-2 min: 8 3-5 min: 4
15. Logoff from SL	4: 4	-	2: 2	8: 8	1 min: 11 2 min: 1

Participant Comments Shared During Group Session

During the 30-minute focus group session that followed the actual use of SL, participants had the opportunity to respond to the questions "What was your overall reaction to using SL?" and "What recommendations would you have for instructors utilizing this technology?". Participants overwhelmingly responded that they believed that being in a group setting while they learned about SL had a positive impact on their comfort with the program. A few items that were suggested included a cheat sheet of commands and group learning sessions in a face-to-face classroom session for orientation.

As a group, the participants indicated that they did not plan to continue to use SL unless it was required for a class. More than one participant indicated that it would depend on how SL would be used as to whether they felt it would have educational value. All participants indicated that the experience felt "real" and that they could sense other people in the environment. They found it an enjoyable experience overall but felt they would need more instruction to be proficient.

Conclusions and Discussion

The population of this study was represented by predominantly undergraduate, white, female participants creating limitations to the study given the lack of diversity. However, it was concluded that the participants possessed a high level of technology awareness and perceived themselves to be competent in the use of technology that is supported by prior research (Murphrey, Rutherford, et al., 2012). It was also concluded that while the participants reported a high use of technology, they were not familiar with SL. This is not surprising given that participants were recruited purposely in an effort to attract a group of participants with limited exposure to SL in an effort to accurately measure usability of the environment without the influence of prior experience. Based on the finding that 75% of the participants expected SL to exhibit social presence, it was concluded that the participants understood the nature of SL as an environment in which one could interact.

Based on the finding that participants' opinions of SL became more positive after the use of SL, it was concluded that participants were not overwhelmed by difficulty in using the program and could see potential application or value in using the technology. Overall, technology acceptance in regard to SL in this study moved in a positive direction. All participants were either neutral or in agreement that the use of SL would be "clear and understandable" while the majority of the participants agreed that it would be easy for them to become skilled at using the technology. It is important to note, given that two participants indicated that learning to operate the SL environment would not be easy, it was concluded that the perception of ease of use varied.

In relation to the element of task difficulty, it was concluded that difficulty in navigation varied depending on the type of navigation being used (i.e., walking, running, flying, or teleporting). In addition, based on the findings reported in the Likert-scale questions related to task difficulty in which only one participant indicated any level of difficulty with having a conversation, it was concluded that as long as technology is setup appropriately, the use of audio will not present a challenge for students.

Observation data provided a robust picture of the interaction of participants with the SL environment. As revealed in findings displayed in Table 4, there was great variation in regard to each task. Requests for assistance were more prominent towards the beginning of the activity during set-up and logon to SL and then reduced until activities such as “running” or “obtaining information from file cabinets” was needed. It was concluded that participants required more assistance with the tasks related to changing mode of movement and also in regard to selection as it related to information gathering.

Findings related to the element of satisfaction revealed that there were more signs of satisfaction early in the activity than later in the activity. In fact, the highest numbers of instances related to satisfaction were associated with movement tasks. This is not surprising given that movement gives one a sense of control in a virtual environment. It was concluded that encouraging movement within the environment can increase satisfaction.

The concept of “teleporting” appeared to be the task that participants found most confusing with nine of the 12 participants displaying signs of confusion during this task. Once again (similar to satisfaction) movement (regardless of method) was revealed to cause more confusion than other steps. It was concluded that the process of movement and overall direction can be an important element that impacts the usability of SL.

“Deviation from task” varied across the tasks but was documented as occurring more predominantly during setup, in putting on clothing, during running, and during the conversation task. This was not surprising given the characteristics of these tasks. During setup and in putting clothing on an avatar there are decisions made by the participants; decisions can lead to deviation from task. It was concluded that tasks that involve decisions have a higher likelihood of deviation from task. It was also interesting that the highest number of instances of deviation was during the final task of logging off. It was concluded that participants were using this opportunity as one last chance to experiment with the environment.

Time to complete each task ranged from a minimum of one minute to a maximum of 12 minutes for any given task. In summing the total range of times per task, it was found that completion of all tasks ranged from approximately 26 minutes to 70 minutes (when considering times as a whole and not connected to any particular participant). It was concluded that time required to engage in the use of SL could vary widely for participants.

It is important to note that this study was conducted in a lab setting meaning that usability was tested in an environment in which the technology had been tested prior to use. This enabled the focus of the study to remain on the interaction between the participants and SL rather than technology issues (e.g., microphone issues) that can occur when users are in their own environment.

Implications and Recommendations

The importance of understanding the usability of educational technology cannot be underestimated. It is not sufficient to merely “ask” students if they find a technology useful. Careful study is required to determine what scaffolding might be necessary to utilize educational technology such as SL in order to successfully use the technology to enable educational effectiveness. The results of this study revealed that students do encounter issues with SL but that the issues are not insurmountable as to completely negate use of the technology. In fact, observations revealed that students are capable of utilizing SL successfully. Assistance with items such as navigation and information collection could enable a more pleasant experience. Students engaged in university settings are typically a generation that is familiar and willing to try out technology. However, as revealed in this study, the applicability of the technology will be the key to adoption and acceptance.

This study focused specifically on the "usability" of *Agriculture Island* – a virtual environment housed in the SL platform. Results revealed that students had a greater interest and belief that learning could occur through the use of SL after use of the program. However, based on comments in the focus group session it was clear that in addition to usability – purpose and relevance are critical elements and should be taken seriously.

In regard to addressing usability issues, it is recommended that students be provided an opportunity to test their skills and signup for one-on-one consultations or group sessions – not only in the virtual environment but also in face-to-face settings. It was obvious through observation that the students felt comfortable with technology but needed direct face-to-face interaction as they learned how to use the system. It is believed that as students become more comfortable with the virtual environment, they would gain greater value from the use of the program.

It is further recommended that additional research be conducted to compare uses of SL across disciplines and document the types of encounters and uses that students believe to be most beneficial. While one can assume that simulations might be the most relevant and purposeful, this should be documented through careful study. The authors believe that programs such as the one investigated will continue to evolve, change, and form into new and creative mechanisms for learning. These technologies should continue to be studied in order to guide effective use of technology and help others to utilize these tools in the best way possible with the least disruption to learning. The opportunities for application of virtual environments is limitless, yet as seen in this study, purpose and relevance will be key once usability issues are addressed and overcome.

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Discussant Remarks

Session E: Professional Development

Discussant: Dr. Kim Dooley

Variations in Professional Development Needs of Florida Agricultural Education Teachers Based on Gender, School Level, and Experience

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Abstract

Teachers must continue to learn throughout their careers to maintain their professional competence. The purpose of this study was to explore the differences in professional development needs of Florida agricultural education teachers based on selected variables. Results of the study indicated that teachers had the greatest professional development needs for skills in dealing with workplace stressors – including managing stress, balancing their work and personal lives, and managing time. Female teachers expressed a greater need for items related to teaching in various laboratories and items related to integrating science and mathematics. Female teachers also expressed a greater need in balancing work and personal life. Professional development needs for middle school and high school teachers did not differ, with one exception: High school teachers expressed a greater need for development in preparing students for industry certifications. Professional development needs also varied by the amount of teaching experience. It is recommended that a variety of professional development opportunities be offered to teachers using a variety of delivery mechanisms.

Introduction/Theoretical Framework

In 2001, *No Child Left Behind* (NCLB) mandated that teachers participate in professional development activities to assist in becoming "highly qualified" in their content areas. To meet this requirement, many states have implemented standards that require teachers to participate in professional development programs with parameters measured in clock hours or in college credits, rather than in competency-based activities that are directly related to developing skills that the teacher may lack, or in honing skills that may have become dull over time.

In Florida, over 6,000 professional development opportunities are offered each year that enable teachers to earn the required 120 clock hours of continuing professional development. Or, teachers can complete six credit hours of college courses in lieu of the 120 clock hours (Florida Department of Education, 2012). Whereas these continuing professional development opportunities are designed to encourage teachers to commit to lifelong learning through continuing professional development, not all professional development activities produce "highly qualified" teachers. Some studies note that factors other than the number of hours present constitute a much more effective professional development program. For example, multiple studies note that the content, duration, presence of active learning techniques, coherence, and collective participation must be present and considered in continuing professional development programs to increase teachers' knowledge and skills (Desimone, 2009; Garet, Porter, Desimone, Birman, & Yoon, 2001).

Greiman (2010) argued that inservice teachers' level of experience in the classroom influenced their needs during continuing professional development. Moir (1990) identified the following five distinct phases of attitude that new teachers experience during their first year of teaching: anticipation, survival, disillusionment, rejuvenation, reflection, and anticipation. During these phases, new teachers achieve their highest attitude levels during the anticipation phases at the beginning and end of the school year. Their lowest attitude phase is during the disillusionment phase towards the end of the first semester (Moir, 1990).

According to Greiman (2010), the professional development needs of new teachers change during these phases and over their career. Greiman stated that as the teachers' experience in the classroom increases, content and pedagogical needs of the teacher change. He argued that presenters of professional development programs must adapt their motivational and delivery strategies based upon teachers' experience and pedagogical/content needs (Greiman, 2010).

Roberts and Dyer (2004) also noted that the professional development needs of teachers change over time. For example, beginning teachers need help with organizationally related areas such as establishing an effective alumni chapter/advisory council/FFA chapter, building relationships with stakeholders/administrators/school staff, management of student discipline, and recruitment of students into the agriculture program (Garton, Chung, 1996, 1997; Joerger; 2002; Mundt & Conners, 1999; Myers, Dyer, Washburn, 2005; Washburn, King, Garton, & Harbstreit, 2001). Experienced teachers, on the other hand, need help in areas involving the updating of technical skills, such as technology integration into the classroom (Briers & Edwards, 1998; Joerger, 2002; Kotrlik, Redmann, Harrison, Handley, 2000; Layfield & Dobbins, 2002; Roberts & Dyer, 2004; Washburn et al., 2001) and the integration of science into the agricultural curriculum (Garton & Chung, 1996, 1997; Joerger, 2002; Washburn et al., 2001).

There are several areas of common need between beginning and experienced teachers in professional development programs. For example, both beginning and experienced teachers have a need for help in student motivation, public relations, creating and supervising Supervised Agricultural Experience programs, completing paperwork for administrators (Garton & Chung, 1996, 1997; Joerger, 2002), and in assisting students with completing FFA applications (Briers & Edwards, 1998; Garton & Chung, 1996, 1997; Joerger, 2002; Layfield & Dobbins, 2002; Mundt & Conners, 1999; Washburn et al., 2001).

The method by which teachers were certified also has an influence on their professional development (Layfield & Dobbins, 2002). For example, Roberts and Dyer (2004) noted that alternatively certified teachers have basic professional development needs in such areas as agricultural mechanics and plant sciences. Traditionally certified teachers, however, need help with more highly technical areas such as the integration of advanced scientific principles into curricula. That is, alternatively certified teachers needed a professional development program built around advancing their understanding of basic agricultural subject matter, whereas teachers who graduated from a teacher preparation program preferred professional development in advanced topics (Roberts & Dyer, 2004).

A review of literature also reveals that not only is the "*what*" should be delivered important, but the "*how*" of its delivery is also central to the success of a professional development program. Thoron (2010) stated that multi-day intensive continuing professional development presentations are ideal for creating change in teacher performance when providing training related to a teaching methodology. Further, Thoron argued that this form of professional development should be considered as a model for professional development workshops in agricultural education. However, Greiman (2010) proposed that various presentation formats should be used, based upon the teacher's needs and length of time available. Suggested formats included invited speakers; conferences; one hour workshops; multi-day workshops; and as technology advances, web conferencing and webinars (Greiman, 2010).

Whereas the research base provides a composite glimpse of the professional development needs of agriculture teachers over the years, it is lacking in information concerning the needs of the various subgroups that comprise the agriculture teaching profession. What we do know, however, is that different groups of teachers have distinct and sometimes dissimilar professional development needs (Roberts & Dyer, 2004). Missing from the research base are the professional development needs of female versus male teachers, novice versus expert teachers, or the needs of middle school versus high school teachers. Likewise, as noted by Roberts and Dyer (2003, 2004), teachers' needs change over time, so it is also important to periodically determine the professional development needs of teachers. This study sought to address these deficiencies.

Purpose/Research Questions

The purpose of this study was to explore the differences in the professional development needs of Florida agricultural education teachers based on selected variables. Specifically, four research questions directed the study.

1. What are the professional development needs of Florida agricultural education teachers?
2. What differences exist, if any, in the professional development needs of male versus female agricultural education teachers?
3. What differences exist, if any, in the professional development needs of middle school versus high school agricultural education teachers?
4. What differences exist, if any, in the professional development needs agricultural education teachers based on years of experience?

Methods

The population for this study consisted of all middle and high school agriculture teachers in Florida during the 2009–2010 school year (n = 385). The sampling frame for the study was the state's agricultural education teacher directory. A total of 171 usable responses were received through an online survey. Follow-up surveys added 11 respondents, bringing the total number of usable surveys to 182 for a final response rate of 47%. Guidelines by Dillman, Smyth, and Christian (2009) were used for administering online surveys. A pre-notice email was sent to teachers to inform them of the forthcoming survey. A second email to teachers contained the link to the survey, while two follow-up email reminders followed. Additionally, to control for nonresponse error, the researchers distributed follow-up surveys to non-respondents of the online survey at the Florida FFA State Convention (Miller & Smith, 1983; Lindner, Murphy, & Briers, 2001). Responses from the initial non-respondents were compared to the online respondents and no significant differences were found. Therefore, the data from the non-respondents who completed the survey at state convention were combined with the online respondents' data. The researchers also compared the respondents to the population on known variables of interest to determine if the respondents were representative of the population. Chi-square tests revealed that no significant differences existed between the respondents and the population on gender (p = .983) or whether they taught high school or middle school (p = .764). The last variable of interest was the number of years taught. Results of an independent samples t-test revealed no significant difference (p = .167) between the respondents and the population. Thus, the sample was deemed representative of the entire population of Florida agricultural education teachers.

Data were collected using a researcher created instrument that asked teachers to provide their perceived levels of knowledge and relevance on 79 items. Knowledge and relevance levels were measured on a 5 point Likert-type scale. A response of 1 indicated low knowledge or relevance, while a response of 5 indicated high knowledge or relevance. An expert panel of teacher education faculty, graduate students, and teachers not included in the study evaluated the instrument for face and content validity. Reliability as a measure of internal consistency was established using Cronbach's alpha, which had a value of .95.

To answer the first research question, data were analyzed using the Borich Needs Assessment Model (Borich, 1980). The Borich model is used to calculate a mean weighted discrepancy score (MWDS) for each item. To calculate the MWDS for an item, first a discrepancy score is found by subtracting each respondent's knowledge score from their relevance score. Each discrepancy score is then multiplied by the mean of the relevance scores for that item to find the weighted discrepancy score. Lastly, the weighted scores are divided by the total number of responses for that item, providing the MWDS. The mean weighted discrepancy scores are then ranked from largest to smallest. Higher mean weighted discrepancy scores for an item indicate a greater need for professional development in that area.

To answer the second and third research questions, an MWDS was calculated on each item for males and females, and for high school and middle school teachers. An independent samples t-test was used to compare the males' 20 highest ranked mean weighted discrepancy scores with the females' 20 highest ranked mean weighted discrepancy scores. For the fourth research question, teachers were grouped based upon their number of years of teaching experience. The range of the groups was 0 to 1 years, 2 to 5 years, 6 to 10 years, 11 to 20 years, and over 20 years. The 20 items with the highest mean weighted discrepancy scores were determined for each group. The groups were compared on these items using a MANOVA. A Tukey's HSD post-hoc test was conducted to determine where significant differences existed.

Results

Of the 182 teachers who completed the study, 58 (31.8%) were middle school teachers, whereas 124 (68.1%) taught high school. The mean age of the respondents was 42 years old (SD = 12.7). A total of 94 respondents (51.4%) were male. Teachers indicated their level of experience was as follows: 0 - 1 year of experience (3.3%), 2 - 5 years of experience (23.1%), 6 - 10 years of experience (17.0%), 11 - 20 years of experience (17.0%), and over 20 years of experience (39.6%).

The first research question concerned the overall professional development needs of Florida agricultural education teachers. To answer this question the mean weighted discrepancy scores for each item were calculated and ranked (see Table 1). *Managing stress* was the highest rated item with a MWDS of 4.33, followed by *balancing work and personal life* (4.11*),* *preparing students for industry certifications* (3.91), *managing time* (3.35), *repairing and reconditioning agricultural tools and equipment* (3.25), and *teaching problem solving skills* (3.02). The remainder of the top 20 items had a MWDS between 2.98 and 2.48.

Table 1
Mean Weighted Discrepancy Scores for Selected Professional Development Items

Item	Knowledge *M*	Relevance *M*	*MWDS*
1. Managing Stress	3.52	4.48	4.33
2. Balancing work and personal life	3.56	4.48	4.11
3. Preparing students for industry certifications	2.88	3.89	3.91
4. Managing time	3.76	4.50	3.35
5. Repairing and reconditioning agricultural tools and equipment	3.02	3.88	3.25
6. Teaching problem solving skills	3.89	4.55	3.02
7. Evaluating technology to fit program needs	3.44	4.16	2.98
8. Teaching critical thinking skills	3.86	4.52	2.97
9. Motivating students	4.09	4.72	2.96
10. Teaching using experiments	3.48	4.19	2.96
11. Teaching decision making skills	3.92	4.54	2.80
12. Managing facilities	3.95	4.55	2.77
13. Integrating math into agricultural instruction	3.74	4.37	2.75
14. Integrating standardized testing strategies into the curricula	3.57	4.22	2.73
15. Designing curricula	3.82	4.42	2.63
16. Budgeting and funding	3.76	4.36	2.63
17. Integrating science into agricultural instruction	3.94	4.52	2.61
18. Integrating benchmark standards into the curricula	3.71	4.31	2.61
19. Teaching using technology	3.79	4.38	2.57
20. Managing the classroom	4.26	4.78	2.48

The second research question sought to identify differences in the professional development needs of male versus female agricultural education teachers (see Table 2). The items with the highest mean weighted discrepancy scores for females were *balancing work and personal life* (5.19), *repairing and reconditioning agricultural tools and equipment* (4.96), *managing stress* (4.54), *teaching using experiments* (4.24), *integrating math into agricultural instruction* (4.13), *teaching problem solving skills* (4.03), and *preparing students for industry certifications* (4.01).

The items with the highest mean weighted discrepancy scores for males were *managing stress* (4.20), *preparing students for industry certifications* (3.97), *balancing work and personal life* (3.27), *evaluating technology to fit program needs* (3.05), *managing time* (2.95), and *integrating benchmark standards into curricula* (2.83). Results of an independent samples *t*-test showed that a significant difference existed between males and females on nine of the items.

Females' mean weighted discrepancy scores were significantly higher for *repairing and reconditioning agricultural tools and equipment* (p = .000), *integrating math into agricultural instruction* (p = .000), *teaching using experiments* (p = .002), *completing award applications* (p = .014), *integrating science into agricultural instruction* (p = .001), *teaching in lab settings* (p = .001), *balancing work and personal life* (p = .038), *preparing for career development events* (p = .017), and *teaching problem solving skills* (p = .007).

Table 2
Mean Weighted Discrepancy Scores by Gender

	Male		Female			
Item	*MWDS*	*SD*	*MWDS*	*SD*	Diff	*p*
Repairing and reconditioning agricultural tools and equipment[b]	1.74	5.52	4.96	5.22	3.22	.000*
Integrating math into agricultural instruction[b]	1.54	4.98	4.13	4.42	2.59	.000*
Teaching using experiments[b]	1.89	4.52	4.24	5.3	2.35	.002*
Completing award applications[b]	1.01	5.92	3.22	5.98	2.21	.014*
Integrating science into agricultural instruction[b]	1.58	4.73	3.72	4.13	2.14	.001*
Teaching in lab settings[b]	1.23	3.74	3.36	4.89	2.13	.001*
Balancing work and personal life[a]	3.27	6.14	5.19	6.18	1.92	.038*
Preparing for career development events[b]	1.23	5.22	3.06	5.02	1.83	.017*
Teaching problem solving skills[a]	2.21	4.47	4.03	4.55	1.82	.007*
Teaching decision making[a]	2.25	4.63	3.57	4.49	1.32	.053
Teaching using technology[b]	1.87	5.40	3.18	4.12	1.31	.069
Managing facilities[a]	2.15	4.57	3.30	4.39	1.15	.086
Teaching critical thinking skills[a]	2.52	4.58	3.54	4.4	1.02	.128
Managing paperwork and finances[c]	2.56	4.96	1.60	5.29	0.96	.209
Managing time[a]	2.95	5.21	3.90	4.7	0.95	.201
Integrating standardized testing strategies into the curricula[a]	2.29	5.61	3.22	3.78	0.93	.195
Motivating students[a]	2.54	4.09	3.41	4.51	0.87	.173
Managing the classroom[a]	2.10	4.21	2.95	4.27	0.85	.182
Teaching biotechnology[c]	2.06	4.06	2.86	4.65	0.8	.221
Recruiting students[c]	1.96	4.53	2.75	5.2	0.79	.279
Budgeting and funding[c]	2.35	5.21	2.82	4.63	0.47	.524
Developing lesson plans[c]	2.18	5.19	2.57	3.62	0.39	.560
Managing stress[a]	4.20	5.88	4.54	5.88	0.34	.698
Teaching leadership[c]	1.99	5.24	2.31	3.54	0.32	.067
Integrating benchmark standards into curricula[c]	2.83	4.98	2.62	3.97	0.21	.763
Designing curricula[c]	2.62	5.44	2.66	4.52	0.04	.957
Preparing students for industry certifcations[a]	3.97	6.16	4.01	5.34	0.04	.961
Evaluating technology to fit program needs[a]	3.05	5.37	3.05	4.33	0.00	.998

[a]Rated by both males and females in their top 20 MWDS; [b]Rated by females in the top 20 MWDS; [c]Rated by males in the top 20 MWDS; *Significant difference at alpha level of .05.

The third research question sought to identify any differences that might exist in the professional development needs of middle school versus high school agriculture teachers (see

Table 3). The items with the highest MWDS for middle school teachers were: *balancing work and personal life* (4.79), *managing stress* (4.76), *repairing and reconditioning agricultural tools and equipment* (4.10), *managing time* (3.61), *motivating students* (3.40), *teaching critical thinking skills* (3.16), *teaching problem solving skills* (3.11), *teaching using experiments* (3.10), *integrating math into agricultural instruction* (3.07), and *understanding learning styles* (3.01). For high school teachers, the items with the highest mean weighted discrepancy scores were: *preparing students for industry certification* (4.46), *balancing work and personal life* (4.10), *managing stress* (4.03), *managing time* (3.08), *teaching problem solving skills* (3.02), *motivating students* (2.98), and *teaching decision making skills* (2.94). When middle school and high school teachers' responses were compared, the results showed a significant difference between responses for only one item; *preparing students for industry certification* (p = .002).

Table 3
Mean Weighted Discrepancy Scores by School Type

	Middle School		High School			
Item	*MWDS*	*SD*	*MWDS*	*SD*	Diff	*p*
Preparing students for industry certification[c]	1.17	5.98	4.46	5.11	3.29	.002*
Repairing and reconditioning agricultural tools and equipment[a]	4.10	6.23	2.74	5.23	1.36	0.331
Teaching biotechnology[c]	1.38	4.21	2.65	3.99	1.27	0.201
Designing curricula[c]	1.78	4.41	2.93	4.58	1.15	0.374
Understanding learning styles[b]	3.01	3.67	1.86	4.19	1.15	0.289
Modifying instruction for special needs[b]	2.84	5.44	1.72	4.29	1.12	0.332
Preparing for career development events[b]	2.91	4.68	1.82	5.07	1.09	0.437
Budgeting and funding[b]	2.96	5.46	2.21	4.54	0.75	0.646
Managing stress[a]	4.76	5.32	4.03	6.07	0.73	0.751
Balancing work and personal life[a]	4.79	6.27	4.10	6.37	0.69	0.796
Integrating math into agricultural instruction[a]	3.07	4.79	2.44	4.78	0.63	0.737
Managing facilities[b]	2.91	4.83	2.38	4.29	0.53	0.769
Managing time[a]	3.61	5.23	3.08	4.94	0.53	0.809
Teaching in lab settings[b]	2.59	4.49	2.15	3.67	0.44	0.838
Managing the classroom[a]	2.88	3.76	2.45	3.31	0.43	0.83
Motivating students[a]	3.40	3.57	2.98	3.57	0.42	0.838
Integrating science into agricultural instruction[c]	2.22	4.39	2.62	4.26	0.4	0.865
Teaching critical thinking skills[a]	3.16	3.56	2.79	4.04	0.37	0.882
Recruiting students[c]	2.28	5.55	2.6	3.87	0.32	0.921
Teaching decision making skills[a]	2.64	3.8	2.94	4.29	0.3	0.924
Teaching using experiments[a]	3.10	4.92	2.82	4.37	0.28	0.943
Teaching using technology[c]	2.12	4.16	2.39	4.69	0.27	0.941
Integrating benchmark standards into curricula[a]	2.58	4.16	2.43	4.19	0.15	0.979
Evaluating technology to fit program needs[a]	2.82	4.54	2.92	4.78	0.10	0.991
Integrating standardized testing strategies into the curricula[a]	2.45	3.73	2.55	5	0.10	0.993
Teaching problem solving skills[a]	3.11	4.14	3.02	4	0.09	0.993

[a]Rated by middle and high school teachers in their top 20 MWDS; [b]Rated by middle school teachers in the top 20 MWDS; [c]Rated by high school teachers in the top 20 MWDS; *Significant difference at alpha level of .05.

The fourth research question sought to identify any differences that might exist in the professional development needs of agriculture teachers based on their years of experience (see Table 4). For new teachers (those with 0 to 1 year of experience) *managing the classroom*, *budgeting and funding*, *evaluating student performance*, *designing curricula*, and *integrating benchmark standards into curricula* were the top five items with the highest mean weighted discrepancy scores. Teachers with 2 to 5 years of experience rated *repairing and reconditioning agricultural tools and equipment*, *managing the classroom*, *managing stress*, *preparing students for industry certifications*, and *balancing work and personal life* as the items in which they most need professional development. For teachers with 6 to 10 years of experience, *balancing work and personal life*, *managing stress*, *preparing students for industry certifications*, *managing time*, and *repairing and reconditioning agricultural equipment and tools* were the items with the highest mean weighted discrepancy scores. For mid–career teachers, those with 11 to 20 years of teaching experience, *balancing work and personal life*, *managing stress*, *managing time*, *integrating benchmark standards into curricula*, and *repairing and reconditioning agricultural tools and equipment* were the items with the highest mean weighted discrepancy scores. Lastly, for teachers with over 20 years of experience, the items with the highest MWDS were *preparing students for industry certifications*, *managing stress*, *evaluating technology to fit program needs*, *balancing work and personal life*, and *managing time*.

Table 4
Mean Weighted Discrepancy Scores by Teaching Experience

Item	*MWDS*	*SD*
0 to 1 year (*n* = 6)		
Managing the classroom	8.00	2.48
Budgeting and funding	7.27	6.56
Evaluating student performance	6.75	2.46
Designing curricula	6.63	2.42
Integrating benchmark standards into curricula	6.47	3.61
2 to 5 years (*n* = 42)		
Repairing and reconditioning agricultural tools and equipment	5.07	5.44
Managing the classroom	4.23	3.70
Managing stress	3.85	5.39
Preparing students for industry certifications	3.79	5.91
Balancing work and personal life	3.63	6.80
6 to 10 years (*n* = 31)		
Balancing work and personal life	6.28	7.18
Managing stress	5.79	6.58
Preparing students for industry certifications	5.38	5.73
Managing time	5.14	4.92
Repairing and reconditioning agricultural tools and equipment	5.12	5.32
11 to 20 years (*n* = 31)		
Balancing work and personal life	4.91	5.71

Managing stress	4.35	5.74
Managing time	3.49	5.79
Integrating benchmark standards into curricula	2.50	3.65
Repairing and reconditioning agricultural tools and equipment	2.35	6.05
More than 20 years (*n* = 72)		
Preparing students for industry certifications	4.36	5.97
Managing stress	3.99	5.77
Evaluating technology to fit program needs	3.94	5.06
Balancing work and personal life	3.51	5.47
Managing time	3.24	5.14

Results of the MANOVA revealed significant differences existed for five items: *completing award applications*, $F(4, 182) = 2.69$, $p = .032$; *managing the classroom*, $F(4, 182) = 6.27$, $p = .000$; *modifying instruction for special needs*, $F(4, 182) = 3.98$, $p = .004$; *teaching biotechnology*, $F(4, 182) = 2.76$, $p = .029$; and, r*epairing and reconditioning agricultural tools and equipment*, $F(4, 182) = 4.56$, $p = .002$. Table 5 displays the mean weighted discrepancy scores for each of these items with the scores for each group.

Table 5
Mean Weighted Discrepancy Scores for Items with Significant Differences

Item	*MWDS*	*SD*
Managing the classroom		
0 to 1 year	8.00	2.48
2 to 5 years	4.23	3.70
6 to 10 years	2.17	2.99
11 to 20 years	1.24	4.46
20+ years	1.71	4.42
Completing award applications		
0 to 1 year	2.53	3.92
2 to 5 years	2.62	4.48
6 to 10 years	4.78	6.12
11 to 20 years	0.37	7.69
20+ years	1.28	5.80
Modifying instruction for special needs students		
0 to 1 year	6.27	2.29
2 to 5 years	3.58	4.08
6 to 10 years	2.50	4.65
11 to 20 years	0.13	4.51
20+ years	1.88	4.75
Teaching biotechnology		
0 to 1 year	2.25	4.09
2 to 5 years	1.96	4.20
6 to 10 years	4.36	4.72
11 to 20 years	0.87	4.36
20+ years	2.57	4.08
Repairing and reconditioning agricultural tools and equipment		

0 to 1 year	6.45	7.61
2 to 5 years	5.07	5.44
6 to 10 years	5.12	5.32
11 to 20 years	2.35	6.05
20+ years	1.61	4.85

Tukey's post-hoc tests showed a significant difference existed between the MWDS for teachers with 6 to 10 years of experience (4.78) and teachers who had been teaching 11 to 20 years (*MWDS* = .37, *p* = .03) or longer than 20 years (*MWDS* = 1.28, *p* = .05) on the variable *completing award applications*.

Teachers with the least experience (0-1 years) rated *classroom management* as their primary concern (*MWDS* = 8.00). A significant difference existed in these teachers' MWDS for *classroom management* and the MWDS for 6 to 10 year teachers (*MWDS* = 2.17, *p* = .012), 11 to 20 year teachers (*MWDS* = 1.24, *p* = .002), and teachers with more than 20 years of experience (*MWDS* = 1.71, *p* = .003). Additionally with *classroom management*, The MWDS of teachers who had been teaching 2 to 5 years (4.23) was significantly higher than teachers with 11 to 20 years of experience (*MWDS* = 1.24, *p* = .016) and teachers with more than 20 years of experience (*MWDS* = 1.71, *p* = .013). For the item *modifying instruction for students with special needs*, the MWDS of teachers with 0 to 1 year of experience (6.27) was statistically different than the MWDS for teachers with 11 to 20 years of experience (*MWDS* = .13, *p* = .021). What is more, teachers with 2 to 5 years of experience also had a significantly higher MWDS for this item (*MWDS* = 3.58) than did teachers with 11 to 20 years of experience (*p* = .012). Post–hoc results also revealed that for *teaching biotechnology*, a significant difference existed between teachers with 6 to 10 years of experience (*MWDS* = 4.36) and teachers with 11 to 20 years of experience (*MWDS* = .87, *p* = .013). Lastly, new teachers had a high MWDS (6.45) score for *repairing and reconditioning agricultural tools and equipment*; however, this was not significantly different than any other groups, but teachers with over 20 years of experience had significantly lower MWDS (1.61) for *repairing and reconditioning agricultural tools and equipment* than did teachers with 2 to 5 years of experience (*MWDS* = 5.07, *p* = .01) or teachers with 6 to 10 years of experience (*MWDS* = 5.12, *p* = .023).

Conclusions, Implications, and Recommendations

Based on the stated research problem and the research questions that guided this study, several conclusions can be drawn from an analysis of the data received. The first research question sought to identify the overall professional development needs of Florida agricultural education teachers. The results revealed that teachers' greatest need was for assistance in dealing with workplace stressors, including *managing stress*, *balancing work/personal lives*, and *managing time*. Whereas these needs were reported in previous studies (Roberts & Dyer, 2003; 2004), teachers did not exhibit the same level of need. Perhaps this is a function of the conditions in Florida at this time. This study was conducted during a time in which budget deficits were causing school districts in Florida to make personnel cuts and increasing class sizes. Teachers were being asked to do more with less. Also, the teacher tenure system was abolished and replaced with a new evaluation system that linked both teacher pay and job security to student performance on end of course exams and industry certification for students at the end of the agriculture program. In this context, it was not surprising to see needs dealing with stress management ranked at the top of teachers' professional development needs.

It should be noted that this change in the types of professional development needs of teachers took place in less than a decade since the last needs survey had been administered to teachers in Florida. Several researchers have expressed the need for continued monitoring of teachers' professional development needs (Garton & Chung, 1996; 1997; Greiman, 2010; Roberts & Dyer, 2003; 2004; Stair, Warner, & Moore, 2012). Findings in this study validate those recommendations. Given the frequency and depth of changes in the educational systems in both Florida and other states across this country, it is recommended that teacher educators closely monitor the professional education needs of teachers in their states and adjust their delivery programs to respond to those needs.

Teachers also expressed needs for professional development in areas that seem to have been identified in virtually all professional development needs surveys. For example, pedagogy, student motivation, classroom management, integration of mathematics and/or science into the agriculture curriculum, as well as other curricular issues, have been identified as needs for several years or even decades in some cases (Garton & Chung, 1996, 1997; Joerger; 2002; Mundt & Conners, 1999; Myers et al., 2005; Roberts & Dyer, 2003; 2004; Stair, Warner, & Moore, 2012; Washburn et al., 2001). Apparently the professional development programs that have been previously offered are not meeting teachers' needs in these areas. Or, is it possible that the educational environment is changing so quickly that the focus of the delivery needs to address not only the existing need, but to help teachers identify ways in which they can contextually adapt solutions from existing problems to emerging ones? It is recommended that more process-oriented studies in the area of professional development be undertaken.

The second research question sought to identify differences that might exist in the professional development needs of male versus female agricultural education teachers. Whereas female teachers expressed a greater need for professional development for most of the items surveyed, the largest differences were observed for items related to teaching in various laboratories and in those related to integrating science and math. It should be noted, however, that a confounding variable may account for these differences. Roberts and Dyer (2004) noted that a majority of alternately certified teachers in their study were female. The differences in needs of female teachers in this study closely resemble those found by Roberts and Dyer and therefore may be more of a function of the path taken to certification than to gender. Another area of need identified in this study that did not appear in the Roberts and Dyer study was *balancing work and personal life*, with females expressing a significantly greater need for assistance. While the challenges experienced by female agriculture teachers have been documented (Baxter, Stephens, & Thayer–Bacon, 2011; Kelsey, 2006a; 2006b), the need still exists to help female teachers with this need.

The third research question sought to identify differences that might exist in the professional development needs of middle school versus high school agricultural education teachers. Only one need appeared as a difference. High school teachers expressed a greater need for development in *preparing students for industry certifications*. Since middle school teachers are not directly affected by this requirement and did not consider it a professional development need, it was expected that a difference would exist in this area. However, the similarities in professional development needs for these two groups of teachers are inconsistent with previous research (Roberts & Dyer, 2003) in which middle school teachers greatly differed in their needs. However, the lack of differences in this study can likely be explained by a curriculum shift in Florida. The course *Agriscience Foundations* had historically been the introductory course offered to high school freshman. This course has a broad focus that examines a wide variety of technical agriculture content. Beginning in 2008, middle school teachers were allowed to offer the course to eighth grade students. Previously, the curricula at the middle school level had been more exploratory, with minimal emphasis on in-depth technical content. It is plausible that since middle school teachers are now teaching many of the same concepts as high school teachers that their professional development needs would now be similar.

The fourth research question sought to identify differences that might exist in the professional development needs of agricultural education teachers based on their years of experience. Multiple differences existed. This is consistent with Moir's (1990) stages of teacher development and with Greiman's (2010) previous work. As expected, new teachers exhibited the highest MWDS on items. Specifically, new teachers expressed a greater need for developing classroom management skills, which decreased as teacher experience increased. This is consistent with previous research (Garton & Chung, 1996; 1997; Stair, Warner, & Moore, 2012). New teachers also expressed a greater need for learning how to *modify instruction for special needs students*, which was also consistent with earlier research (Myers et al., 2005). The most inexperienced teachers also expressed a greater need for developing their skills in *repairing and reconditioning agricultural tools.* This deficiency was also noted for beginning teachers in Texas (Saucier & McKim, 2011).

As teachers gained experience, their needs varied. Teachers with moderate experience (6 to 10) expressed the greatest need on *completing* [FFA] *award applications* and *teaching biotechnology*. This emphasis on program enhancement (student recognition and curricula enhancement) likely indicate that this group of teachers has reached a stage of career development in which they had moved beyond the novice and apprentice stages experienced by new teachers and transitioning to the stages of professional and expert by expanding their own ability to provide a higher quality program for their students (Steffy & Wolfe, 2001). Whereas teachers with more experience (11 to 20 years) had expressed lower needs than their peers on many of the items, perhaps because they had reached the expert stage of development (Steffy & Wolfe, 2001). Teachers with over 20 years of experience had lesser needs than their younger colleagues, as they were likely transitioning in to the expert and distinguished stages of their careers (Steffy & Wolfe, 2001).

Based on the teachers surveyed in this study, it would appear that there is no "one size fits all" approach to teacher professional development. Greiman (2010) recommended that a variety of professional development opportunities should be offered to teachers using a variety of delivery mechanisms. Professional development providers in Florida should use these results to develop and implement a plan for the next 3 to 5 years.

This study represents the findings from one state at one point in time. Given the national–level professional development opportunities (i.e. NAAE Conference, National FFA Convention, etc.), teachers in other states should be assessed to see if similar patterns emerge on a national scale. Additionally, professional development needs should routinely be assessed over time to see if they change. It appears that teachers in the current study were reacting to immediate pressures in their situations. These conditions may change over time as policies and economic conditions change.

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Discussant Remarks: Kim E. Dooley

Variations in Professional Development Needs of Florida Agricultural Education Teachers Based on Gender, School Level, and Experience

Inservice teacher training and professional development are critical for the retention and continuous improvement of the teaching profession. Ensuring that professional development topics match with perceived training needs is an important consideration. In my role as discussant, I would like to pose discussion around broader implications from the results of this study.

This study determined the professional development needs of Florida agricultural education teachers by gender, level of instruction, and years of experience using survey methodology. The Borich Needs Assessment Model was a good measure to determine differences in knowledge and relevancy. Essentially, the greatest needs were managing stress, time, and finding balance. Professional development alone cannot fully address these issues, due to the demands and complexity of the agricultural teaching position. As agricultural educators, how can we address these issues beyond professional development? What other strategies reduce teacher burn-out in general?

It was interesting to review the findings through a gender lens. Female agricultural teachers are growing in numbers with many of them being alternatively certified. Other studies within our profession have looked at topics like STEM integration across the curriculum. Are we preparing our pre-service teachers to effectively integrate STEM? Are there differences between alternatively certified teachers regardless of gender? In the book "Talk about Leaving" women were interviewed about why they left the STEM majors. Are there social factors causing girls to select out of STEM at an early age? Are there equal opportunities to learn how to repair and recondition agricultural tools and equipment as in the past? Is family life-work balance more of an issue for women because of traditional gender roles in the home?

It was not surprising that a key difference between middle school and high school agricultural teachers was industry certifications. I did find it intriguing that the basic development needs were the same regardless of level. Years of experience did impact perception of training needs, as would be expected. Other studies show that mentoring is an effective professional development tool. How can more experienced teachers become a part of the professional development model?

I enjoyed reading the manuscript and look forward to our discussion.

Effective Professional Development: An Examination of Core Features

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Abstract

Inservice teacher professional development has been a foundational component of many reform efforts aimed at increasing student achievement and has been recommended as a means of increasing academic integration in CTE courses. This study was designed to determine the impact of a professional development opportunity which used recommended core professional development features on agriscience teachers' perceptions regarding various aspects of science integration. Through a survey design, findings indicated that teachers engaged in inquiry-related activities more often following the professional development. Additionally, professional development duration and the inclusion of active learning in professional development were not directly influential in the event's effectiveness. Because both duration and active learning are included in Desimone's (2009) core features of professional development, further research should be conducted to better understand why increased duration and the inclusion of active learning did not result in a difference in respondents' perceptions of their behaviors.

Introduction

Student achievement has been the educational currency by which secondary school programs have been measured for at least the past three decades. In their report titled, *A Nation at Risk: The Imperative for Educational Reform*, the National Research Council (Gardner, 1983) cited numerous pieces of evidence of the American school system's failure to its students, including a steady decline in standardized test scores, an increase in illiteracy, and a lack of "higher order intellectual skills" (p. 9). The No Child Left Behind Act (2001) cited similar problems related to student achievement and proposed improving educational quality through a blueprint which focused on increasing school and teacher accountability for student achievement and providing funds for enhancing teacher quality through numerous avenues, including professional development.

Efforts in career and technical education (CTE) have followed a similar path. Business leaders have anticipated shortages in "areas ranging from non-residential construction and energy to information technology, healthcare and the STEM fields" (Harvard Graduate School, 2011, p. 4) as a result of inadequate educational preparation. In 1988, the National Research Council recommended that secondary agricultural education programs be substantially revised to better prepare students for further education and future employment, and that the quality of programs be enhanced. The constantly increasing overlap between agricultural science and science, technology, engineering, and math (STEM) (NRC, 2009) has led to the development of CTE programs that strive to teach students aspects of scientific literacy, including the acquisition of STEM principles, problem solving, and scientific inquiry (Asunda, 2012; Clark & Ernst, 2008; Phipps, Osborne, Dyer, & Ball, 2008). However, numerous studies (Myers, Thoron, & Thompson, 2009; Myers & Washburn, 2008; Shelley-Tolbert, Conroy, & Dailey, 2000; Spindler, 2010; Steward, Moore, & Flowers, 2004) have found that CTE teachers express feelings of inadequacy related to science integration, citing barriers including insufficient background in science content and lack of personal experience in science integration. Castellano, Stringfield, and Stone III (2003) stated that teachers in general, including CTE teachers, lacked the training necessary to develop curriculum which integrates CTE and academics. In 2001, Layfield, Minor, & Waldvogel summarized a group of 11 studies from 1989 to 2000 concerning the state of science integration in agricultural education, relaying the following themes:

1. many teachers feel that they did not receive adequate science coursework in college to teach agriscience effectively;
2. there is a shortage of in-service training available to make up for this lack of science knowledge;
3. there is a need for more interaction between agriculture and science teachers;
4. teaching resources and institutional support for agriscience curriculum revision are not always available in needed amounts; and
5. pre-service agricultural education curricula need to focus specifically on agriscience as a core theme. These programs also need to provide would-be teachers with practical experience in how to successfully integrate science with agriculture in the classroom (p. 423).

Inservice teacher professional development has been a foundational component of many reform efforts aimed at increasing student achievement (Supovitz & Turner, 2000), and has been recommended as a means of increasing academic integration in CTE courses (Castellano, Stringfield, & Stone III, 2003; Levin, 1995; Myers & Thompson, 2009; Myers & Washburn, 2008; Spindler, 2010). Billions of dollars are spent annually on a myriad of professional development activities in an effort to improve student achievement (Birman, et al., 2007). While these activities can vary greatly, the features of professional development activities have been shown to impact desired outcomes (Desimone, 2009). This study was designed to determine the impact of a professional development opportunity which used recommended core professional development features on agriscience teachers' perceptions regarding various aspects of science integration.

Theoretical Framework

Professional development has been considered the most effective means of changing teacher practices (Supovitz & Turner, 2000). The assumptions of professional development's effectiveness can be seen in Bandura's (1986) social cognitive theory, which states that behavior both influences and is influenced by environment and internal personal factors. The teacher enters professional development activities with certain personal factors, such as physical characteristics and personal beliefs. These factors influence behaviors, which are expressed in the environment of the professional development activity. Characteristics of the professional development activity can also influence attitudes, which can alter teacher behavior. These shared assumptions between social cognitive theory and the use of professional development justify the use of social cognitive theory as the grand theory of this study.

Desimone (2009) proposed a list of empirically based core features to be incorporated into professional development activities, including a focus on content, active learning strategies, coherence between new content and previous knowledge and beliefs, sufficient duration, and collective participation among teachers (Figure 1). Desimone recommended that these core features be included in "studies of the effectiveness of professional development, to allow studies to build on each other and refine and expand our knowledge base" (p. 183).

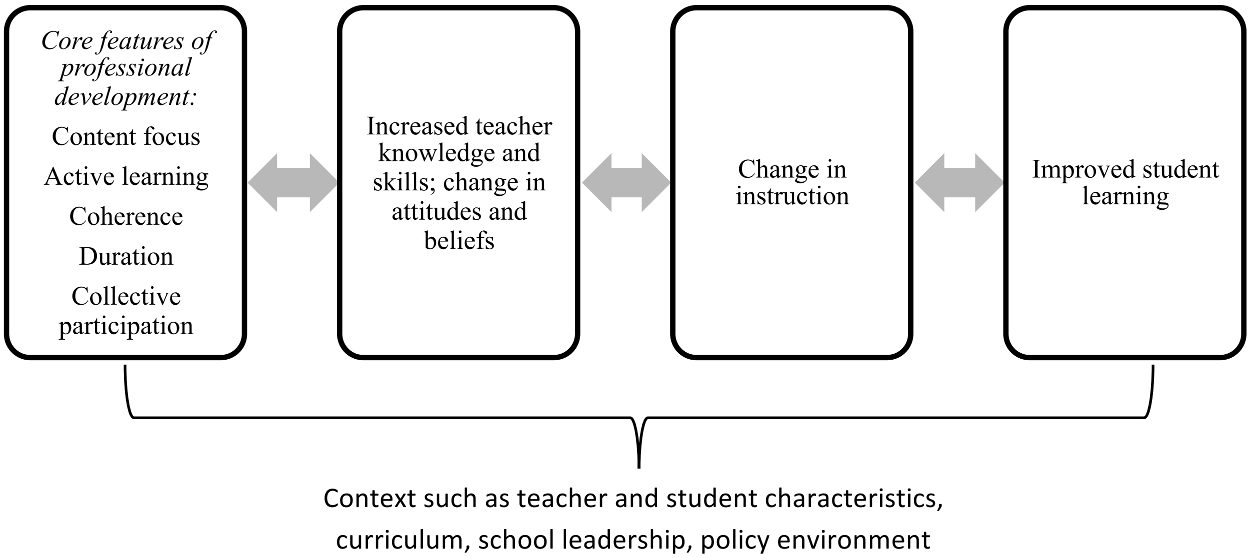

Figure 1. Proposed core conceptual framework for studying the effects of professional development on teachers and students (Desimone, 2009).

Core Features of Professional Development

Encompassing “any activity that is intended partly or primarily to prepare paid staff members for improved performance in present or future roles in the school districts” (Little, 1987, p. 491), professional development experiences constitute a variety of teacher training activities, ranging from “formal, structured topic-specific seminars…to everyday, informal ‘hallway’ discussions” (Desimone, 2009, p. 182). Among the myriad of professional development venues and activities, a national consensus regarding effective components of teacher training has emerged (Supovitz & Turner, 2000). Research contributing to the effectiveness of these established attributes, as well as additional characteristics currently in more infantile stages of exploration, can greatly improve the body of knowledge in effective professional development, as previous research has shown that the characteristics of professional development were influential in the impact the training had on teacher behavioral change (Desimone, Porter, Garet, Yoon, & Birman, 2002; Garet, Porter, Desimone, Birman, & Yoon (2001). According to Desimone’s (2009) model, these effective components include content focus, active learning, coherence, duration, and collective participation.

Content Focus

Research has indicated that effective professional development activities focus on subject matter content (Cohen & Hill, 1998; Desimone, 2009; Kennedy, 1998; Little, 2001; Supovitz & Turner, 2000). Loucks-Horsley, Stiles, & Hewson (1996) stated that this focus on content can help teachers gain a more thorough understanding of the disciplines they teach while helping them better understand how students will react to specific conceptions. Among the benefits of professional development with content focus are increased student learning, increased teacher knowledge and skills, and improved teaching practices (Desimone, 2009; Kennedy, 1998; Supovitz & Turner, 2000).

Active Learning

In a variety of forms, active learning has been shown to positively impact the effectiveness of professional development activities (Desimone, 2009; Supovitz & Turner, 2001). In contrast to the more traditional lecture-style professional development setting, active learning opportunities engage teachers in activities that require interactive feedback (Desimone, 2009), inquiry and experimentation (Supovitz & Turner, 2000), and learning in and from practice (Little, 2001). Established on the notion of modeling best teaching practices, professional development activities which model scientific reasoning have been found to have a greater impact on student achievement than that which inform about specific curricula (Marek & Methaven, 1991).

Coherence

Coherence refers to "the extent to which teacher learning is consistent with teachers' knowledge and beliefs", as well as to "the consistency of school, district, and state reforms and policies with what is taught in professional development" (Desimone, 2009, p. 184). Supovitz & Turner (2001) alluded to coherence through their recommendations for professional development that is grounded in standards, alignment with other aspects of school reform, and connected to teachers' standards of student performance. Coherence can be a challenge for CTE-based reform, as the delivering entities are often associated with groups not associated with the school or district, including university-based teacher educators and those representing CTE associations and organizations (Anderson, Barrick, & Hughes, 1992).

Duration

Effective professional development initiates teacher behavioral change through intensive practice which is sustained over a sufficient period of time (Desimone, 2009; Little, 2001; Supovitz & Turner, 2001). While "sufficient" is less than prescriptive, research has not indicated an exact 'tipping point' for duration but shows support for activities that are spread over a semester and include 20 hours or more of contact time" (Desimone, 2009, p. 184). Opportunities for sustained professional development in CTE teacher education are rare, as the majority of sustained professional development programs occur within schools (Shoulders & Myers, 2011).

Collective Participation

Collective participation by teachers provides opportunities for sustained discourse and collaboration among a group of teachers (Desimone, 2009). While supported both financially and verbally in recent reform efforts, professional development activities enabling effective, sustained collective participation have been scattered and inconsistent (Little, 2001). Collective participation in CTE professional development has been even more undocumented; Desimone (2009) recommended that collective participation can occur through the establishment of groups "from the same school, grade, or department" (p. 184), yet omitted any collective participation opportunities beyond the single school setting. However, in a collection of CTE teacher interviews, Ruhland & Bremer (2002) found that support, through mentors or a peer support group, was identified as a needed component of professional development. The professional identity of CTE teachers as a group, apart from other teachers, gives merit to the notion of collective participation in professional development designed specifically for these teachers (Shoulders & Myers, 2011).

The need for effective professional development is great among CTE teachers, as can be seen in agricultural education. In their study, Roberts & Dyer (2004) found that over half of their sample of traditionally certified teachers felt a great need for professional development in aspects of FFA and SAE supervision, teaching through technology, student motivation, teaching leadership, and aspects of technical agricultural concepts, including biotechnology, genetic engineering, and global positioning systems. However, the professional development needs and professional identities of CTE teachers are varied, causing researchers to recommended individualized professional development programs for these teachers (Ruhland & Bremer, 2002; Shoulders & Myers, 2011). The five core features of effective professional development can be included in studies examining the components of professional development opportunities for CTE teachers to better recommend best practices in CTE teacher inservice (Shoulders & Myers, 2011), as well as to add to the body of knowledge regarding effective core features of professional development (Desimone, 2009).

Agriscience teachers currently have the opportunity to participate in a professional development program which employs Desimone's (2009) five core features. The National Agriscience Teacher Ambassador Academy (NATAA) was established in 2002, and for the first five years of its existence focused "primarily on offering science curricula professional development to agriculture teachers…as well as showcasing the importance of promoting careers in science" (Shoulders & Myers, 2011b, p. 60). Since 2006, the program has offered agriscience teachers intensive, week-long immersion in recommended inquiry-based teaching techniques through active participation in agricultural contexts (Thoron, 2010). The teachers create a cohort through the program, sustained through workshops and leadership in further professional development throughout the year (Shoulders & Myers, 2011b). Teachers are also permitted to participate in the program for up to two years, further enabling sustained professional development in a participatory environment coherent with their identities as agriculture teachers (Shoulders & Myers, 2011a).

Purpose and Objectives

The purpose of this study was to describe the impact of professional development opportunities employing Desimone's (2009) five core features on CTE teachers' behavioral practices related to scientific literacy. To achieve this purpose, the following objectives guided this study:

1. Describe teachers' perceptions regarding the impact of professional development on their use of inquiry-based practices teaching practices and laboratory activities.
2. Describe the impact of professional development opportunities utilizing all five of Desimone's (2009) core features on CTE teachers' perceptions of their use of inquiry-based teaching practices and laboratory activities.
3. Describe the difference between the impact of one- and two-year durations of participation in professional development on CTE teachers' perceptions of their use of inquiry-based teaching practices and laboratory activities.

Methodology

This study utilized a descriptive survey research design. The population was all participants of the NATAA since its establishment in 2002 (n = 133). Through its evolution toward greater focus on inquiry and the opportunity for teachers to participate more than once, as well as through its opportunities for collective participation within a nation-wide group of CTE teachers, the NATAA provides an opportune environment in which Desimone's five core features of professional development can be examined. The study employed a census, thereby limiting all findings and related discussion to the population.

The population was sent an electronic questionnaire which was adapted from a collection of previously developed questionnaires: a) the Teacher Inquiry Scale (Dunbar, 2002; Washburn & Myers, 2010); b) the Student Inquiry Scale (Dunbar, 2002; Washburn & Myers, 2010); and c) the Perception of the Role of Practical Work Instrument (Al-Naqbi & Tairab, 2005). The Teacher Inquiry Scale and Student Inquiry Scale were adapted by Washburn and Myers (2010) from Dunbar's (2002) questionnaire by modifying items to include the term "agricultural" and substituting terms to improve clarity. Dunbar (2002) reported internal consistency on the original questionnaire using Cronbach's alpha of 0.90, while Washburn and Myers' *post-hoc* reliability analysis resulted in a Cronbach's alpha of 0.81. This section of the questionnaire included nine teacher-related statements and 14 student-related statements asking teachers to indicate on a Likert-type scale the frequency with which they proceeded in a certain manner, such as, "encourage students to initiate further investigation," or asked students to proceed in a certain manner, such as, "memorize scientific facts or information separately from activities". The six choices on the Teacher Inquiry Scale ranged from "never" to "5x per week", while the six choices on the Student Inquiry Scale ranged from "never" to "1x per day".

The Perception of the Role of Practical Work Instrument utilizes 20 statements to ascertain teachers' perceptions about the role of laboratory work in knowledge acquisition, process skill development, and attitude development (Al-Naqbi & Tairab, 2005). Face and content validity were established by the developers through consultation with seven educators in post-secondary and secondary science education. Reliability was calculated on the original instrument through the use of 50 undergraduate students and was found to be 0.88.

The questionnaire items utilized in this survey were adapted from Washburn and Myers' (2010) version and Al-Naqui and Tairab's (2005) instrument by including an area for teachers to respond to the question regarding their perceptions both before and after their participation in the NATAA. This method of retrospective pretesting is designed to counter potential response bias, "where participants may under- or overestimate their knowledge, skills, abilities or understanding prior to course implementation or any program intervention" (Reston, 2007, p. 3). The retrospective pretest has been identified as particularly appropriate when assessing professional development, as "the traditional pretest may not be effective if participants do not sufficiently understand, prior to the workshop, terms or concepts needed to answer pretest questions" (Lamb, 2005, p. 18). While vulnerable to limitations including social desirability to display a learning effect, the retrospective pretest enables respondents to fully understand the terminology included in items regarding a newly-introduced theory or technique (Campbell & Stanley, 1963). Because of the complex nature of inquiry-based instruction and scientific literacy and ease with which longitudinal data can be collected, the researchers deemed the retrospective pretest an appropriate means of instrumentation for this study.

In an attempt to address non-response error, a total of eight respondent contacts were made (Dillman, 2000). These included a pre-study electronic mail contact, instrument electronic mailings, and reminders via both electronic and telephone. A total of 105 respondents returned questionnaires for a 79% response rate. Findings are limited to these respondents.

Findings

The majority (80%) of the respondent group was found to still be engaged in teaching agriculture at the secondary school level. Further, 82% of the respondents attended the NATAA professional development after the format change which occurred in 2006. It was also reported less than one-third (31%) of the respondents participated in more than one NATAA professional development session. Only those respondents who were still actively engaged in teaching agriculture at the secondary school level participated in the remainder of the instrument. This decision was made since respondents were asked to indicate the level to which specific ideas, skills, and methods were implemented in the agriculture classroom. Those individuals not engaged in teaching would not have the opportunity to implement these items in the setting of interest.

The first objective of this research was to describe teachers' perceptions regarding the impact of professional development on their use of inquiry-based practices teaching practices and laboratory activities. This was achieved through the use of three difference scales, the Teacher Inquiry Scale and the Student Inquiry Scale (Dunbar, 2002) and the Perception of the Role of Practical Work Instrument (Al-Naqbi & Tairab, 2005). The Teacher Inquiry Scale asked respondents to indicate the frequency in which they engage in inquiry activities in their classrooms prior to (Table 1) and following (Table 2) the professional development. A grand mean of 2.42 (SD = 0.87) for this scale was calculated from teacher responses prior to the professional development with a grand mean of 4.11 (SD = 0.80) following the event.

Table 1
Teacher Inquiry Scale Prior to Professional Development

	Percent						
On average, to what extent do you:	Never[b]	<1x per week[c]	1x per week[d]	2x per week[e]	3x per week[f]	4x per week[g]	5x per week[h]
Use a textbook as the primary method for studying agriscience.[a]	14.6	30.5	11.0	17.1	20.7	3.7	2.4
Use open-ended questions that encourage observation, investigations, and scientific thinking.	2.5	15.0	27.5	32.5	16.3	5.0	1.3
Identify agricultural situations/issues that can be investigated at varying levels of complexity.	6.1	18.3	40.2	24.4	6.1	2.4	2.4
Encourage students to initiate further investigation.	8.9	24.1	27.8	26.6	7.6	5.1	0.0
Ask a question or conduct an activity that calls for a single correct answer.[a]	0.0	6.2	9.9	25.9	25.9	12.3	19.8
Facilitate and encourage student dialogue about science.	3.9	20.8	18.2	32.5	15.6	6.5	2.6
Encourage students to defend the adequacy or logic of statements and findings.	8.8	25.0	25.0	22.5	16.3	2.5	0.0
Make readily available to students a wide variety of resource materials for scientific investigations.	4.9	38.3	14.8	23.5	8.6	2.5	7.4

Encourage students to design and conduct experiments.	14.6	48.8	14.6	11.0	6.1	1.2	3.7

Note. $N = 82$. Grand mean = 2.42 (SD = 0.87) [a] reverse coded for analysis. [b] Coded as 0, [c] Coded as 1, [d] Coded as 2, [e] Coded as 3, [f] Coded as 4, [g] Coded as 5, [h] Coded as 6

Table 2
Teacher Inquiry Scale Following Professional Development

	Percent						
On average, to what extent do you:	Never[b]	<1x per week[c]	1x per week[d]	2x per week[e]	3x per week[f]	4x per week[g]	5x per week[h]
Use a textbook as the primary method for studying agriscience.[a]	22.0	51.2	12.2	13.4	1.2	0.0	0.0
Use open-ended questions that encourage observation, investigations, and scientific thinking.	0.0	1.2	3.7	12.3	28.4	23.5	30.9
Identify agricultural situations/issues that can be investigated at varying levels of complexity.	0.0	2.4	9.8	29.3	26.8	20.7	11.0
Encourage students to initiate further investigation.	0.0	2.6	9.0	19.2	30.8	23.1	15.4
Ask a question or conduct an activity that calls for a single correct answer.[a]	3.8	29.1	22.8	24.1	8.9	6.3	5.1
Facilitate and encourage student dialogue about science.	0.0	1.3	2.6	17.9	25.6	29.5	23.1
Encourage students to defend the adequacy or logic of statements and findings.	0.0	1.3	8.8	26.3	21.3	23.8	18.8
Make readily available to students a wide variety of resource materials for scientific investigations.	0.0	3.7	17.3	18.5	17.3	22.2	21.0
Encourage students to design and conduct experiments.	0.0	12.2	15.9	23.2	24.4	11.0	13.4

Note. $N = 82$. Grand mean = 4.11 (SD = 0.80) [a] reverse coded for analysis. [b] Coded as 0, [c] Coded as 1, [d] Coded as 2, [e] Coded as 3, [f] Coded as 4, [g] Coded as 5, [h] Coded as 6

The Student Inquiry Scale asked respondents to indicate the frequency of which students are asked to engage in various inquiry activities prior to (Table 3) and following (Table 4) the professional development. A grand mean of 2.47 (SD = 0.64) for this scale was calculated from teacher responses prior to the professional development with a grand mean of 3.36 (SD = 0.46) following the event.

Table 3
Student Inquiry Scale Prior to Professional Development

How often do you ask students in your	Percent

classroom to:	Never[b]	1x per year[c]	1x per semester[d]	1x per month[e]	1x per week[f]	1x per day[g]
Memorize scientific facts or information separately from activities. [a]	25.4	8.5	11.3	32.4	21.1	1.4
Use data to construct a reasonable explanation.	5.2	11.7	26.0	36.4	16.9	3.9
Seek and recognize patterns (trends in data).	9.2	11.8	28.9	31.6	17.1	1.3
Follow a set series of steps to get the right answer to a question. [a]	2.6	5.2	16.9	26.0	39.0	10.4
Ask questions during investigations that lead to further ideas, questions, and investigations.	6.4	3.8	24.4	28.2	26.9	10.3
Wait to act until the teacher gives instruction for the next step in the investigation. [a]	3.8	1.3	12.7	22.8	31.6	27.8
Choose appropriate tools for an investigation.	10.1	6.3	17.7	31.6	21.5	12.7
Wait for the teacher's explanation before expressing an observation or conclusion. [a]	10.3	2.6	10.3	29.5	32.1	15.4
Offer explanations from previous experiences and from knowledge gained during investigations.	2.6	3.8	20.5	29.5	25.6	17.9
Make connections to previously held ideas (or revise previous conceptions/assumptions).	3.9	3.9	18.2	29.9	24.7	19.5
Communicate investigations and explanations to others.	6.4	10.3	23.1	33.3	17.9	9.0
Use investigations to satisfy their own questions.	25.3	8.9	29.1	17.7	16.5	2.5
Listen carefully to peers as they discuss scientific investigations.	16.9	10.4	22.1	28.6	18.2	3.9
Use drawing, graphing, or charting to convey new information from an agriscience activity	6.3	12.7	26.6	32.9	19.0	2.5

Note. *N* = 82. Grand mean = 2.47 (SD = 0.64) [a] Reverse coded for analysis [b] Coded as 0, [c] Coded as 1, [d] Coded as 2, [e] Coded as 3, [f] Coded as 4, [g] Coded as 5

Table 4
Student Inquiry Scale Following Professional Development

	Percent					
How often do you ask students in your classroom to:	Never[b]	1x per year[c]	1x per semester[d]	1x per month[e]	1x per week[f]	1x per day[g]
Memorize scientific facts or information separately from activities. [a]	19.4	8.3	12.5	26.4	26.4	6.9
Use data to construct a reasonable explanation.	0.0	2.6	1.3	33.3	51.3	11.5
Seek and recognize patterns (trends in data).	0.0	1.3	10.7	33.3	40.0	14.7
Follow a set series of steps to get the right answer to a question. [a]	1.3	1.3	7.9	31.6	50.0	7.9
Ask questions during investigations that lead to further ideas, questions, and investigations.	0.0	0.0	2.6	15.6	41.6	40.3

Wait to act until the teacher gives instruction for the next step in the investigation. [a]	11.7	5.2	13.0	32.5	23.4	14.3
Choose appropriate tools for an investigation.	0.0	2.6	9.1	31.2	37.7	19.5
Wait for the teacher's explanation before expressing an observation or conclusion. [a]	26.9	6.4	19.2	19.2	21.8	6.4
Offer explanations from previous experiences and from knowledge gained during investigations.	0.0	0.0	3.9	20.8	41.6	33.8
Make connections to previously held ideas (or revise previous conceptions/assumptions).	0.0	0.0	2.6	18.2	35.1	44.2
Communicate investigations and explanations to others.	0.0	0.0	5.2	27.3	49.4	18.2
Use investigations to satisfy their own questions.	1.3	1.3	10.3	33.3	39.7	14.1
Listen carefully to peers as they discuss scientific investigations.	0.0	1.3	7.7	25.6	42.3	23.1
Use drawing, graphing, or charting to convey new information from an agriscience activity	0.0	0.0	5.1	27.8	50.6	16.5

Note. $N = 82$. Grand mean = 3.36 (SD = 0.46) [a] Reverse coded for analysis [b] Coded as 0, [c] Coded as 1, [d] Coded as 2, [e] Coded as 3, [f] Coded as 4, [g] Coded as 5

Teachers were asked to state their perceptions about the role of laboratory work in knowledge acquisition, process skill development, and attitude development using the Perception of the Role of Practical Work Instrument (Al-Naqbi & Tairab, 2005) both prior to (Table 5) and following (Table 6) the professional development. A grand mean of 2.60 (SD = 0.33) for this scale was calculated from teacher responses prior to the professional development with a grand mean of 2.85 (SD = 0.19) following the event.

Table 5
Teacher Perception of Laboratory Activities Prior to Professional Development

The purpose of laboratory activities in my classroom are:	%D	%N	%A
To arouse and maintain interest	1.3	1.3	97.3
To develop an ability to comprehend and carry out instruction	2.7	9.5	87.8
To make phenomena more real through experience	2.6	10.5	86.8
To find facts and arrive at new principles	6.7	10.7	82.7
To verify facts and principles already taught	4.0	13.3	82.7
To encourage accurate observation descriptions	3.9	17.1	78.9
To give experience in standard techniques	3.9	19.7	76.3
To promote logical reasoning	5.3	21.1	73.7
To practice seeing problems and seeking ways to solve them	15.8	11.8	72.4
To develop an ability to communicate	16.0	14.7	69.3
To develop a critical attitude	9.3	25.3	65.3
To help remember facts and principles	13.3	21.3	65.3
To develop specific manipulative skills	16.2	20.3	63.5
To indicate the industrial aspects of agriscience	14.5	22.4	63.2
To prepare students for practical examinations	18.7	22.7	58.7
To develop self-reliance	12.2	31.1	56.8

To develop creativity	21.1	22.4	56.6
To elucidate theoretical work as an aid to comprehension	16.2	31.1	52.7
To develop certain attitudes of discipline	11.8	38.2	50.0

Note. *N* = 82. Grand mean = 2.60 (SD = 0.33) Original scale: 1 = Strongly Disagree (SD), 2 = Disagree (D), 3 = Neither Agree or Disagree (N), 4 = Agree (A), 5 = Strongly Agree (SA). Responses were collapsed into: Disagree (D), Neither Agree or Disagree (N), and Agree (A)

Table 6
Teacher Perception of Laboratory Activities Following Professional Development

The purpose of laboratory activities in my classroom are:	%D	%N	%A
To practice seeing problems and seeking ways to solve them	0.0	1.3	98.7
To arouse and maintain interest	0.0	1.3	98.7
To promote logical reasoning	0.0	2.7	97.3
To make phenomena more real through experience	1.3	4.0	94.7
To encourage accurate observation descriptions	1.3	3.9	94.7
To develop an ability to communicate	2.7	2.7	94.6
To develop a critical attitude	0.0	5.5	94.5
To develop self-reliance	0.0	6.7	93.3
To find facts and arrive at new principles	4.0	2.7	93.3
To develop an ability to comprehend and carry out instruction	4.0	4.0	92.0
To give experience in standard techniques	3.9	6.6	89.5
To elucidate theoretical work as an aid to comprehension	2.7	8.1	89.2
To develop creativity	2.6	10.5	86.8
To develop specific manipulative skills	5.3	9.3	85.3
To indicate the industrial aspects of agriscience	5.3	10.5	84.2
To develop certain attitudes of discipline	7.9	10.5	81.6
To prepare students for practical examinations	11.8	11.8	76.3
To verify facts and principles already taught	7.9	15.8	76.3
To help remember facts and principles	9.3	14.7	76.0

Note. *N* = 82. Grand mean = 2.85 (SD = 0.19) Original scale: 1 = Strongly Disagree (SD), 2 = Disagree (D), 3 = Neither Agree or Disagree (N), 4 = Agree (A), 5 = Strongly Agree (SA). Responses were collapsed into: Disagree (D), Neither Agree or Disagree (N), and Agree (A)

The second objective sought to determine the impact of professional development opportunities utilizing all five of Desimone's (2009) core features on CTE teachers' perceptions of their use of inquiry-based teaching practices and laboratory activities. In 2006, the NATAA format was restructured to more closely align with the core features. Therefore responses were separated based on the participants' attendance prior to or following the restructuring. The respondents who attended the professional development prior to 2006 (n = 13) had grand means on the three measures of the Teacher Inquiry Scale, Student Inquiry Scale, and the Perception of the Role of Practical Work Instrument of 4.16 (SD = 1.24), 3.39 (SD = 0.72), and 2.85 (SD = 0.17) respectively. The respondents who attended the professional development 2006 or after (n = 69) had grand means on the same three measures of 4.10 (SD = 0.71), 3.36 (0.41), and 2.86 (SD = 0.20) respectively.

The third objective sought to describe the difference between the impact of one- and two-year durations of participation in professional development on CTE teachers' perceptions of their use of inquiry-based teaching practices and laboratory activities. Therefore responses were separated based on the number of times participants attended the professional development – once or twice. The respondents who attended the professional development once (n = 60) had grand means on the three measures of the Teacher Inquiry Scale, Student Inquiry Scale, and the Perception of the Role of Practical Work Instrument of 4.09 (SD = 0.71), 3.33 (SD = 0.40), and 2.88 (SD = 0.20) respectively. The respondents who attended the professional development twice (n = 22) had grand means on the same three measures of 4.16 (SD = 1.03), 3.43 (0.61), and 2.80 (SD = 0.18) respectively.

Conclusions/Recommendations

Based on an evaluation of the grand means of the various scales utilized in this the research, participant responses differed following attending the professional development from what was reported prior to the event, supporting previous statements regarding the effectiveness of professional development on teacher behavior change (Desimone, 2009; Supovitz & Turner, 2000). The greatest difference, a change of 1.69, was found in response to the Teacher Inquiry Scale. This difference indicates teachers engaged in inquiry-related activities more often following the professional development. More modest differences were found in the Student Inquiry Scale (0.89) and the Perception of the Role of Practical Work Instrument (0.25) following the event. A comparison of the participant responses based on attending the professional development prior to or following the restructuring or the number of times the respondent participated in the professional development did not show practical differences, indicating that professional development duration and the inclusion of active learning in professional development were not directly influential in the event's effectiveness.

Because both duration and active learning are included in Desimone's (2009) core features of professional development, further research should be conducted to better understand why increased duration and the inclusion of active learning did not result in a difference in respondents' perceptions of their behaviors. The week-long, intensive format of the professional development could have provided sufficient duration for participants, implying that increasing duration beyond a certain point is no longer beneficial to participants. Future research should examine the impact of professional development offered in varying durations to determine the most appropriate, yet cost effective, duration to impact teacher behavior change.

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Discussant Remarks: Kim E. Dooley

Effective Professional Development: An Examination of Core Features

This study was designed to determine the impacts of a professional development program on inquiry-related activities for science integration. Desimone's core features of content focus, active learning, coherence, duration, and collective participation were the constructs under review. Based upon other studies, this is an important professional development need.

A descriptive survey research design was used to examine these impacts based upon three modified scales: the teacher inquiry scale, the student inquiry scale, and the perception of the role of practical work instrument. Only respondents who were still teaching agriculture completed the full instrument. Impressive grand mean changes were shown on the teacher inquiry scale before and after training. Could there be some confusion by respondents due to the differences in the scales for teacher inquiry vs. student inquiry? Did previous studies using these two scales find the teacher inquiry items to have greater differences or are there other reasons for less change with students and role of practical work because the teacher respondent's do not feel confident replying to those scales?

Based upon Desimone's core features of professional development, duration and active learning did not show practical differences. This was surprising. The authors suggest further research to understand why increased duration and active learning did not result in differences. For discussion, what are potential research approaches that could provide further explanation or confirmation? For professional development, what is an ideal duration? Could there be a professional development saturation point where more time makes no difference? Could this part of the theoretical model be misguided in this context? For active learning, it would be helpful to learn more about what type of active learning was used. For example, were teachers placed in a lab setting actively doing experiments? If they typically express feelings of inadequacy related to science integration, could a pre-assignment be given where teachers could learn scientific principles and core knowledge before the professional development session so they are applying concepts actively with scaffolded knowledge? Do teachers need more time to absorb knowledge gains and transfer new learning in their classrooms before being surveyed on behavioral change?

I look forward to our discussion on this important topic.

The Thornless Rose: A Phenomenological Look at Decisions Career Teachers Make to Remain in the Profession

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Abstract

Attrition among the agricultural education profession is concerning as approximately 50% of agriculture teachers leave within the first six years of teaching (Heath-Camp & Camp, 1990). Therefore, the purpose of the phenomenological study, conducted from an emic perspective, was to explore and describe secondary agriculture teachers' experiences related to remaining in the profession past the point of retirement eligibility. Four themes emerged from the study: (1) Career teachers experienced a transformative shift in mid-career, leading to career sustainability; (2) Career teachers experienced an abundance of support from students, parents, administrators, and community; (3) Career teachers maintained a balance between work and personal life; and (4) Career teachers reduced their workload later in their careers to coincide with aging. The essence deduced from the data revealed that teachers balanced work, family, and community life, reduced known stressors, and found satisfaction that led to long-term engagement in the profession. The emergent metaphor of this phenomenon was the Thornless Rose and served as the structural framework for reporting the findings. The results of this study can serve as a transferrable means to help teachers remain in the profession.

Introduction

After attending the National FFA convention and sharing his experience with a career teacher, cowboy poet Baxter Black wrote:

> I looked at him more attentively. "How long have you been teaching?" I asked. "Thirty-eight years," he said. There was a touch of weariness in his voice. We looked out over the sea of blue coats that surged through the huge convention. His wife took our picture. "That's a long time to be married to an agricultural teacher." I told her, knowing the commitment a spouse makes to accommodate the late suppers, kid's projects, county fairs, field trips, night calls, weekend practices, long hours and exhaustion that are an accepted requisite of the job description. She smiled and touched his elbow. "It was worth it," she said and they walked away (Black, 2006 as cited in Black, 2007).

Burnout and Attrition

For many, spending a career teaching agriculture has been *worth it*, but many others have abandoned the profession prior to reaching retirement eligibility. Many teachers leave because they experience burnout, anxiety surrounding family and life balance, and poor time management skills (Boone & Boone, 2009; Clark, Brown, & Ramsey, 2012; Chenevey, Ewing, & Whittington, 2008; Murray, Flowers, Croom, & Wilson, 2011; Torres, Lambert, & Tummons, 2009). Early career teachers in general immerse themselves in their career. Hughes (2001) reported that many teachers become exhausted by work-related duties until some form of intervention occurs. Furthermore, when looking at the role of a secondary agriculture teacher from a holistic approach, Cano and Miller (1992) found that teachers were undecided (neither satisfied nor dissatisfied) when considering all facets of the job.

Attrition is a concern among teachers and educational stakeholders at large (Jalongo & Heider, 2006) as over 90% of the teachers who were hired in the United States were replacement teachers for those who left for reasons other than retirement (Ingersoll, 2002). Further, 40% of secondary teachers currently teaching in the United States (grades 9-12) do not expect to be teaching in K-12 schools by 2016 (Feistritzer, 2011). Many studies have focused on teacher burnout as researchers seek to understand attrition theoretically for the purpose of cultivating retention strategies. In spite of these efforts, over 50% of teachers leave within the first six years of their career (Heath-Camp & Camp, 1990; Marso & Pigge, 1997). While the majority of research has focused on why teachers leave (Boone & Boone, 2009; Clark et al., 2012; Chenevey et al., 2008; Moore and Camp, 1979; Murray et al., 2011; Torres et al., 2009), understanding why teachers remain in the profession is equally valuable for understanding attrition.

There is limited research in agricultural education that examines teachers who remain in the profession long-term with a focus of retention (Boone and Boone, 2007; Walker, Garton, & Kitchel, 2004), especially those who remain after retirement eligibility. The need for retaining high quality teachers is also underscored in the National Research Agenda for Agricultural Education under Research Priority Area 5: Efficient and Effective Agricultural Education Programs (Doerfert, 2011). Therefore, this study examined the experiences of career teachers (those who remained in the profession for 30+ years) to identify the essence of their experiences and advance the literature pertaining to teacher retention from a phenomenological perspective that informs practice.

Job Satisfaction

Job satisfaction has been defined as feelings one has towards his or her job (Smith, Kendall, & Hulin, 1969), and can be both positive and negative; unfortunately, negative feelings often lead to teacher attrition. Conversely, those who experience positive feelings remain in their careers. Research has found that most agriculture teachers are generally satisfied with their jobs (Kitchel et al., 2012; Walker et al., 2004) for several reasons including self-fulfillment from educating youth, experiences outside the classroom, sound health, and community visibility (Bruening & Hoover, 1991). In addition, Boone and Boone (2007) found that student-centered teachers were also motivated to remain in the profession. Student-centeredness can be defined as the desire to educate and help students in the context of agricultural education, and assisting students gain achievements in FFA. Teacher motivation was also reinforced by financial rewards, professional fellowship, job location and security, and administrative support. Accordingly, Jewell, Beavers III, Malpiedi, & Flowers (1990) found that agriculture teachers were generally satisfied with intrinsic job satisfiers versus extrinsic job satisfiers. Extrinsic job satisfiers included duties not related to instruction, such as financial support.

Walker et al. (2004) discovered that job satisfaction increased among agriculture teachers who remained in the profession, positing that maturity and becoming accustomed to job responsibilities were related to increased satisfaction. The authors also reported that agriculture teachers who stayed in the profession may have reached a plateau or homeostasis in their career, leading to energy saving behavior and complacency; while not satisfying, neither were their jobs dissatisfying.

In summary, attrition is a considerable problem within the secondary agricultural education profession due to a host of factors such as burnout, anxiety surrounding family and life balance, and poor time management skills. Researchers have identified reasons teachers leave, but there is also a need to focus on why teachers remain in the profession. Those who remain teaching, in general, are satisfied with their current job. It was purported that teachers have become accustomed to job responsibilities and may have reduced their workload, resulting in less stress and higher job satisfaction (Walker et al., 2004).

Theoretical Framework

Teachers who participated in the research reported here were classified as career teachers because they remained on the job well past the point of retirement eligibility (+30 years) in Oklahoma. The participants' careers endured for the majority of their lifespan; therefore, Super's (1957) life span/life space theory was used as the lens for framing the phenomenological study. Super recognized changes individuals experience as they mature and identified the variable of *career maturity* as a major theme of his theory. *Career maturity* is manifested by physical maturity (age) and career development through stages within the lifespan.

Super's (1957) five stages of development are growth (ages 4-14), exploration (15-24), establishment (25-44), maintenance (45-65), and disengagement (65+). Growth is the time when people discover their ability to develop necessary skills for self-achievement and increase control over their life. Exploration is defined by crystallization of interests by specifying and implementing an occupational choice. Establishment happens when individuals seek a secure place in their career track. The Establishment stage is often characterized by career achievements. Maintenance is primarily characterized by constancy, continuity, a reduction in stress, safety, and stability. This is the stage in middle adulthood when individuals may ask, *what have I done with my life?* or *what else can I offer?* Finally, disengagement is typically marked by reduction or decline, where individuals may imagine and plan for retirement. Super (1980) later reported that not everyone transitions through these five stages at fixed ages or in the same manner and that the process is more fluid than linear. Super's theory is an ideal fit for this study because it focuses on teachers who have navigated through their careers 30+ years.

Purpose of the Study

The purpose of the study was to examine the essence of secondary agricultural education teachers' experiences as late career professionals using Super's life span/life space theoretical lens. The authors specifically sought to surface a deeper understanding of what participants experienced in terms of (1) remaining in the agricultural education profession beyond retirement eligibility, and (2) what situations influenced their life as a career teacher.

Methodology

Research Design

Phenomenology was the appropriate approach for this inquiry as the design seeks to capture the "meaning for several individuals of their lived experiences of a concept or a phenomenon" (Creswell, 2007, p. 57). In this study, the phenomenon addressed was the essence of secondary agricultural education teachers who have continued to teach beyond their eligibility to retire (30+ years of service).

Of the two types of phenomenological approaches to inquiry (hermeneutical and transcendental), transcendental phenomenology was employed (Creswell, 2007). Transcendental phenomenology requires the researcher to suspend past knowledge and experience in an effort to understand the phenomenon at a deeper level through a process called *epoché* (Merleau-Ponty, 1956). Transcendental implies that the research assume a stance "in which everything is perceived freshly, as if for the first time" while immersed in the study (Moustakas, 1994, p. 34). *Bracketing* completes the process of suspending one's past knowledge and experience (Creswell, 2007). While not a perfect process, bracketing reduces researcher bias by bracketing out ideas and familiarities related to the phenomenon to describe better the meaning of the participants' lived experiences. It was necessary for me, as the primary researcher, to bracket my experiences as an agriculture teacher. In an effort to achieve epoché, the study was delivered from an *emic* perspective, or the telling of the story from the participant's perspective.

Reflexivity

Reflexivity encourages researchers to recognize their strengths and shortcomings and is one of the most celebrated practices in qualitative research (Tracy, 2010). Reflexivity is used to help *bracket*, and requires researchers to be honest and authentic with self, research participants, and audience. Therefore, the following narrative informs readers about my background in secondary agricultural education and elucidates my epistemological stance.

I grew up in rural Oklahoma and took advantage of the opportunities offered by the local agricultural education program. My agriculture teacher was a career teacher, having taught 28 years. I achieved the state FFA degree and was a state FFA officer under my agriculture teacher's mentorship and these experiences served as a springboard for my successful career as a secondary, and now tertiary, agricultural educator. I earned a baccalaureate degree in agricultural education from Oklahoma State University and taught high school agriculture for four years in a rural setting. I am currently a doctoral student in agricultural education at Oklahoma State University while teaching full time for a regional university. My experience as a secondary agriculture teacher, along with my experience of learning from a career teacher, informs the reader of my strengths and shortcomings in conducting this study. It is for these reasons I sought to bracket out my experiences.

My epistemological stance aligns with social constructivism where, "individuals seek understanding of the world in which they live and work…relying as much as possible on the participants' views of the situation" (Creswell, 2007, p. 20). This viewpoint allowed me to make sense of a phenomenon and to interpret findings utilizing my strengths as a member of the cultural group.

Participant Selection and Recruitment

Polkinghorne (1989) recommended researchers interview from five to 25 individuals who have all experienced the phenomenon under investigation. Upon approval from the Institutional Review Board (IRB) at Oklahoma State University, a snowball sample of five men was selected to participate in the study. Only men participated because there were no female agriculture teachers in Oklahoma who were eligible for retirement at the time of the study. Four participants were White; one teacher reported being bicultural (Cherokee and White). All participants taught more than 30 years and averaged 36.6 years of service with a mean age of 61.8 years.

The snowball sample allowed me to interview participants who were similar in age and years of career service. The first participant, Mr. Allen (pseudonyms were used to achieve anonymity) was selected because he met the criteria of 30+ years in the field, was eligible to retire, and had experienced success during his tenure as an agriculture teacher. He taught 34 years, however, not continuously. He resigned from teaching secondary agricultural education twice during his career: once to work in the oil field as a young man and once to work for the state Agricultural Education Division.

I asked Mr. Allen to recommend a peer who had similar experiences in the profession; he recommended the next participant, Mr. Walker. Mr. Walker taught secondary agricultural education at the same school for 38 years, never leaving the profession. The third participant, Mr. Miller, taught out of state for two years and spent an additional 30 years in Oklahoma. Unique to the participants, Mr. Miller exited the classroom for 14 years after teaching for seven years. He did so when his children were young so he could spend more time with his family. He returned to the profession and has taught in his current position for 25 years. The fourth participant, Mr. Buck, a career teacher of 45 years, taught out of state for one year before returning home for the remainder of his career. Mr. Buck subsequently moved once within his home state to another school due to dissatisfaction with the administration. Mr. Buck taught for 37 years at his current location. Finally, Mr. Morris was selected upon referral from Mr. Buck. He taught in a suburban school for two years and then moved to a rural school where he spent the past 32 years. All of the participants reported experiencing fruitful careers by revealing success in the classroom, supervised agricultural experiences (SAE), and FFA.

Procedures for Data Collection and Analysis

In phenomenology, "the process of collecting information involves primarily in-depth interviews" (Creswell, 2007, p. 131). After approval from the IRB, I conducted in-depth, face-to-face interviews with each participant at their preferred location. I met Mr. Walker at his home while the rest of the participants were interviewed on the job. To focus the study, I followed Moustakas' (1994) suggestion that the data collection concentrate on what participants have experienced in terms of remaining in the agricultural education profession beyond retirement eligibility and what situations influenced their life as a career teacher.

During the interviews, additional probing questions were asked to guide participants in a semi-structured approach for the purpose of gaining a deeper understanding of the phenomenon. Interviews lasted approximately one hour and proceeded until *data saturation* (Creswell, 2007) was reached. In addition, the technique of *triangulation* (Tracy, 2010) was used as I took photographs, scribed field notes, and observed documents that would help illuminate the phenomenon at hand. Interviews were then transcribed verbatim using a digital recording application on an iPad® so they could be analyzed further.

Data Analysis

Creswell (2007) reported that phenomenological data analysis is completed through the method of reduction; therefore, analysis was conducted using the Stevick-Colaizzi-Keen method modified by Moustakas (1994). Transcriptions were downloaded and coded for the purpose of *horizontalization*, or looking at each statement, or horizon, of the transcription equally and then identifying significant statements (Moustakas, 1994). Delimited horizons were then clustered under emic codes. Once the horizons were coded, "…nonrepetitive, nonoverlapping constituents were clustered into themes" (Moustakas, 1994, p.180). Themes were then used to develop textural descriptions, describing *what* was experienced and structural descriptions describing *how* it was experienced. The textural and structural descriptions of what and how were then synthesized into the *essence* of the experience (Moustakas, 1994). Essence is the distilled experience, converted to narrative and shared with interested audiences for the purposes of advancing our understanding of teacher retention in the context of agricultural education.

Building Quality into the Study

A central concept of high quality, qualitative research is *trustworthiness* (Tracy, 2010). In an effort to provide viable, trustworthy research to the agricultural education profession, I approached the study with a transparent lens. Trustworthiness is achieved through multiple methods, including rigor and those already discussed within *reflexivity*. Rigor not only provides an abundance of description and explanation, in doing so, it also provides face validity.

Another quality building technique used in the study was a multivocal approach called *member reflection* (Tracy, 2010). I sought input from participants through *member checking* as well as *peer debriefed* with a group of eight individuals in a qualitative research club at Oklahoma State University along with the two co-researchers for this study in collecting and analyzing data.

Ethics

I was cognizant of the ethics required of qualitative research. I employed procedural, situational, relational, and exiting ethics (Tracy, 2010) to ensure that I, as a human instrument, would be a responsible and cautious researcher. Procedural ethics were achieved by avoiding deception, receiving informed consent, and ensuring privacy and confidentiality among participants. Situational ethics asks the researcher "to constantly reflect on our methods and the data worth exposing" to ensure that the means justify the ends (Tracy, 2010 p. 847). The data presented in this study were carefully analyzed and statements presented were ethically considered before exposing. Relational ethics involve mutual respect. The researcher is expected to be mindful of his or her character while constantly weighing the consequences of actions taken (Tracy, 2010). The concept of *reciprocity* is key to the establishment of relational ethics. Reciprocity was achieved because both parties benefited from the study; the participants agreed to tell their story and I agreed to accurately report the findings to the agricultural education profession for the mutual benefit of understanding better the essence of teacher retention. Finally, exiting ethics were employed to leave the data collection phase with accuracy and avoid unintended consequences. To reduce wrongful interpretation of the data, I presented direct quotes within their context and provided rich, thick descriptions within the data. These ethical considerations were taken seriously to protect participants and provide an accurate portrayal of the essence of their experiences.

Findings: Emerging the Essence

From five verbatim transcripts, 183 significant statements, or horizons, were extracted for the first step in data analysis (Moustakas 1994). The data were then clustered into codes and further refined into four themes. Among the themes, textural and structural descriptions were developed to deduce the essence of the phenomenon.

Theme 1: Thorns Among the Roses - Career Teachers Experienced Certain Thorn Pricks, Causing a Transformative Shift in Their Career, Leading to Career Sustainability

Consistent with Mezirow's (2006) transformational learning theory, emergent from the findings, each teacher experienced a major event(s) that provoked change in his career. According to transformational learning theory, an individual may encounter an event or life transition that causes them to change their current mindset about a situation. As such, participants experienced a *thorn prick*, or an event that caused them to reflect and reevaluate their current situation. It became evident teachers had transitioned from proving themselves, which corresponds with Super's (1954) stage of establishment, to maintenance after they experienced transformational learning, stimulated by thorn pricks.

Two teachers, Mr. Allen and Mr. Miller, exited secondary agricultural education early in their careers, and Mr. Allen exited more than once. Upon their return, the teachers had a new attitude about their approach to teaching. Mr. Allen said, "When I left, I could refresh myself" [Al: 55]. Burnout occurred among these two teachers as they exhausted themselves to establish their careers, aligning with Hughes (2001) findings on teacher burnout. Mr. Miller, who exited secondary agricultural education said, "When I left teaching, it was because I just ran myself, and we are talking about in off hours, to death trying to win at every contest that came along and this and that. Then I came back to teaching, and I decided I wasn't going to do that. I was going to do the contests and the showing that I enjoyed and if that wasn't good enough, I would do something else. And that's actually all I've done since I came back" [Mi: 84-88]. The career shift allowed these teachers to reevaluate their roles (Mezirow, 2006) while embarking on other ventures and return to the profession with a new mindset focused on life balance.

Without the support of significant others, it is hard to maintain job satisfaction (Cooper & Nelson, 1981). In an effort to remove his dissatisfaction, Mr. Buck experienced a career shift as he left his position for another agriculture teaching position after seven years of teaching in Oklahoma, saying, "I probably would still be there but the superintendent and I were not getting along real well" [Bu: 36-37]. Administration can be a contributing factor for teacher dissatisfaction (Boone & Boone, 2007).

Mr. Morris left his role in a suburban setting as an agriculture teacher for a rural setting. When planning his career, he anticipated teaching five years. After an early move to a new town, he invested 32 years in his current rural school district. Physically, Mr. Morris experienced another career shift, or *life crisis* (Mazirow, 2006), due to his health. He experienced heart surgery at age 49, which had significant implications on his job performance, causing him to slow down and reduce his workload immediately.

Divorce served as another thorn prick. Too often, in the early career stages, teachers tend to vigorously attack their job to achieve success (Talbert, Camp, & Heath-Camp, 1994). Mr. Walker admitted his early mistakes by saying, "When I was younger, I was gone all the time – weekends and after school, I would come in late at night, and I was gone all the time. One divorce later, missing out on my kids growing up, and participating in one thing or another in school, I figured out that some of those hours weren't used wisely. Now, I think I use my hours wisely for my benefit" [Wa: 127-134].

The career shifts that occurred for each of these teachers were the catalysts to move from establishment to maintenance in Super's (1954) theory. Job satisfaction increased once the teachers were able to successfully transition into maintenance mode. Four of the five teachers changed schools at least once in their career, but the teacher who remained at the same school experienced a divorce. Perhaps, once a teacher moves, he may be better able to focus on well-being and life balance compared to early career striving; however, we recognize there are many factors that influence divorce. Eventually, the teachers successfully transitioned from the establishment to maintenance (Super, 1954) in their careers.

The thorn pricks experienced by the teachers motivated major shifts in their careers and served as the impetus to seeking a thornless rose as an agricultural educator. The thorn pricks experienced by participants were administrators, unmotivated students, poor life balance, and too much time spent on the job, which is consistent with the literature (Boone & Boone, 2009; Moore & Camp, 1979; Myers, Dyer, & Washburn, 2005; Torres et al., 2009; Walker et al., 2004). These men were able to navigate around their stressors, resolve them, and, consequently, survived and thrived in the profession. The participants still experience challenges within their career; however, their challenges are generational rather than situational. The most talked about challenge was that students have changed over the years; hence, the teachers expressed difficulty in practicing effective motivational strategies for youth who have various social interests, home situations, and availability to more extracurricular activities within the school. Additional challenges faced by participants included competing with sports programs, lost student potential, changes in educational policies, physical challenges, and competing against livestock professionals (jocks). Although they still faced challenges in their careers, participants were able to manage stressors by blunting the thorns over the years.

Theme 2: Fertilizing the Rose: Career Teachers Experienced an Abundance of Support from Students, Parents, Administrators and Community Members

When discussing the variables that sustained their careers, each of the teachers boasted proudly about those who made their lives easier through their support including students, parents, administrators, and community members.

Evidence of support was documented for the purpose of triangulating the data. I quickly observed support in Mr. Buck's agricultural education building as I walked by two large granite figures scripted with thankful messages from students who credited their agriculture teacher for making a difference in their lives. As I observed further, I noticed the newness of the facility. I later learned the administration had funded the new agricultural building as a reward for Mr. Buck's successes in working with students. When asked about what had sustained him as a teacher he said, "The great kids and the administration" [Bu: 69-70]. All of the participants spoke at length about "having great kids." Mr. Miller said, "Unless you happen to be that one that just really has something that you're going to get rich doing, I don't know that there's anything financially a whole lot better than teaching kids" [Mi: 152-154]. As a result of their successful interactions with students, they did not spend much time disciplining students or in conflict with parents. "I've never had many parent problems" [Mi:163], Mr. Miller stated.

Participants also identified the community as a supportive link to the agricultural education program. Community support ranged from encouragement and physical help in accomplishing tasks, to financial support. Two teachers reported raising over $30,000 at their local, community-supported fundraisers. All of the study participants indicated financial support was solid and spoke about having the resources to participate in more opportunities and provide better learning environments for their students in the classroom. Aside from community-supported fundraisers, many community members were a part of the local booster club that raised money to support student-centered expenses, such as funding travel expenses for FFA events.

In addition to financial support from the public, members of the community were willing to help with other needs including providing labor at local events and fundraisers and/or contributing to a need by donating time and providing resources. "The community has always stepped up and helped with everything I have needed. They've done a fantastic job at stepping up and doing the heavy work and a lot of things to help with my shortcomings. They don't ask me, they know there are things that I can't do and they get it taken care of. I appreciate that. I also have people in the community that volunteer to come up and do all different types of things at the school for me. The main thing is if you just ask, you'll have people who will help you" [Mr. Walker, 169-186].

All five career teachers had very supportive experiences that were conducive to job satisfaction. Mr. Allen said it best, "I've been really fortunate from the standpoint of having some really, really good kids, some really, really good parents, really, really good school systems and administrators and school boards. As a neighbor and a program specialist, I saw teachers who had those kinds of problems and I've been really fortunate in the 34 years that I've taught. I've never had administrator problems; I've never had school board problems. That stress has never been there for me" [Al: 28-33]. All five teachers expressed similar sentiments in terms of a supportive professional climate. As a result, the teachers experienced fewer thorns and more fertilizer from supportive stakeholders, resulting in a high level of job satisfaction.

Theme 3: Enough Blooms for All: Career Teachers Experienced a Positive Life Balance Between Work and Family

Career and family balance is a concern for job satisfaction in agricultural education (Murray et al., 2011). Despite the methods in which teachers spent time with their families, it was evident family was extremely important to these teachers later in their career. Due to the supportive role of most spouses, family time was spent together at job-related events, such as FFA activities. "They just went with me," Mr. Buck said [Bu: 169]. Understandably, life balance did not occur during the teacher's establishment stage as Mr. Allen said, "It was stupid doing that because you took time away from your family that you shouldn't have been taking" [Al: 259-260]. As teachers moved into the maintenance and disengagement stages, the teachers in this study revealed that they spend more time with their family than in the early years of their career.

Although Mr. Walker experienced a divorce, he learned from his prior experience and currently seeks good life balance with his second wife, children, and grandchildren. He said, "You probably have to cut back a few things and decide to make more intelligent decisions so you can balance work and family life" [Wa: 156-157]. Being visible at other activities for his own children was important for Mr. Morris. He said, "I watched a lot of softball and cheerleading, pageants, and other stuff too" [Mo: 229-230]. Life balance helped these teachers to be more satisfied in their jobs, and it was evident that early in their career, this was not always the case. Findings are congruent with Baxter, Stephens, and Thayer-Bacon's (2011) findings in female teachers, reporting that the amount of time teachers spent on their job may not have been worth the sacrifice of family time.

The most unique family dynamic belonged to Mr. Miller who had exited the profession for more than ten years. When discussing his family he said, "Well families do suffer. I saw that was going to happen if I didn't do something different" [Mi: 97-99]. Consequently, he left teaching agricultural education while his children were young. He returned to teaching agricultural education after his daughter graduated high school.

The participants stressed the importance of taking vacation days and breaks and spending more time with family. In their opinion, this time should be used for the purpose of remaining balanced between career and family, and should not be taken lightly. In contrast from his early career practices, Mr. Miller said, "I think having your summers, is to some degree, I mean we do a lot of things in the summer, but having that summer slowdown and having a Christmas break is important. From a family standpoint, I think having those breaks that you can do things with your family is awfully good" [Mi: 156-159]. Teachers found a positive balance, which gave them the ability to spend time with family and career related activities: having enough blooms for everyone.

Theme 4: The Rose Loses its Thorns: Career Teachers Experienced a Reduction in Workload Later in Their Careers

All of the teachers in this study experienced a reduction of workload, which is consistent with Super's (1954) theory and Walker's et al. (2004) findings. This does not mean these teachers abandoned necessary job duties; rather, their time was spent differently than during the establishment phase of their career. Teachers learned to delegate tasks to capable individuals, such as students, parents, and community members. “I’ve learned instead of taking it all on my shoulders, I’ve delegated it out,” said Mr. Allen [Al: 248-249]. When teachers delegated, it allowed more time to complete other tasks, resulting in less hours spent working. Lambert, Henry, and Tummons (2011) reported that many teachers who become excellent time managers compound their workload by adding new tasks; however, the teachers in this study did not do so.

The teachers in this study also chose not to battle with students over participating in FFA events and SAE activities. Decisions to participate shifted from early career teachers expecting full participation of their students in FFA events and SAE activities to late career teachers allowing students the option not to participate in those activities. Mr. Morris said, “I don’t fight the kids as hard. If they say no, I just say, okay, if you don’t want to do it” [Mo: 140-142]. The agriculture teachers in this study knew their limits, and they valued life balance over winning competitions. They remain productive, yet do not maintain the same workload as they did during their establishment or early maintenance stage. They matured gracefully by identifying the thorns in teaching agricultural education, actively sought to blunt the thorns in the process, saving enough blooms for all, resulting in the essence of teacher retention, *a rose with no thorns*.

Discussion

The results of this study confirm and support Super’s (1957) theory in every aspect, in addition to illuminating the process in the agricultural education context. Participants successfully transitioned through each career stage. The most challenging transition for the teachers was from establishment to maintenance as there were multiple thorns to be thwarted. Learning life balance and with the support of their communities, the teachers successfully transitioned from establishment to maintenance and are now in the process of disengagement as they consider retirement. Figure 1 juxtaposes Super’s theory in the context of the essence that emerged.

Figure 1. Super's Life Cycle Rainbow of the Career Agriculture Teacher

Teachers in this study were generally satisfied with their careers as agriculture teachers, which is supported by the findings of Walker et al. (2004), who also found teachers who stayed in the profession longer were satisfied with their careers. The final product of phenomenology is to deduce the data into the essence of the phenomenon (Moustakas, 1994). The essence for these teachers: they experienced a rose without the thorns. In other words, outside of normal stressors, these teachers had supportive schools, students, parents, administrators, and family. Due to a high level of support, the teachers were fortunate to have a high level of autonomy, as their motivation was not controlled by outside demands, similar to what Clark et al. (2012) found. In addition, the reduction of extrinsic factors may have increased their job satisfaction (Jewell et al., 1990). Aside from their initial career shift, which was related to transformational learning, teachers defined their role of teacher as a central identity (Mezirow, 2000). They were not deterred from the profession. Once firmly situated in the maintenance stage, they achieved contentment with their supportive families and constructed perceptions of good students who had supportive parents, in a decent school within a solid community.

As with all qualitative studies, the findings should not be generalized. Instead, results of qualitative inquiry have utility in being transferrable.

Recommendations for Practice

The current study added to the literature by highlighting individuals who successfully navigated through Super's (1957) predictable career stages. Many teachers in the establishment phase of career development can learn from mature, career teachers as a model to emulate for developing coping strategies that lead to a long-term career in a profession that experiences a high burnout rate (Croom, 2003). Coping is a way an individual can manage environmental demands in his or her life (Lazarus & Folkman, 1984). Mearns and Cain (2003) reported that teachers who rely on active coping strategies experience lower levels of stress and burnout. Agricultural education teacher educators are advised to teach pre-service teachers about coping strategies and emotional maturity in order to help them successfully navigate through the thorns they will face. Emotional maturity is evidenced by the ability to accept life's challenges objectively, with freedom from superstition and prejudice (Jordan, 1939), developing the capability to be accountable for one's life and actions. If pre-service teachers are educated about coping strategies and developing emotional intelligence to make wise career and family-related decisions, perhaps they will encounter fewer thorns and experience deeper job satisfaction, leading to more teachers retained in the field.

Teachers in this study can serve as a model to help teachers in the establishment phase make wise decisions, leading to retention within the profession. Super's theory does not fix itself on age categories; therefore, teachers can experience any one of the stages at any time, resulting in the ability to adjust work and/or personal life according to one's unique life circumstances.

Agricultural education researchers should continue to examine career teachers by exploring their ability to transition from one stage to the next. Administrative support was critical to the success of the teachers; therefore, it is recommended to also investigate administrators who are supportive of agriculture teachers to identify characteristics desired by administrators to achieve a conducive work environment.

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Discussant Remarks: Kim E. Dooley

The Thornless Rose: A Phenomenological Look at Decisions Career Teacher Make to Remain in the Profession

When we think about agricultural teacher attrition, we often focus on the reasons teacher's leave (burn-out, family-life balance, etc.) instead of why teachers stay. This phenomenological study provides a glimpse at teachers who have persevered in the profession.

Super's life span/life space served as the theoretical framework. The manuscript provides a nice description of phenomenological methodology for the novice qualitative researcher. It was interesting that some teachers had left and returned to the profession due to family-life balance. By leaving the profession, individuals had a new attitude. For the sake of discussion and engagement in the session, I would like for us to consider the idea of a sabbatical for secondary teachers. Would school districts have the flexibility to allow teachers to renew and reflect at a mid-career point? What are the administrative constraints to such a practice? Could a district even do a "teacher swap" where perhaps a rural teacher teaches in an urban area and vice versa?

The concept of "support" was also important. As a point of discussion, do we prepare our pre-service (and in-service) teachers on fund-raising? Seeking extramural funding is essential for a university faculty position, so why not include strategies for financial sustainability as a part of teacher preparation? This might include broader topics like creating an advisory board or working with volunteers. Beginning teachers might find that delegating certain tasks to parents or community supporters could help them with time management and access to resources for student participation in FFA and SAE events.

As mentioned in previous discussant remarks in the session, I believe that established teachers can serve an important role in professional development and mentoring. Observing career educators and hearing how they survived their establishment stages could help retain teachers and improve their work balance.

Effective Recruitment Strategies and Activities of Georgia Agriculture Teachers

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Abstract

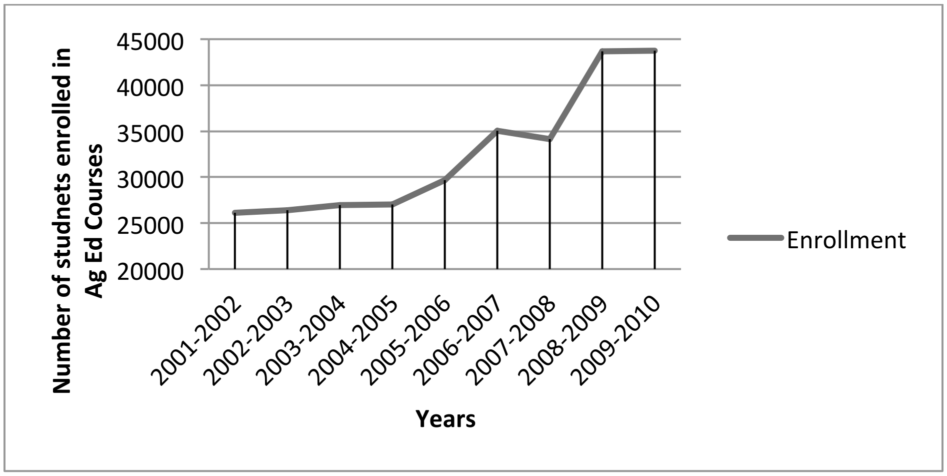
This study aimed to address the oscillating enrollment numbers in secondary agricultural education programs in Georgia. The purpose of this study was to identify the effective strategies and activities utilized by Georgia agriculture teachers in recruiting students into secondary agricultural education programs. A census was conducted of Georgia agriculture teachers (N=280). Georgia agriculture teachers perceive the FFA to be the most helpful in regards to recruitment as well as the most beneficial to the students through participation. The most effective recruitment strategies as reported by Georgia agriculture teachers were FFA chapter events, the curriculum, Agriculture education student - student contact, recruitment events, feeder school contact, publications, parents/teacher/support groups, and agriculture teacher - student contact. Activities specific to each strategy were ranked within each strategy. It is recommended ~~that~~ this information be used as a springboard to develop recruitment strategies and activities for the local program by current teachers and pre-service teachers in Georgia.

Introduction

Since the passing of the Smith-Hughes Act in 1917, agricultural education has been a vital and growing part of the public school system in the state of Georgia (Georgia Agricultural Education 2010 Annual Report). Georgia has been increasing the number of agricultural education programs throughout the past 10 years (B. Lastly, personal communication, January 13, 2012) and, therefore, enrollment in these programs has steadily increased (Figure 1). The state now boasts 180 high school (9^{th}-12^{th} grade) agricultural education programs (Georgia Agricultural Education 2010 Annual Report).

Figure 1

Georgia Agricultural Education Enrollment Numbers



According to The National Council for Agricultural Education (2009), there are over 800,000 students enrolled in formal agricultural education programs offered in grades seventh to adult in the 50 states and three U.S. territories. In the past, national studies have found a fluctuation of enrollment in secondary agricultural education programs over the past decades (Breja & Dyer, 1999). According to the National Research Council (1988), “Agriculture is too important a topic to be taught only to the relatively small percentage of students considering careers in agriculture and pursuing vocational agriculture studies” (p. 1). According to Rayfield and Croom (2007), the 10 x 15 Long-Range Goal for Agricultural Education mandates there will be 10,000 quality agricultural education programs that serve students through the three-circle model: classroom instruction, supervised agricultural experience, and FFA programs by the year 2015. However, these fluctuations in the enrollment of agricultural education programs can determine the success or failure of a program (Speer, 1998). According to Kantrovich (2007) it will be very difficult to meet the goal of having 10,000 quality programs by 2015. The fluctuating numbers indicate the National Research Council’s mandate is at risk of not being met. One strategy for positively influencing these enrollment numbers in the short-term is to better understand current recruitment techniques used by agricultural education teachers. This study seeks to provide new insight regarding student recruitment for agricultural education in support of research priority 5 of the American Association for Agricultural Education National Research Agenda (Doerfert, 2011). With knowledge of the most effective recruitment strategies, teachers will be better able to market their programs to students not typically enrolling in agricultural education programs or better meet student needs through innovative program implementation techniques.

Conceptual Framework, Theoretical Framework, and Review of the Literature

The agricultural education program is made up of three parts forming The Three-Circle Model, which served as the conceptual framework for this study. Students in an agricultural education program will receive instruction through three different components, including: (1)

Classroom/Laboratory, (2) Supervised Agricultural Experience (SAE), and (3) FFA (National FFA Organization, 2012). The Three-Circle Model of Agricultural Education is often compared to a three-legged stool. Just as each leg is vital for the stool to stand, so are the three components of Agricultural Education (Benson, A. 2006). Agricultural education is based on these three components and no one component should be ostracized or promoted more than another component. Agricultural education Teachers are encouraged to overlap the three components as much as possible. According to the National Teach Ag Campaign (Par, 3), " The successful integration of each of these three components results in a strong program that produces well rounded individuals who are prepared to be leaders in agriculture, business, and industry.".

Engagement, persuasion, involvement, motivation, and recruitment theoretical foundations were examined to determine the most appropriate theoretical framework for this study. Involvement theory was determined to be the most appropriate as it addresses student involvement as: 1. An investment of physical and psychological energy, 2. Involvement over a continuum, 3. Both quantitative and qualitative features, 4. Student learning and personal development as proportional to quality and quantity of student involvement, 5. Educational policy effectiveness is directly related to capacity of that program to involve students (Astin, 2009). With regards to this study involvement theory serves as a framework to examine Georgia agriculture teachers' strategies and activities for engaging students. Specifically do Georgia agriculture teachers use the conceptual framework of 1. Classroom, 2. FFA, and 3. SAE to move forward the theoretical framework described above.

The existing literature in student recruitment and enrollment into agricultural education programs primarily focuses on the barriers of enrollment, factors influencing students to enroll into agricultural education programs, and reasons for enrollment patterns (Knight, 1987; Riesenberg & Lierman, 1990; Hoover & Scanlon, 1991a; Hoover & Scanlon, 1991b; Marshall, Herring, & Briers, 1992; Dyer, Breja, & Ball, 2003). A limited amount of research has been conducted on the solutions to recruitment barriers as well as recruitment strategies and activities used by agriculture teachers (Myers, Breja, & Dyer, 2004; Myers, Dyer, & Breja, 2003).

Enrollment in agricultural education programs offered in grades seventh through adult in all 50 states and three U.S. territories exceeded 800,000 students as of 2009 (The National Council for Agricultural Education, 2009). According to Breja and Dyer (1999), secondary agricultural programs have experienced a fluctuation in enrollment over the past several decades. Various reasons may to be to blame for the oscillating enrollment patterns in secondary agricultural programs throughout history, including: transitions from the traditional Vo-Ag I, II, III, and IV to semester length courses (Marshall, Herring, & Briers, 1992) and the Excellence in Education movement causing higher education standards to increase (Riesenberg & Lierman, 1990).

Agricultural education must mesh well with the overall trends and priorities within individual schools as well as the overall educational agenda in order to be successful (Phipps et al., 2008). All of these influential factors would suggest that changes in educational structure and requirements will cause an undulation in enrollment numbers whether for the better or worse. The success of the agricultural education program will depend on its ability to adapt in an ever-changing system; this includes using relevant and innovative student recruitment strategies to ensure enrollment patterns continue to increase.

The majority of the current research base in recruitment has focused on the barriers to enrollment in agricultural education programs. Knight (1987) identified five key factors that contribute to declining numbers in agricultural education enrollment. These factors include the heavy emphasis on the production side of agriculture, increased academic requirements for graduation conflict with the offered agricultural courses, the perception of a college degree equals a "successful life,"therefore, demoting agricultural careers that do not require degrees, the perception vocational classes are for academically challenged students versus the academically talented students, and the stereotypical student who comprises an agricultural education program is primarily a white, farm boy (Knight, 1987). Riesenberg & Lierman (1990) reported four of the most limiting factors affecting enrollment in Idaho's agricultural education programs, as perceived by administration and instructors: "scheduling conflicts, change in students' interests and attitudes toward agriculture, competition with other elective courses, and academically oriented students guided away from secondary agriculture" (Riesenberg & Lierman, 1987, p. 10). Other barriers facing agricultural education programs, according to Hoover and Scanlon (1991a), are the negative images surrounding agriculture, the elevated requirements for high school graduation, the "anti-vocational" bias, the perceived value of class for the future, and the role of significant others.

Throughout the early literature there are several reoccurring factors that have been identified as problematic for enrollment into agricultural education programs. The factors identified throughout the literature base include: the future value of the class or future plans (Gilbertson, Rathbun, & Sabol, 1975; Pruckno & Miller, 1985; Brandy, 1986; Scanlon & Yoder, 1989; Hoover & Scanlon, 1991), influence of significant others (Flores, 1989; Scanlon & Yoder, 1989; Hoover & Scanlon, 1991a), enrollment in vocational classes conflict with obtaining a college degree (Knight 1987; Hoover & Scanlon, 1991a) and scheduling difficulties (Riesenberg & Lierman, 1990; Hoover & Scanlon, 1991a; Hoover & Scanlon, 1991b).

More recent research, conducted by Dyer and Breja, identified the barriers associated with successful recruitment of students into agricultural education programs. Even though there is a 10 to 20 year span between Dyer and Breja's study and earlier research, several of the factors identified early on are still barriers in enrollment of students in agricultural education programs. The top ten problems secondary agriculture teachers experience are "scheduling difficulties, finding time to recruit, student involvement in other activities, access to students, competition from other programs, lack of guidance counselor support, increased graduation requirements, image of agriculture, lack of interest in agriculture, and block scheduling" (Dyer & Breja, 2003, p75).

Agricultural education programs have several enrollment barriers that must be overcome; however, there are other enrollment factors that must be considered. These factors include students' perceptions about agricultural education, the future value of agricultural education, the role of significant others, and the image of agricultural education. All of these factors influence students' perceptions about agricultural courses (Hoover &Scanlon, 1991b). The perceived value and image of the agricultural education program as well as the agricultural industry serve as strong influencing factors for student enrollment into agricultural education programs. Significant others including parents, school counselors, friends, and teachers, all can greatly influence a student to enroll in an agricultural education program or vice versa (Marshall et al., 1992; Hoover & Scanlon, 1991b). According to Reis and Kahler (1997), parents, agricultural teachers, friends, and former agricultural education students are the most influential people when it comes to students enrolling in an agricultural education program.

Motivational factors that potentially lead to student enrollment, identified by students in Iowa, included personal interest in agriculture or agricultural education, a farming background, and activities associated with agricultural education (Reis & Kahler, 1997.) Similar findings were noted in a study conducted in Texas. Students were asked about their reasons for enrolling in agriscience and responses included class characteristics, identity enhancement, agricultural interest, instrumental/practical reasons, significant others, and circumstantial reasons (Marshall et al., 1992).

Because of the fluctuating enrollment numbers of agricultural programs across the country, the recruitment of students is an essential part of stabilizing this oscillation. Within the literature base of enrollment in agricultural education programs there is a very limited discussion devoted to recruitment strategies. According to teachers from 24 different states, FFA and the activities held injunction with the FFA are the most effective and frequently used recruitment strategies (Hoover & Scanlon, 1991a). The least effective and least used of the recruitment strategies was the use of the media, including news-papers, radio, and television (Hoover & Scanlon, 1991a).

In a more recent study, Myers et al. (2003), identified seven effective recruitment strategies along with activities that contribute to the effectiveness of each of the seven strategies. The most frequently used recruitment strategies as identified by agriculture teachers were contact with feeder schools, individual contact between the agricultureteacher and current students with prospective students, FFA, various promotional publications, a strong agriscience based curriculum, utilizing support groups of the agricultural education program and the FFA chapter, and recruitment events (Myers et al., 2003). The two most effective strategies were feeder school contact and agricultural teacher – student contact. According to Myers et al. (2003), the single most used effective practice given by the respondents was student word of mouth. On the other hand, recruitment events were considered the least effective; however, "respondents expressed attitudes that events that focused solely on recruitment could be very effective" (Myers et al., 2003, p.101).

Purpose and Objectives

The purpose of this study was to determine the effective strategies and activities Georgia agriculture teachers utilize in recruiting students into secondary agricultural education programs. The information gathered from the recruitment questionnaire will provide information to Georgia agriculture teachers, the Georgia agricultural education state staff, post-secondary agricultural teacher educators, and pre-service teachers. The findings of this study will assist agricultural education programs by increasing the awareness of secondary agriculture teachers regarding current recruitment strategies being used by Georgia agriculture teachers. The specific objectives of the study were to describe:

1. Demographic characteristics of Georgia agriculture teachers.
2. Strategies and activities Georgia agriculture teachers utilizing in their agricultural education program to recruit students.

Strategies and activities do Georgia agriculture teachers perceive to be most effective.

Methods

This study is descriptive in nature and utilizes survey research methods as described by Dillman (2000). Leedy and Ormrod (2005) describe survey research as, "acquiring information about one or more groups of people – perhaps about their characteristics, opinions, attitudes, or previous experiences – by asking them questions and tabulating their answers" (p.183). This is a simple design and allows the researcher to pose a series of questions to the participants, summarize the responses with statistical means, and draw inferences about the population from the sample population (Leedy & Ormrod, 2005).

The data collection method for this study was a questionnaire distributed to the Georgia agriculture teachers who were in attendance at the Georgia Area Teacher Meetings in April 2012. This questionnaire was developed by Dr. Bryan Myers, Dr. Jim Dyer, and Lisa Breja for a national study (Myers et al., 2003). Because this study was limited to the state of Georgia, the questionnaire was modified to fit Georgia agriculture teachers. The questionnaire was broken into two sections: Section I—Attitudes Toward Recruitment and Section II—Background and Characteristics. The questionnaire was used to determine three main objectives, including the demographics of Georgia agriculture teachers, the current activities and strategies Georgia agriculture teachers utilize in recruiting students into the secondary agricultural education program, and the most effective activities and strategies utilized by Georgia agriculture teachers in recruiting students.

Validity of an instrument is "the extent to which the instrument measures what it is actually intended to measure" (Leedy and Ormrod, 2005, p. 92). For this study, the researcher formed a panel of experts that consisted of Georgia Agricultural Education State Staff, Area Teachers, and University of Georgia – Agricultural Leadership, Education, and Communications Departmental Faculty to ensure the validity of the instrument. According to Leedy and Ormrod (2005), "Face validity is the extent to which, on the surface, an instrument looks like it's measuring a particular characteristic", whereas, "content validity is the extent to which a measurement instrument is a representative sample of the content area (domain) being measured" (p. 92). The face and content validity of the instrument were determined by using a panel of experts consisting of agricultural education state staff, university faculty, and agriculture teachers. The questionnaire was revised based upon the recommendations from the panel of experts.

Reliability was established utilizing a pilot test consisting of 14 Georgia young farmer teachers who have a teaching responsibility within their respective schools, but were not included in the population of this study. A cronbach alpha of 0.79 was determined for section I; reliability was not calculated for section II as it consisted of background and demographic questions.

The population of this study consisted of current high school (9^{th}-12^{th} grade) agricultural education teachers in the state of Georgia. The population framework was compiled from the Georgia Agricultural Education 2010 Annual Report of all of the Georgia high school (9^{th}-12^{th}) agricultural education teachers. This framework contained 280 high school (9^{th}-12^{th}) agriculture teachers for a total population of 280.

The sampling technique utilized in this study was a convenience sample. The scope of this study included Georgia high school (9^{th}-12^{th}) agriculture teachers who were in attendance at the Area Teacher Meetings in April 2012. The state of Georgia is broken into three regions: North, Central, and South. Each region is made up of two areas for a total of six areas in the state. Convenience samples inherently miss a portion of the population that is not present during the data collection; the Area Teacher Meeting for each area is a mandatory meeting for all current Georgia agriculture teachers in that area and the attendance rate is approximately 98% thus allowing the researcher to conduct a census. Of the 280 Georgia agriculture teachers surveyed, 131 responded producing a 47% response rate. Dyer and Breja (2000) indicated that due to the nature of this topic that forced nonresponse error was not a factor.

Results

This study had three objectives including determining the demographics of Georgia agriculture teachers; determining the current recruitment strategies and activities utilized by Georgia agriculture teachers; and determining the most effective recruitment strategies and activities as perceived by Georgia agriculture teachers. The findings are divided into the following sections: (1) Objective One, (2) Objective Two, and (3) Objective Three; each section contains the study's objective and the finding that relates to that objective.

Objective One: Determine the demographics of Georgia agriculture teachers.

As indicated in Table 1, 69.4 % (n=86) of the teachers were male and 29.8% (n=37) were females. Approximately 50% of the teachers surveyed reported having 10 years or less experience in the classroom as an agriculture teacher. The teachers surveyed reported the majority, 59.7% (n=77) are in a single teacher department and 40.3% (n=52) were in a multiple teacher department.

Table 1

Selected Teacher Demographics

Demographic Characteristics	f	%
Gender		
Male	86	69.4
Female	37	29.8
Teaching Experience		
Less than 5 years	33	25.8
6 to 10 years	32	25.0
11 to 15 years	18	14.1
16 to 20 years	19	14.8

21 to 25 years	9	7.0
26 to 30 years	10	7.8
More than 30 years	7	6.0
Department Type		
Single teacher department	77	59.7
Multiple teacher department	52	40.3

Objective Two: Determine the current recruitment strategies and activities utilized by Georgia agriculture teacher in the secondary agricultural education program.

Georgia agriculture teachers were asked to rank 14 recruitment strategies that were most helpful in recruiting students into their program using the following scale: Most Helpful (1); Least Helpful (14). As reported in Table 2, Georgia agriculture teachers view FFA activities to be the most helpful in recruitment and the Young Farmer program as the least helpful in recruiting students into the agricultural education program. The top five helpful recruitment strategies as perceived by Georgia agriculture teachers include FFA activities, personal visits to students, contact with students currently enrolled in the program, contact with chapter FFA officers, and social media.

Table 2

Recruitment Strategies Found Most Helpful by Georgia Agriculture Teachers

Item	n	Mean	SD
FFA activities	96	2.60	2.20
Personal visits to students	91	3.26	2.71
Contact with students currently enrolled in the program	92	4.60	3.09
Contact with chapter FFA officers	94	5.09	2.78
Social Media (Facebook, Twitter, etc.)	78	6.69	4.15
SAE activities	88	7.05	3.56
Texting	77	7.77	3.34
Letter to parents	82	7.98	3.31
Letter to students	80	8.06	3.05

Phone calls	79	8.11	2.69
Brochures	78	8.42	3.82
Alumni program	76	9.96	3.12
Contact with state FFA officers	77	10.01	2.88
Young Famer program	71	11.37	3.21

Note. Scale 1 = Most Helpful; 14 Least Helpful

Teachers were asked to rank the three components of agricultural education with respect to their helpfulness in recruitment. Ranking used the scale: Most Helpful (1), Somewhat Helpful (2), and Least Helpful (3). As Table 3 illustrates Georgia agriculture teachers perceive FFA to be the most helpful with regards to recruitment.

Table 3

Components of the Agricultural Education Program Ranked by Their Helpfulness in Recruitment by Georgia Agriculture Teachers

Item	n	Mean	SD
FFA	131	1.28	0.52
Classroom instruction	131	1.98	0.70
SAE	131	2.59	0.63

Note. Scale: 1 = Most Helpful; 2 = Somewhat Helpful; 3 = Least Helpful

Teachers were asked to rank the components of agricultural education based on their benefit to the students through participation using the following scale: Most Beneficial (1), Somewhat Beneficial (2), and Least Beneficial (3). As reported in Table 4, Georgia agriculture teachers perceive FFA to be the most beneficial for students to participate in.

Table 4

Components of the Agricultural Education Program Ranked According to the Perceived Benefits to the Students by Georgia AgricultureTeachers

Item	n	Mean	SD
FFA	131	1.48	0.66
Classroom instruction	131	1.89	0.80

SAE	131	2.40	0.72

Note. Scale: 1 = Most Helpful; 2 = Somewhat Helpful; 3 = Least Helpful

Objective 3: Determine the most effective recruitment strategies and activities as perceived by Georgia agriculture teachers.

As indicated in Table 5, there are eight strategies identified by Georgia agriculture teachers as well as activities that fall under each recruitment strategy. The eight most effective recruitment strategies as reported by Georgia agriculture teachers are FFA chapter events, the curriculum, Ag student-student contact, recruitment events, feeder school contact, publications, parents/teacher/support groups, and agriculture teacher-student contact. The top five activities utilized as reported by teachers were socials with food, FFA meetings with food, FFA trips, 100% membership drives, and CDE's.

Table 5

Effective Recruitment Strategies and Activities Used by Georgia Agriculture Teachers

Rank	Strategy	Activity
1	FFA chapter events	Socials with food
		FFA meetings with food
		FFA trips including state convention, national convention, Georgia National Fair, Sunbelt Ag Expo, etc.
		100% membership drive
		CDE's
		FFA activities
		T-shirts
		FFA camps
		Officer/member presentations
		FFA week
2	Curriculum	Fieldtrips
		Quality/Successful program
		Livestock program
		Leadership and FFA component

		Hands on learning Contest/games
3	Ag student – student contact	Peer advising Word of mouth
4	Recruitment events	High school orientation Career day Booths at open house Recruitment nights Beginning of the school year social with food
5	Feeder school contact	Visit to the middle school Middle school agriculture day Working with the middle school chapter
6	Publications	Bulletin boards Brochures Newspaper articles Videos/slide shows Announcements around school via posters, flyers, intercom, etc.
7	Parents/Teachers/Support groups	Alumni program support Parental involvement Family members and friends were former members
8	Agriculture teacher- student contact	Teacher encouragement

Conclusions and Recommendations

After the review of the literature, it was concluded the existing literature base of student recruitment into agricultural education programs primarily concentrated on the reasons for enrollment patterns, barriers of enrollment, and influencing factors of enrollment. The amount of research that exists on recruitment strategies and solutions to recruitment barriers is relatively small. Within the past five to seven years there has been very little research in the area of recruitment into the agricultural education program. This manuscript sought to close the gap in the literature on recruitment strategies and offer suggestions for enhancing student enrollment numbers.

To best bridge the gap, this study had three objectives: (1) determine the demographics of Georgia agriculture teachers, (2) determine the current recruitment strategies and activities utilized by Georgia agriculture teachers in the secondary agricultural education program, and (3) determine the most effective recruitment strategies and activities as perceived by Georgia agriculture teachers in the secondary agricultural education program. Therefore, to draw conclusions beyond that of the study's objectives goes beyond the scope of this study.

According to Hoover and Scanlon (1991a), teachers from 24 states identified FFA and the activities held injunction with the FFA as the most effective and frequently used recruitment strategy. Further research should be conducted to find out if students already enrolled in an agricultural education program would agree that FFA and the activities held injunction with FFA was helpful in recruiting them into the program. In addition, understanding the specific components of FFA that have the greatest influence on students and retention is also warranted in a future study.

According to this study, Georgia agriculture teachers identified eight effective recruitment strategies as well as activities that fall under each strategy. The most effective strategies as perceived by Georgia agriculture teachers are (1) FFA chapter events, (2) curriculum, (3) Ag student – student contact, (4) recruitment events, (5) feeder school contact, (6) publications, (7) parents/teachers/support groups, and (8) agriculture teacher – student contact. The findings reported in this study differ greatly from the study which this study intended to replicate. Myers et al. (2003) reported seven effective recruitment strategies and activities used by agriculture teachers including: (1) feeder school contact, (2) agricultural teacher – student contact, (3) FFA chapter events, (4) publications, (5) curriculum, (6) parents/teachers/support groups, and (7) recruitment events. The conflicting findings suggest this study should be duplicated in other states and further research should be conducted in the area of recruitment strategies from the perception of the agriculture educator as well as the agricultural education student.

Georgia agricultural teachers continuously ranked FFA and the activities associated with FFA as the most helpful factors in regards to recruitment as well as the most effective recruitment strategy. Agricultural Education on the national level as well as the state level stresses the importance of all three components: classroom/laboratory, supervised agricultural experience (SAE), and FFA. It is also stressed that no component be singled out and highlighted more than the other components. For this reason, the researchers find the results from this study to be of some concern. Georgia being the third largest membership state in the nation is very active in FFA (National FFA Organization, 2012). The researchers suggest further research be conducted to find out if there is a link between state FFA membership levels and the importance placed on FFA in regards to recruitment. For example, would the top five membership states, California, Texas, Georgia, Missouri, and Oklahoma (National FFA Organization, 2012) place more importance on FFA as a recruitment tool than the lowest membership level states? Further research must be conducted to see if there is any connection as suggested.

Overall, the recommendations for research are founded on the findings and conclusions of this study and are as follows:

1. Research should be conducted in the area of recruitment strategies from the perceptions of both the agriculture teacher and the agricultural education student.
2. Research should be conducted to find out if the perception of students enrolled in an agricultural education program agree with the perceptions of agriculture teachers about FFA and the activities held injunction with FFA in relation with recruitment.
3. Research should be conducted to find out if there is a link between FFA membership levels and the importance placed on FFA in regards to recruitment.
4. This study should be duplicated in other states.

The results from this study have practical uses for Georgia agriculture teachers, Georgia agricultural education state staff, post-secondary agricultural teacher educators, and pre-service teachers. The findings of this study will assist agricultural education programs by increasing the awareness of secondary agriculture teachers regarding current recruitment strategies being used by Georgia agriculture teachers. Current and future Georgia agriculture teachers can utilize the recruitment strategies and activities reported in this study to plan recruitment events in their local program. These strategies and activities will serve as a springboard for teachers to develop recruitment events customized for their local program. These findings will provide Georgia agricultural education state staff with recruitment information for the state. Post-secondary agricultural teacher educators can use these findings to teach pre-service teachers about recruitment in the state of Georgia. Pre-service teachers can use these effective strategies identified by Georgia agriculture teachers to help develop recruitment plans for their future program. Recommendations for practice include:

1. Teachers should use these findings as a springboard to developed customized recruitment strategies and activities for their individual program.
2. An effort should be made to educate pre-service teachers on the effective strategies identified by Georgia agriculture teachers.
   An effort should be made to spotlight the benefits of all three components of agricultural education.

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Discussant Remarks: Kim E. Dooley

Effective Recruitment Strategies and Activities of Georgia Agriculture Teachers

The review of the literature indicated that most research on recruitment into agricultural education programs is focused on barriers. But, what strategies work? The purpose of this study was to determine effective strategies and activities Georgia agriculture teachers utilize in recruiting students into secondary agricultural education programs. A convenience sample was surveyed to determine recruitment strategies. FFA activities, personal visits, contact with currently enrolled students including chapter officers, and social media were ranked as most helpful. For discussion, let's consider the social media piece since it is relatively new in the mix. How can social media be used to attract students, not only for secondary agriculture programs, but also 4H or other youth development activities? I would guess that most students enrolled in secondary programs already have an interest in agriculture. Can social media serve as a tool to promote these programs to non-traditional audiences? As suggested for future research in the manuscript, wouldn't it be interesting to ask what students think are the most successful recruitment strategies?

In addition to FFA chapter events, an effective recruitment strategy was the curriculum. Field experiences/experiential learning, awards and recognitions with competitions, and leadership development are all curricular components that could be attractive to potential students. Many states provide science credit for agricultural science classes. How could these selling points promote this choice for career pathways in STEM? How can student-student/faculty-student contact and recruitment events, including feeder school contacts, be enhanced with the use of social media as suggested previously? What could explain differences by state; if in this case, Georgia and Florida had different results? Can it be explained by enrollment percentages in FFA?

With the session having a focus on professional development, I think it would be interesting to discuss recruitment strategies and activities as part of pre and in-service training. Thanks for sharing your results with the profession.

Session F: Non-Formal & In-Formal Education
Discussant: Dr. Brian Parr

An Examination of Student Learning Outcomes and Knowledge Retention at FFA Summer Camp

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Abstract

The National FFA Organization is committed to providing non-formal learning activities that focus on leadership education. Summer camps are a major component of FFA activities and focus on personal development, leadership skill building, and recreational activities for youth. This repeated measures study determined the level of cognitive gain and the amount of information retained by campers who participated in the 2011 Oklahoma FFA Alumni Leadership Camp and was informed by Vygotsky's sociocultural theory, a lens for viewing camper learning in the context of social interactions. In addition, the study described the relationship between learning outcomes and selected characteristics (sex, race, age, grade level, socioeconomic status, years of camp attendance, chapter FFA officer status, and grade point average) of participants. On average, campers doubled their score from the pretest to the posttest but the amount of information retained after six-months was negligible. Three personal characteristics were related to camper performance: GPA, socioeconomic status, and chapter officer status.

Introduction and Background

The National FFA Organization (FFA) is committed to providing non-formal learning activities that focus on leadership education (Hoover, Scholl, Dunigan, & Mamontova, 2007) with a mission to make "a positive difference in the lives of students by developing their potential for premier leadership, personal growth, and career success through agricultural education" (National FFA Organization, 2008, p. 5). Summer camps are a major component of FFA activities and focus on personal development, leadership skill building, and recreational activities for youth (Connors, Falk, & Epps, 2010). One such camp has been hosted by the Oklahoma FFA Alumni Association for more than 30 years and serves 1,500 FFA members annually (McCrea, 2011). Campers must have completed at least one year of agricultural education coursework at the eighth grade level or higher, be pre-enrolled in an agricultural education course for the following semester, and paid the camp fee.

Oklahoma FFA camp planners consulted with an outside youth personal/leadership development specialist to evaluate the camp structure and curriculum in 2005. The evaluation recommended that camp learning outcomes could be improved if measurable learning objectives were developed and used to write non-formal curriculum to be taught to participants during the camp. In response to the evaluation, camp planners designated small group breakout sessions as the appropriate time to deliver leadership curriculum to campers similar to what is taught in formal classroom settings (K. Boggs, personal communication, May 16, 2011).

While several researchers have reported on the purposes and activities of FFA camps (Comings, 1977; Connors, Falk, & Epps, 2010; Javornik, 1962; Keels, 2002; McCrea, 2011), there is a dearth of literature examining the educational significance and learning outcomes of non-formal camp programs. Non-formal learning activities provided through FFA camps, conferences, and conventions require significant financial and human resources to plan and execute. In their study of small group leaders who participated in the Oklahoma FFA leadership camp environment, Brown and Terry (2012) recommended additional research to more fully understand "camper learning style and factors that contribute to cognitive gain in an FFA camp setting" (para. 5). Therefore, the research reported here determined the level of cognitive gain and the amount of information retained by campers who participated in the 2011 Oklahoma FFA Alumni Leadership Camp.

Review of Literature

Non-Formal Learning and the FFA

Educational learning environments are categorized as formal, informal or non-formal, and are designed to empower learners with knowledge and skills for personal development (Kasworm, Rose, & Ross-Gordon, 2010). While the boundaries of each environment are not clearly defined, Malcolm, Hodkinson, and Colley (2003) support the position that authentic learning occurs in all three environments and that none is inherently superior to the other in terms of learning outcomes.

Non-formal learning environments exhibit a loosely organized structure offered outside of institutional constraints (Kasworm, Rose, & Ross-Gordon, 2010). Brennan (2006) identified three sub-types of non-formal education positioned as a complement, alternative, and/or supplement to formal education. Malcolm et al. (2003) suggest that the terms informal and non-formal could be used interchangeably to signify characteristics contrary to the formal environment.

Non-formal learning activities that inform the FFA infrastructure focus largely on leadership education (Hoover et al., 2007). As outlined in the FFA mission statement, "students have the opportunity to develop their own leadership potential, grow personally, and prepare for career success through their involvement in FFA" (National FFA Organization, 2008, p. 5). FFA developed a variety of leadership conferences and experiences such as Washington Leadership Conference (WLC), National FFA Convention, the 212 Degrees Conference, and summer camps to support their mission. The goal of these programs is to teach students principles of leadership and personal development beyond what is taught in the formal classroom environment (National FFA Organization, n.d.).

FFA summer camps especially focus on personal and leadership development. Conners et al. (2010), reported "leadership development (at camps) played an important role in preparing FFA officers and members for future FFA chapter activities" (p. 39). Smith, Garton, and Kitchel (2010) identified three themes inherent in youth organizations, including the FFA: (a) equipping youth to contribute to society, (b) supporting the family, and (c) assisting in personal growth and development.

The Impact of Learning Style and Personal Characteristics on Learning Outcomes

Not only do people experience different learning outcomes given a specific learning environment (formal, non-formal, informal) (Kasworm et al., 2010), they are also influenced by different learning styles. Considerable research has documented the effect of learning styles in school-based agricultural education programs, focusing more on the learning styles of students over teachers (Brown & Terry, 2012; Cano & Garton, 1994; Cano, Garton, & Raven, 1992; Dyer & Osborne, 1996; Friedel & Rudd, 2006; Garton, Spain, Lamberson, & Spiers, 1999; Lambert, Smith, & Ulmer, 2010; Marrison & Frick, 1994; Whittington & Raven, 1995). Research focused on teacher learning styles has been useful in identifying gaps in meeting the educational needs of students. While the impact of learning styles on learning outcomes has been extensively researched, little evidence exists to suggest that one style is superior to another. However, personal characteristics and involvement in agricultural education were found to have significant impacts on learning outcomes (Caldas & Bankston, 1997; Moore & Braun, 2005; Nye, Konstantopoulos, & Hedges, 2004; Thoron & Myers, 2011).

When examined through the lens of their post-school lives, the attitudes students acquire in school are more important than cognitive achievements (Popham, 2009). A student's tendency to attribute success to internal or external factors is correlated to self-efficacy and performance (Bandura, 1982; Cochran, McCallum, & Bell, 2010; Haugen & Lund, 1998). A positive correlation between attitude and academic success has been established in several studies (Cochran et al., 2010; Horwitz, Horwitz, & Cope, 1986; Onwuegbuzie, Bailey, & Daley, 2000).

Socioeconomic status (SES) is also positively correlated with academic achievement (Caldas & Bankston, 1997; Nye et al., 2004; Thoron & Myers, 2011). However, Caldas and Bankston (1997) found that "going to school with classmates from relatively high family social status backgrounds does make a strong and significant contribution to academic achievement, independent of one's family SES or race" (p. 275). Teacher selection, teacher effectiveness, and interventions to increase teacher effectiveness through replacement or in-service training have a higher impact on students' academic achievement in low-SES schools compared to high-SES schools (Nye et al., 2004). However, Brown (1991) reported "there are few, if any, differences among social classes in students' ability to process school resources to make gains in achievement" (p. 355).

High school grade point average and ACT scores predicted first-year college performance for 1997 incoming freshmen (Garton, Ball, & Dyer, 2002). In addition, high school core GPA alone was the best predictor of academic achievement in college (Garton et al., 2002).

Smith et al. (2010) examined the relationship between students who were actively involved in school-based agricultural education and their academic performance as college freshmen. The study compared 1998 and 2003 Missouri State FFA Degree recipients to 1998 and 2003 college freshmen who were never enrolled in high school agricultural education. The results were inconclusive. The findings from both 1998 and 2003 incoming freshmen conflict with results reported by Moore and Braun (2005), which asserted that students with school-based agricultural education experience earned a significantly lower GPA than those with no agricultural education experience. Garton, Kitchel, and Ball (2005) found FFA membership alone yielded a positive influence on academic achievement and college degree completion. Overall, the literature reports mixed findings in regard to academic performance and enrollment in school-based agricultural education and membership in the National FFA Organization.

Theoretical Framework

The research reported here was informed by Vygotsky's (1962) sociocultural theory, a lens for viewing camper learning in the context of social interactions. Sociocultural theory is predicated on constructivism, which contends that individuals build new knowledge from previous experiences and new information (Bruning, Schraw, Norby, & Ronning, 2004). Sociocultural theory also emphasizes the role of social interactions to facilitate learning and personal growth (Tudge & Scrimsher, 2003). Social interactions are mediated through cultural objects such as technology, language, and social institutions (Shunk, 2012). Cognitive growth occurs when individuals use cultural tools within social interactions to create meaning (Bruning et al., 2004). Vygotsky's (1962) theory focused on the interaction between people and their environment, contending that all advanced cognitive functions begin in a social context.

Another key component of Vygotsky's theory is the zone of proximal development (ZPD), which is defined as "the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (Vygotsky, 1978, p. 86). A person's ZPD is determined by the amount of information an individual can learn when provided instruction in an appropriate educational environment (Puntambeker & Hübscher, 2005). The ZPD is an indicator a student's level of intellectual development in a given learning domain and demonstrates how student development and cognitive gain are associated (Bredo, 1997). Vygotsky also believed that formal education was important because it afforded students the opportunity to become aware of themselves, their contribution in the world, and their language (Shunk, 2012).

Purpose, Objectives, and Hypotheses

The purpose of this study was to examine how personal and academic characteristics affected the learning outcomes and knowledge retention of Oklahoma FFA Alumni Leadership Camp participants in a non-formal learning environment. The study is aligned with the American Association for Agricultural Education's research priority area four "meaningful, engaged learning in all environments" (Doerfert, 2011, p. 9) Five objectives guided the study:

1. Describe selected characteristics (sex, race, age, grade level, socioeconomic status, years of camp attendance, chapter FFA officer status, and grade point average) of participants.
2. Determine the participants' knowledge gain associated with curriculum taught during small group sessions of the camp.
3. Determine the participants' knowledge retained associated with curriculum taught during small group sessions of the camp after a 6-month period.
4. Describe the relationship between posttest scores and selected characteristics of participants.
5. Measure the relationship between delayed posttest scores and selected characteristics of participants.

Methodology

The objectives of this study were met by utilizing a repeated measures design. According to Field (2009), study participants are required to complete all levels of the study. This criterion was met as participants' cognitive gain and retention were measured using a pretest, posttest, and delayed posttest to determine their level of cognitive gain and retention of material taught during small group breakout sessions. Small groups convened seven times during the four-day camp, which resulted in 12 hours of instruction. Each small group was led by a post high school, former FFA member known as a Small Group Leader (SGL). The university Institutional Review Board approved the study.

Population and Sampling

The population consisted of all FFA members who attended the Oklahoma FFA Alumni Leadership Camp summer 2011 (N = 1,543). Because the target population exceeded 1,500, a random sample was drawn. Randomization was accomplished by assigning individual campers a unique number during camp registration and matching them with a randomly generated number. G*Power version 3.1, a computer statistical power analysis software tool, was used to determine that a sample size of 60 was needed to reach maximum statistical power with an expected effect size of ($\eta_p^2 = .25$) (Faul, Erdfelder, Lang, & Buchner, 2007).

To ensure that the final sample size was large enough to generalize study results, we randomly sampled 435 campers (Krejcie & Morgan, 1970). Forty of the 435 selected campers did not obtain parental consent and were removed from the sample. After accounting for missing and unusable data, 344 campers participated in the study by completing the pretest and posttest while at camp, resulting in an 87% response rate. An 87% response rate was large enough that no procedures to control for non-response error were necessitated (Lindner, Murphy, & Briers, 2001).

Data Collection

Two original instruments were developed to collect the data: (a) the Camp Communications Content Examination (CCCE) and (b) a questionnaire to collect personal characteristics of the campers. In cooperation with state FFA staff and camp planners, we created the Camp Communications Content Examination (CCCE), a criterion-referenced exam designed to assess camper's cognitive gain of concepts associated with the curriculum taught during camp small group breakout sessions. The CCCE was composed of 17 multiple-choice items focused on personal communication, team communication, and family communication.

A panel of experts comprised of two leadership curriculum specialists, three agricultural education teacher educators from Oklahoma State University, and three students from high schools in Oklahoma reviewed the CCCE for face and content validity (Creswell, 2008). After two rounds of reviews and feedback from the panel, minor changes were made to the instrument. As a result, the CCCE was deemed a valid instrument.

The CCCE was screened for reliability by including homogeneous items, discriminating items, enough items, high quality copying and format, clear directions for the students, a controlled setting, motivating introduction, and clear directions for the scorer (Wiersma & Jurs, 1990). In addition, the Kuder-Richardson (*KR20*) formula (Cronbach, 1970) was utilized to test the CCCE for reliability after administration, producing a reliability coefficient of .52 (*KR20*), which is acceptable for criterion-referenced exams (Kane, 1986). Based on this finding, the CCCE was determined to be a valid and reliable instrument.

Personal characteristics were obtained using a nine-item questionnaire that included six multiple-choice questions, two fill-in-the-blank questions, and one open-ended question. The same panel of experts that reviewed the CCCE also reviewed the personal characteristics questionnaire for face and content validity.

During the camp registration period participants were asked to complete the CCCE and the personal characteristics questionnaire. Before leaving camp, campers again completed the CCCE as a posttest. Six months later (January 2012) participants were asked to complete the CCCE again as a delayed posttest. The decision to administer the CCCE six months after the camp experience was supported by Berti and Andriolo (2012). The results of the delayed posttest were used as a measure of cognitive retention.

Dillman's Tailored Design (2000) was used to achieve a high response rate for the delayed posttest. Two hundred and forty-three campers completed and returned the instrument, resulting in a 70.63% response rate. The best method to control for nonresponse error is to compare those who responded to those who did not (Lindner et al., 2001). We contacted, by telephone, campers who did not respond and requested that they complete and return their delayed posttest. Twenty completed instruments were received, the minimum standard for the number of respondents needed to represent non-respondents (Lindner et al., 2001). A *t*-test analysis showed no significant differences between the respondents and non-respondents [$t\,(261) = -.56$, $p = .58$], thus respondents were representative of the population and the results can be generalized to the population.

Data Analysis

All data were analyzed using Statistical Package for Social Sciences (SPSS) version 20 for Macintosh computers. The repeated measures analysis was used to meet objectives two and three and was the primary analysis procedure for this study. Objectives four and five were achieved using three analysis procedures. First, a one-way ANOVA was employed to test if relationships existed between camper test scores and nominal variables with more than two categories (Kirk, 1995). Second, Student's *t*-test scores were used to test if relationships exist between camper test scores and nominal variables with two categories (Kirk, 1995). Third, Pearson's correlation coefficient *r* was used to test if relationships exist between camper test scores and continuous variables (Field, 2009). Appropriate statistical tests were used to determine that all assumptions were met during secondary data analysis procedures.

Findings

Findings Associated with Objective One

The first objective was to describe selected characteristics (sex, race, age, grade level, socioeconomic status, years of camp attendance, chapter FFA officer status, and grade point average) of participants. Table 1 presents campers' personal characteristics (sex, race, age, and socioeconomic status). Socioeconomic status was determined by campers' response to a question about whether they receive free or reduced lunch at school. This method of determining socioeconomic status is prevalent in academic literature (Caldas & Bankston, 1997; Molnar et al., 1999; Nye et al., 2004).

Table 1

Frequency of Campers' Personal Characteristics (*n* = 344)

Personal Characteristic	*f*	%
Sex		
Female	198	57.56
Male	146	42.44
Race		
White	287	83.10
Native American or Alaskan Native	42	12.20
Asian or Pacific Islander	6	1.70
Hispanic	6	1.70
African American	1	0.30
Other	2	0.60
Age		
16 years of age	110	32.00
15 years of age	89	25.90
17 years of age	78	22.70
14 years of age	36	10.50
18 years of age	15	4.40
13 years of age	5	1.50

19 years of age	1	0.30
No age specified	10	2.90
Socioeconomic Status		
Does not receive free or reduced school lunches	284	83.00
Receives free or reduced school lunches	60	17.00

Campers' academic characteristics (grade level, years of camp attendance, chapter FFA officer status, and grade point average) are presented in Table 2.

Table 2

Frequency of Campers' Academic Characteristics (*n* = 344)

Academic Characteristic	*f*	%
Grade Level		
11th grade	111	32.40
10th grade	98	28.60
12th grade	90	26.20
9th grade	42	12.00
8th grade	3	0.90
Years of Camp Attendance		
1st year of attendance	159	46.22
2nd year of attendance	107	31.10
3rd year of attendance	52	15.12
4th year of attendance	23	6.69
5th year of attendance	3	0.87
FFA Chapter Officer Status		
Holds FFA chapter office	211	61.34
Does not hold FFA chapter office	129	37.50
FFA chapter officer status not specified	4	1.16

Camper Grade Point Average (GPA)[a]		
GPA range (2.00 – 2.99)	15	4.36
GPA range (3.00 – 3.99)	194	56.40
GPA range (4.00 – 5.00)	100	29.07
No GPA specified	35	10.17

[a]GPA Range = 0.00 – 5.00 due to weighted AP courses.

Findings Associated with Objective Two and Three

The second objective of the study was to determine participants' knowledge gain associated with curriculum taught during small group sessions of the camp. The overall mean raw pretest score was 5.21 (30.65% correct) and the overall average posttest score was 9.78 (57.53% correct). On average, respondents increased their score by 4.57 raw points or 26.88%. A repeated measures 4x2 analysis was performed to determine that a statistically significant difference existed between campers' mean pretests and posttest scores, [$F(1, 343) = 976.63$, $p = .00$]. Levene's test of equality of error variances was non-significant, and thus equal variances were assumed. The observed power for the statistical analysis was 1.00. Partial eta squared was calculated and showed a large effect size ($\eta_p^2 = .74$).

Objective three was to determine the participants' knowledge retained associated with curriculum taught during small group sessions of the camp after a 6-month period. The total mean raw pretest score of the campers who completed all three repeated measures was 5.23 (30.76% correct), the mean raw posttest scores was 9.78 (57.53% correct), and the total average delayed posttest score was 7.16 (42.12% correct). On average, campers increased their score by 1.95 points or 11.47% when comparing pretest scores to delayed posttest scores. A repeated measures - 4x3 analysis was performed to determine that a statistically significant difference existed between campers' mean pretests, posttest, and delayed posttest scores [$F(2, 242) = 322.81$, $p = .00$]. Levene's test of equality of error variances was non-significant, and thus equal variances were assumed. Mauchly's test of sphericity was non-significant. Therefore, sphericity was assumed. The observed power for the statistical analysis was 1.00. Partial eta squared was calculated and showed a large effect size ($\eta_p^2 = .57$).

Findings Associated with Objective Four

Objective Four was to describe the relationship between posttest scores and selected characteristics of participants. As shown in Table 3, an independent samples *t*-test indicated that the difference between male and female scores was significant [$t(342) = -3.65$, $p = .00$]. Levene's test was non-significant, and thus, equal variances were assumed. Cohen's *d* was calculated and showed a negligible effect size ($d = -.14$).

Table 3

Camper Posttest Scores: Contrast of Males versus Females ($n = 344$)

Contrast	*n*	*M*	Mean Difference	*t*	*SE*	*df*	*p*
Male	146	9.20					
			-1.01	-3.65*	.28	342	.00
Female	198	10.21					

*p < .05.

A one-way ANOVA was used to determine if posttest scores varied based on the race of campers. No statistically significant differences existed between groups [$F(5, 338) = .51$, $p = .77$]. Levene's test indicated that equal variances were assumed.

No statistically significant relationship existed [$r(332) = .03$, $p = .56$] between camper age and posttest score (see Table 4). Camper posttest scores were significantly correlated to camper GPA [$r(308) = .22$, $p = .00$]. According to Chen and Popovich (2002) an $r = .22$ is a small to medium effect size.

Table 4

Correlation Between Camper's Personal Characteristics (Age and GPA) and Posttest Scores

	Age	GPA
Camper Posttest Score	.03	.22*

*p < .001.

A one-way ANOVA was used to determine if campers' grade level affected their posttest score. No statistically significant differences existed between grade level [$F(4, 339) = 1.14$, $p = .34$]. Levene's test indicated that equal variances were assumed.

An independent samples *t*-test indicated that the difference between the two scores of those campers who received free or reduced lunch and those who did not was statistically significant [$t(78.13) = -2.08$, $p = .04$]. Levene's test was significant; therefore, equal variances were not assumed, and the Welch-Satterthwaite method was used to adjust the degrees of freedom to account for the violation of the equal variances assumption (Kirk, 1995). Cohen's *d* was calculated and showed a small effect size ($d = -.31$) (see Table 5).

Table 5

Camper Posttest Scores: Contrast of Campers Who Receive Free or Reduced Lunches at School versus Campers Who Do Not Receive Free or Reduced Lunches at School ($n = 344$)

Contrast[a]	*n*	*M*	Mean Difference	*t*	*SE*	*df*	*p*
Yes	60	9.08					
			-.85	-2.08*.	40	78.13	.041

No	284	9.93

[a]Equal variances not assumed.

*p < .05.

A one-way ANOVA was used to determine if the number of times a camper had attended camp affected their posttest score. No statistically significant posttest score differences existed [F(4, 14.57) = 2.89, p = .06]. Levene's test was statistically significant, revealing that the ANOVA assumption that group variances are roughly equal (Kirk, 1995) was violated. Therefore, the Welch statistic was utilized to adjust the degrees of freedom to account for unequal group variances.

An independent samples t-test indicated that the difference between the post-test scores campers who were FFA chapter officers and those campers were not FFA chapter officers was significant [t(338) = 3.47, p = .00]. Levene's test was non-significant, and thus, equal variances were assumed. Cohen's d was calculated and showed a small to medium effect size (d = .39) (see Table 6).

Table 6

Camper Posttest Scores: Contrast of Campers Who Are FFA Chapter Officers versus Campers Who Are Not FFA Chapter Officers (n = 340)

Contrast	*n*	*M*	Mean Difference	*t*	*SE*	*df*	*p*
Officer	211	10.14					
			.98	3.47*	.28	338	.00
Not Officer	129	9.16					

*p < .05.

Findings Associated with Objective Five

Objective Five was designed to measure the relationship between delayed posttest scores and selected characteristics of participants. Male campers achieved a raw delayed posttest score of 7.01 (41.24% correct), and females scored 7.27 (42.76% correct). An independent samples t-test indicated that the difference between the two scores was non-significant [t(241) = -.85, p = .40]. Levene's test was non-significant, and thus, equal variances were assumed.

A one-way ANOVA was used to determine if campers of divergent races produced significantly different delayed posttest scores. No statistically significant differences existed between groups [F(5, 237) = .30, p = .91]. Levene's test indicated that equal variances were assumed. No statistically significant relationship existed [r(241) = -.04, p = .55] between camper age and delayed posttest scores (see Table 7). The data do; however, reveal that camper delayed posttest scores were significantly correlated to camper GPA [$r(241) = .14$, $p = .03$]. According to Chen and Popovich (2002) an $r = .14$ is a negligible effect size.

Table 7

Correlation Between Camper Personal Characteristics (Age and GPA) and Delayed Posttest Scores ($n = 243$)

	Age	GPA
Camper Delayed Posttest Score	-.04	.14*

*$p < .05$.

A one-way ANOVA was used to determine if campers' grade level affected their delayed posttest score. No statistically significant differences existed between grade level [$F(4, 238) = .72$, $p = .58$]. Levene's test indicated that equal variances were assumed.

Campers who received free or reduced lunch at school achieved a raw delayed posttest score of 6.80 (40.00% correct), and those campers who did not receive free or reduced lunches scored 7.23 (42.53% correct). An independent samples *t*-test indicated that the difference between the two scores was non-significant [$t(241) = -1.04$, $p = .30$]. Levene's test was non-significant, and thus, equal variances were assumed.

A one-way ANOVA was used to determine if the number of times a camper had attended camp affected their delayed posttest score. No statistically significant delayed posttest score differences existed [$F(4, 238) = 1.29$, $p = .28$]. Levene's test was non-significant and equal variances were assumed.

An independent samples *t*-test indicated that the difference between the two scores of campers who were FFA chapter officers and those who were not FFA chapter officers was statistically significant [$t(237) = 2.12$, $p = .04$]. Levene's test was non-significant, thus, equal variances were assumed. Cohen's *d* was calculated and showed a small effect size ($d = .28$) (see Table 8).

Table 8

Camper Delayed Posttest Scores: Contrast of Campers Who Are FFA Chapter Officers versus Campers Who Are Not FFA Chapter Officers ($n = 239$)

Contrast	*n*	*M*	Mean Difference	*t*	*SE*	*df*	*p*
Officer	151	7.40					
			.67	2.12*	.31	237	.04
Not Officer	88	6.74					

*$p < .05$.

Conclusions, Implications, and Recommendations

In conclusion, the typical Oklahoma FFA Alumni Camp attendee is a white, middle or upper class female who maintained a good GPA. She completed her sophomore year of high school, held a local FFA chapter office, and was attending camp for the first time. As most campers were first- or second-time attendees, many Oklahoma FFA members may view the camp as a one-time experience. We recommended that Oklahoma FFA staff and camp planners clarify the purpose of camp to determine if it should be a one-time experience, allowing more students to attend. Limiting attendance to once/lifetime could alleviate the reported strain on facilities and accommodate more FFA members who wish to attend as well as address concerns about repetitive programs.

On average, campers doubled their score on the CCCE from the pretest to the posttest. The large effect size indicated that campers experienced cognitive gains related to the communications curriculum taught during small group breakout sessions in the short term. However, the average posttest score was an unimpressive 58%. In addition, the amount of information retained after six-months was negligible. The average delayed posttest score was 42%, only 11% higher than the average pretest score. According to sociocultural theory, the camp environment should be conducive to learning because campers are exposed to an environment that includes adult guidance (SGLs) and capable peers (other campers) (Vygotsky, 1978). Why did campers fail to master the material? We suggest that the college-age SGLs were incapable of effectively delivering instruction toward acceptable outcomes. Newcomb, McCracken, and Warmbrod (1993) contend that a working knowledge of effective instructional methods and an understanding of pedagogy are necessary to effectively teach learning objectives. It is recommended that camp planners examine SGL effectiveness in delivering instruction during small group, breakout times. According to sociocultural theory (Vygotsky, 1978), effective adult guidance is a vital component of the learning environment and must be present for student success; however, more than adult guidance is needed if measurable learning outcomes are desired.

We also postulate that camp (an informal environment) may not be the best environment for delivering formal lessons. Delansky (1991) reported that camps are an appropriate avenue for increasing campers' self-concept and social skills. Conners et al. (2010) stated "the FFA camp experience can take average students and catapult them into over-achieving leaders in their home chapters and create bonds between campers that last a lifetime" (p. 32). We recommend that small group sessions focus on meeting personal development and leadership objectives rather than teaching communications curriculum.

Posttest scores were not affected by camper race, grade level, or previous camp attendance. Although a statistically significant difference was found between posttest scores of males and females, the statistical analysis showed a negligible effect size. Three personal characteristics, however, were significant and produced a small to medium effect size: GPA, socioeconomic status, and chapter officer status. Campers who held a chapter FFA office outperformed those campers who did not hold an office. Vygotsky (1978) theorized that the experiences a person brings to the learning environment could potentially affect the outcome. Perhaps this finding is an indicator that chapter officers bring more experiences to the camp than non-chapter officers.

Delayed posttest scores were not affected by camper sex, race, age, grade level, socioeconomic status, or previous camp attendance. A statistically significant correlation was found between delayed posttest score and camper GPA. This correlational analysis did, however, produce a negligible effect size indicating that the actual effect had little meaning. Campers who held a FFA chapter office continued to outperform campers who did not hold an office. This finding suggests that chapter officers had the opportunity to apply what they learned at camp when they returned home. This conclusion further compounds the divergent field of literature exploring the relationship between level of involvement in agricultural education and student performance (Dyer & Osborne, 1996; Garton et al., 2005; Moore & Braun, 2005; Smith et al., 2010).

In the future, phenomenological qualitative research should be employed to understand the essence of campers' decision to attend camp. The inquiry should focus on expectations for the camp experience in terms of learning, social development, and leadership outcomes. Gaining a better understanding of campers' decision to attend camp and expectations while at camp will assist FFA advisors in selecting future campers as well as camp planners to design more meaningful experiences that have lasting impact.

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Discussant Remarks: Brian Parr

An Examination of Student Learning Outcomes and Knowledge Retention at FFA Summer Camp

I have chosen to combine the remarks for these papers since they appear to be created out of the same study.

I certainly appreciate the efforts of the researchers to examine and evaluate the effectiveness of instruction in a non-formal environment. The research methodology employed appears to be extremely sound in every aspect.

I appreciate the point that the researchers made concerning the previous published research concerning the impact of learning styles on learning outcomes or the lack of impact. Further, this research failed to uncover evidence that learning styles impact student achievement. My question is; is it time that we as teacher educators begin to change our message on the importance of learning styles?

Or, since your study did support claims that students' learning styles do have an impact on how much they enjoy certain types of educational experiences, is this enough of a reason to maintain the instruction concerning the different learning styles and means by which we appeal to those students through our teacher preparation programs. I think that it would be easy to point out through research and years of anecdotal evidence that students can learn, relatively speaking, through instructional efforts that they find boring and unattractive. If this wasn't true, most of us would still be repeating sixth grade.

I also would like to hear more about the subject matter that was delivered at the camp. My impression from the papers is that the subject matter may be delivered at an "informal" facility but may actually be poorly delivered formal instruction?

As a side note and as a way to document this change, I would like to commend each of you for bringing us to a more correct form of writing for our profession that is written from the first person perspective, thanks!

A Quasi-Experimental Study to Explore the Interaction Between Students' Learning Outcomes and Preferred Learning Style in a Non-Formal FFA Camp Environment

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Abstract

Twenty-four states host FFA summer camps to support adolescent maturation along with indoctrination into the culture and values of the FFA. Camps typically include a variety of activities designed to engage members in social activities and non-formal academic content. More than 1500 campers attend the Oklahoma FFA Alumni Leadership Camp annually and are taught leadership curriculum. Using a split-plot factorial repeated measures quasi-experimental design we established learning styles of campers and the relationship between learning style and learning outcomes. Campers did not retain knowledge taught over time regardless of learning style and no differences were found between learning outcomes and learning style. However, extroverts had more positive attitudes toward camp than introverts. Camp planners are advised to developmentally evaluate the use of academic curriculum during camp and to attend to the unique psychosocial needs of introverts to improve their attitudes toward camp.

Introduction and Background

The National FFA Organization (FFA) seeks to make "a positive difference in the lives of students by developing their potential for premier leadership, personal growth, and career success through agricultural education" (mission statement, National FFA Organization, 2008, p. 5). In support of the mission, FFA sponsors numerous leadership experiences, including summer camps that focus on developing personal leadership skills among participants, namely eighth through twelfth grade students (National FFA Organization, n.d.). Twenty-four state FFA associations offer summer camps, including Oklahoma, whom has hosted a camp for 30 years (McCrea, 2011). The camps encourage youth to improve their social, personal, and leadership attributes and prepares FFA officers and members for success in the classroom (Conners, Falk, & Epps, 2010).

Approximately 1,500 campers attend Oklahoma FFA Alumni Leadership Camp annually (McCrea, 2011). Campers are admitted based on having completed at least one year of agricultural education coursework at the eighth-grade level or higher, being pre-enrolled in an agricultural education course for the following semester, and paying the camp fee (K. Murray, personal communication, May 16, 2011).

Camp leaders seek to deliver not only a recreationally and socially satisfying experience for campers, but also an academically rich curriculum in leadership and communication studies that compliments agricultural education classroom instruction. Small group peer leaders (19 year old camp alumni) use breakout sessions to deliver lessons to campers using methods similar to those used in formal classroom settings (K. Boggs, personal communication, May 16, 2011). Given the resources devoted to creating and delivering academic curriculum, camp leaders sought to determine the impact of the breakout sessions on knowledge gained and retained over time among campers. Knowledge retention is often predicated on learner characteristics such as learning styles, among other attributes (Cano & Garton, 1994; Dyer & Osborn, 1996; Lambert, Smith, & Ulmer, 2010). Therefore, the study was designed to understand better the impact of campers' learning styles on knowledge gained and retained over time.

Learning styles have been defined as "the way people absorb, process, and retain information" (DeBello, 1990, p. 203), and was operationalized in this study using Jung's (1971) personality dimensions of extraversion, introversion, sensation, and intuition as attributes that may impact learning outcomes.

Much research has been conducted exploring the impact of learning style on academic outcomes in school-based agricultural education (Brown & Terry, 2012; Cano & Garton, 1994; Cano, Garton, & Raven, 1992; Dyer & Osborne, 1996; Friedel & Rudd, 2006; Garton, Spain, Lamberson, & Spiers, 1999; Lambert, Smith, & Ulmer, 2010; Marrison & Frick, 1994; Whittington & Raven, 1995). An abundance of literature associated with learning styles also exists in the broader educational context, implicating learning styles as a variable of considerable interest when studying curriculum effectiveness (Hansen & Stansfield, 1982; McDonald, 1984; Mehdikhani, 1983; Miller, 1991; Paradise & Block, 1984).

Numerous learning style inventories have been developed to diagnose an individual's style and predict preferred learning processes in formal classroom settings. An early and popular tool was the Gregorc Style Delineator™ (GSD), which classified learners into four sub-types: Concrete Sequential (CS), Abstract Sequential (AS), Abstract Random (AR), and Concrete Random (CR) (Gregorc, 1982). The GSD used a continuum consisting of concrete and abstractness on opposing ends to classify learners. Concrete learners are prone to thinking in terms of right or wrong versus abstract learners who find value in the idea that things could be right and wrong and are open to ambiguity (Gregorc, 1982). Lambert, Smith, and Ulmer (2010) used the GSD to determine if mind styles affected the relational satisfaction between mentors and protégés who were participating in a new teacher-mentoring program.

Several researchers in agricultural education have used the Group Embedded Figures Test (GEFT) to assess students' preferred learning style (Cano & Garton, 1994; Cano & Metzger, 1995; Dyer & Osborne, 1996; Garton, Spain, Lamberson, & Speirs, 1999). The GEFT classifies learners as field-dependent or field-independent, where field-dependent learners focus on the social environment and struggle with problem solving and field-independent learners prefer to perform activities independently and excel in solving problems (Oltman, Raskin, & Witkin, 1971).

The Kolb Learning Style Inventory (KLSI) identified nine learning styles based upon an individual's preference among learning modes identified by Kolb (1984); they are concrete experience, reflective observation, abstract conceptualization, and active experimentation (Kolb & Kolb, 2009). The KLSI was theoretically rooted in Jung's (1971) psychological trait theory (Kolb, 1984).

More recently, the Paragon Learning Style Inventory (PLSI) (Shindler & Yang, 2003) emerged as an alternative to Kolb's often-criticized model for its overly complex application (Loo, 1999). The PLSI also used Jung's four dimensions of extroversion-introversion, sensation-intuition, thinking-feeling, and judging-perceiving (Jung, 1971). The 52 items making up the PLSI were constructed using a single question or stem statement with two opposing statement choices. Shindler and Yang (2003) indicated that the first two Jungian types, extroversion versus introversion and sensation versus intuition, most influence how an individual learns and preforms in an academic setting and they named and described four learning styles associated with the two type dimensions.

Action Oriented Realists are people who are both extraverted and sensate. They thrive on action and prefer to work in groups. They are also impatient with slow complicated situations and place high value on practical results. *Action Oriented Innovators* are people who are both extraverted and intuitive. They share their thoughts openly and enjoy testing their many theories with the group. They are also deterred by details and routine activities. *Thoughtful Realists* are people who are both introverted and sensate. They make careful, steady choices and prefer to work alone. Although they are not expressive by nature, they are detailed observers. Finally, *Thoughtful Innovators* are people who are both introverted and intuitive. They are excellent problem solvers and prefer to work alone on their own thoughts and ideas. They are fascinated with scientific ideas and are future oriented. (Shindler & Yang, 2003)

Many agricultural education scholars have focused their work on the impact of learning styles on various attributes including teaching impact, learning outcomes, satisfaction with schooling and mentoring experiences, and creative thinking (Cano & Garton, 1994; Cano et al., 1992; Dyer & Osborne, 1996; Friedel & Rudd, 2006; Garton et al., 1999; Lambert et al., 2010; Marrison & Frick, 1994; Whittington & Raven, 1995). The wider body of educational research (Hansen & Stansfield, 1982; McDonald, 1984; Mehdikhani, 1983; Miller, 1991; Paradise & Block, 1984) has also used learning styles as a key variable for examining the impact of style upon similar constructs, with similar results – no significant differences between groups. These findings incriminate learning styles as an inconclusive variable for predicting teaching and learning outcomes.

However, the majority of learning style research has been conducted in formal classroom settings, whereas FFA camps are noted as non-formal learning environments (Kasworm, Rose, & Ross-Gordon, 2010). There is a paucity of research examining the effect of learning styles of leaders and learners in non-formal settings; therefore, research exploring the impact of camper learning style on learning outcomes in an FFA camp setting was warranted (Brown & Terry, 2012).

Theoretical Lens

Jung (1971) outlined traits that affect how people learn, act, think, communicate, and view the world. He identified four factors that determine a person's psychological type using four continua: Extrovert-Introvert, Sensate-iNtuitive, Thinker-Feeler, and Judger-Perceiver. People trend naturally toward one characteristic of each dyad, resulting in 16 possible psychological types. Each type predicts how people learn, behave, and interact with others.

Extroverts are drawn to other people or objects as a source of energy, while introverts draw energy from the self (Jung, 1971). Shindler and Yang (2003) explained further that extroverts are more comfortable and confident in social environments and gain their ideas from external forces, while introverts prefer to work alone, set their own standards, and acquire ideas from within.

Intuition or sensation explains how people process and making meaning of ideas. Shindler and Yang (2003) explained that sensates view ideas as physical and real whereas intuitives operationalize ideas as real and see them "as a world in and of themselves" (p. 2). Sensates rely on folk knowledge and value practical viewpoints, whereas intuitives value imagination and are future-oriented (Jung, 1971).

While making decisions, people either rely primarily on thought or feeling to guide them (Jung, 1971). "Thinkers tend to make decisions based on logic and ideas whereas feelers tend to make decisions based more on relation to people and how their actions affect others, especially their feelings" (Shindler & Yang, 2003, p. 2). Further, feelers dislike conflict and stimulate enthusiasm among groups (Shindler & Yang, 2003). Finally, thinkers are unprejudiced in conflict and require reason when making decisions (Shindler & Yang, 2003).

Judgers and perceivers differ in their orientation to the external environment (Jung, 1971). Perceivers struggle to make decisions and prefer to maintain several options for action (Shindler &Yang, 2003). Perceivers are spontaneous people and tolerate the differences they have with others, while judgers are decisive rather than curious and can suffer from rash decision-making (Shindler &Yang, 2003). Shindler and Yang (2003) have taken Jung's personality profiles and applied them to learning styles vs. personality styles alone.

Purpose, Objectives, and Hypotheses

The purposes of the study were to study the interaction between learning outcomes and learning style of Oklahoma FFA Alumni Leadership Camp participants (campers), and explore the relationship between campers' attitudes about camp and their learning style. The study addresses the American Association for Agricultural Education's National Research Agenda priority area five, meaningful, engaged learning in all environments (Doerfert, 2011). The following objectives were formulated to accomplish the purposes:

1. Determine the preferred learning style of campers.
2. Determine relationships between campers' preferred learning style and their attainment of knowledge associated with the curriculum taught during the camp.
3. Determine the relationship between campers' learning style and their retention of knowledge gained during the camp.
4. Determine if a relationship exists between campers' learning style and their attitude about the camp experience.

The following hypotheses were formulated for objectives two and three and guided the statistical analysis of the study:

Objective 2

H_0: No difference existed between pretest and posttest scores of campers with differing learning styles.

H_0: No interaction existed between pretest and posttest scores of campers and their personal learning style.

Objective 3

H_0: No difference existed between pretest, posttest, and delayed posttest scores of campers with differing learning styles.

H_0: No interaction existed between pretest, posttest, and delayed posttest scores of campers and their personal learning style.

Methodology

Population and Sampling

The target population for this study was FFA members who participated in the Oklahoma FFA Alumni Leadership Camp, summer 2011. Because the target population exceeded 1,500 (N = 1,543), a random sample was drawn to select the subjects. Individual campers were assigned a number during the camp registration process and matched to a list of randomized numbers generated using a web-based randomization tool (randomizer.org).

Although a sample of 60 was needed to reach maximum statistical power with a moderate effect size (Faul, Erdfelder, Lang, & Buchner, 2007), generalization to the population was desired; therefore, a sample size larger than 60 was necessary. Krejcie and Morgan's (1970) *Table for Determining Sample Size from a Given Population* was utilized to determine the appropriate sample size (n = 310) for the study population (N = 1,543). To ensure a final sample size large enough to generalize study results, we chose to randomly sample 435 campers after approval from the Institutional Review Board at Oklahoma State University. Ultimately, the sample was reduced to 395 due to a lack of parental consent from 40 campers. In all, 344 FFA members participated in the study while at camp, resulting in an 87% response rate. According to Lindner, Murphy, and Briers (2001), a response rate at this level requires no further procedures to control for non-response error.

Research Design

The objectives of this study were met by using a split-plot factorial repeated measures quasi-experimental design. The study was deemed quasi-experimental because campers were not randomly assigned to treatment groups (Kirk, 1995) due to the natural occurrence of learning styles among individuals. According to Field (2009), study participants are required to complete all levels of the quasi-experiment when using the repeated-measures research design. The three levels of this repeated-measures quasi-experiment were a pretest, posttest, and delayed posttest. To meet the objectives of the study, student learning style was identified, student cognitive gain and retention was determined by pretest, posttest, and delayed posttest scores, and students were split into four test groups based on their preferred learning styles to determine if their individual style affected their level of cognitive gain and retention of material taught during small group breakout sessions. Small groups convened seven times during the four-day camp, which resulted in 12 hours of treatment. Each small group was led by a post high school (age 18-19), former FFA member known as a Small Group Leader (SGL).

Steinberg (2008) defined an independent variable as "the treatment or condition that the researcher expects will make subjects perform either better or worse on some measure of behavior" (p. 142). The independent variables in the quasi-experimental component were the four learning styles: (a) Action Oriented Realists, (b) Action Oriented Innovators, (c) Thoughtful Realists, and (d) Thoughtful Innovators (Shildler & Yang, 2003). Camper attitude scores pertaining to evaluation, potency, and activity of camp also served as independent variables in secondary data analysis procedures designed to meet the forth research objective.

Dependent variables are "the measured outcome or behavior, which the researcher then assumes is attributable to the treatment" (Steinberg, 2008, p. 142). Three repeated measures of knowledge related to communications served as the dependent variables for this study. Those measures were collected in the form of a pretest, posttest, and delayed posttest.

In experimental design research, there are eight primary threats to internal validity: (a) history, (b) maturation, (c) testing, (d) instrumentation, (e) statistical regression, (f) differential selection of participants, (g) mortality, and (h) selection-maturation interaction (Gay, Mills, & Airasian, 2009). Three powerful tactics for overcoming threats to internal validity in experimental research are random assignment of subjects, random selection of subjects, and researcher control over other nuisance variables (Gay et al., 2009). Although extensive precautions were taken to ensure that threats to internal validity were addressed, some threats were unavoidable due to the quasi-experimental nature of the study. Campers were not randomly assigned to treatment groups; therefore, nuisance variables could have skewed the data.

Data Collection Instruments

Through a thorough review of the literature, we determined that the Paragon Learning Style (PLSI), a widely used 52-item instrument, was the most appropriate learning style inventory to meet the objectives of the study (Shindler & Yang, 2003). Items of the PLSI were constructed using a single question or stem statement with two opposing answers or statement choices. This standardized instrument has been reviewed continuously to increase reliability and improve validity for more than 10 years. Shindler and Yang (2003), creators of the instrument, reported split-half reliability coefficients between .90 and .94 for each of the four dimensions. Based on this report, the instrument was considered valid and reliable.

An original instrument was created to assess camper's cognitive gain of concepts associated with the curriculum taught during camp small group breakout sessions. The instrument, Camp Communications Content Examination (CCCE), was a criterion-referenced test. State FFA staff and Alumni Camp planners collaborated with us to identify objectives of the curriculum, which focused on personal communication, team communication, and family communication. The CCCE was composed of 17 multiple-choice items.

A panel of experts comprised of two leadership curriculum specialists, three agricultural education teacher educators, and three students from high schools in Oklahoma, reviewed the CCCE for face and content validity. Creswell (2008) explained, "content validity is the extent to which the questions on the instrument and the scores from these questions are representative of all the possible questions that a researcher could ask about the content or skills" (p. 172). Two leadership curriculum specialists were included on the review panel primarily for the purpose of reviewing each test item for content validity. Both of the leadership curriculum specialists had previous experience writing curriculum and assessments for FFA leadership seminars and conferences such as Made for Excellence and the Washington Leadership Conference. Teacher education faculty members in agricultural education were also included on the panel due to their expertise in constructing summative education assessments. Panel members were tasked with determining if the test items were constructed appropriately. Finally, three Oklahoma high school students were asked to review the CCCE primary for face validity. The three students reviewed the instrument to ensure that all test items and directions were written at an age-appropriate level and were easy to comprehend. After two rounds of reviews and feedback from the panel, minor changes were made to the instrument. As a result of these procedures, the CCCE was deemed a valid instrument.

Reliability "is the ability of the measure to produce the same results under the same conditions" (Field, 2009, p. 12). Wiersma and Jurs (1990) suggested eight specific methods to establish reliability of a criterion-referenced examination including homogeneous items, discriminating items, enough items, high quality copying and format, clear directions for the students, a controlled setting, motivating introduction, and clear directions for the scorer. To ensure test reliability, we carefully considered and applied these eight directives when constructing the CCCE. Multiple sources in the literature described the relevant function of reliability indices in criterion-referenced tests (Kane, 1986; Lang, 1982; Popham & Husek, 1969; Wiersma & Jurs, 1990). The Kuder-Richardson (*KR20*) formula (Cronbach, 1970), a test for internal consistency used commonly in association with criterion-referenced exams, was used to test the CCCE for internal consistency. The CCCE produced a coefficient of .52 (*KR20*), which is acceptable for criterion-referenced exams (Kane, 1986). Based on these efforts, the CCCE was determined to be a valid and reliable instrument.

The Alumni Camp Attitude Assessment (ACAS) semantic differential (Osgood et al., 1965) was developed by the researchers to determine the attitudes of campers regarding the camp experience in the areas of evaluation, potency, and activity. Following the advice of Isaac and Michael (1995), we chose five adjective pairs for each of the three factors, and varied the arrangement of each adjective pair so that the potent, evaluative, and active ends of the scales were positioned on both the left and right positions of the seven-point scale to avoid the development of response patterns. Fifteen pairs of polar adjectives were chosen to be included in the sematic differential. According to Isaac and Michael (1995), an attitude score between 1.00 and 3.99 is considered negative, a score between 4.00 and 4.99 is considered neutral, and a score between 5.00 and 7.00 is considered positive.

The ACAS was reviewed for face and content validity by the same panel of experts that reviewed the CCCE. All adjective sets were chosen from the list of factor-analyzed adjective pairs developed by Osgood et al. (1965) and were standardized. We chose to conduct a post-hock reliability analysis of the ACAS because the instrument was administered to students rather than adults. The ACAS produced a reliability coefficient of .70 (Cronbach's Alpha).

Procedures

During the registration period for each of the four sessions of camp, randomly selected campers were hand delivered a packet containing two instruments, a content examination designed to measure cognitive gain of camp curriculum, and the Paragon Learning Style Inventory (PLSI) (Shindler & Yang, 2003), designed to measure camper learning styles. This administration served as the pretest. Before leaving camp, the same campers were asked to complete the CCCE as a posttest and the ACAS.

Six months later (January 2012), participants were mailed the CCCE as a delayed posttest measure. The decision to administer the CCCE six months after the camp experience was supported in educational literature (Berti & Andriolo, 2012). The results of the delayed posttest were used to determine the level of cognitive retention. Dillman (2000) explained that survey implementation has a much greater bearing on response rate than the actual design and quality of the questionnaire and outlined five elements for achieving high response rates: (a) creation of a respondent-friendly questionnaire, (b) four separate mailings to each subject by first class mail, with an additional special contact, (c) return envelopes with first class stamps, (d) personalized mailings to each subject, and (e) prepaid incentives. Dillman's (2000) design was followed to contact the teachers of each subject rather than to communicate with each camper individually.

Two hundred and forty-three campers completed and returned the delayed posttest resulting in a 70.63% response rate. The best method to control for nonresponse error, a threat to external validity, is to compare those who responded to those who did not (Lindner et al., 2001). The researcher contacted agricultural education teachers who did not return their students' instruments by telephone to request the completed instruments from the sample. Twenty completed instruments were received through this process, meeting the minimum standard for the number of subjects needed to represent non-respondents (Lindner et al., 2001). A *t*-test analysis showed no significant differences between the respondents and non-respondents [t (261) = -.56, p = .58]. It was, therefore, determined that the respondents were representative of the population and the results can be generalized to the population.

Data Analysis

All data were analyzed using Statistical Package for Social Sciences (SPSS) version 20 for Macintosh computers. To reduce human error, we also used SPSS to calculate individual camper scores for all three levels of the CCCE and to calculate mean scores for the three attitude factors associated with the ACAS. The split-plot factorial (SPF) design was used to meet objectives two and three and was the primary analysis procedure. SPF designs test for between-subjects effects and within-subjects effects (Kirk, 1995). This study employed a SPF-4x2 design that tested differences among four between-subjects groups (learning styles), differences between two repeated measures (pretest and posttest scores) and determined if an interaction existed between learning styles and test scores. We also utilized an SPF-4x3 design, which included one additional repeated measure (delayed posttest) to test for between-subjects effects and within-subjects effects when the delayed posttest was added to the analysis. Field (2009) explained that a test for sphericity is not necessary when an analysis includes only two repeated measures. Therefore, Mauchly's (1940) sphericity test was only used as part of the SPF-4x3 analysis. Mauchly's (1940) test for sphericity was non-significant (p = .43); therefore, the assumption of sphericity was met. Furthermore, Levene's (1960) test for homogeneity of variance was used to determine that there were no significant differences between the variances of each group. Levene's (1960) test produced a p value of .86 when comparing group variances for the pretest, a p value of .14 when comparing group variances for the posttest, and a p value of .65 when comparing group variances for the delayed posttest.

Objective four was achieved using a one-way ANOVA to test if relationships existed between campers' preferred learning style and their attitude score. Appropriate statistical tests were used to determine that all assumptions were met during the secondary data analysis procedures.

Partial eta squared (η_p^2) is a suitable statistic to calculate effect size in a repeated measures design with more than two independent variables (Richardson, 2011). Cohen (1965) explained that the partial eta squared statistic (η_p^2) is appropriate because other non-error causes of variation are partialed out of the analysis. Therefore, partial eta squared (η_p^2) was utilized to report effect sizes for both SPF analyses.

Findings

The first objective was to determine the preferred learning style of campers. Approximately 60% of the respondents possessed an extraverted learning style ($f = 206$). The most common learning style among campers was Action Oriented Realists ($f = 108$; 31.40%) followed by the second extraverted learning style, Action Oriented Innovators ($f = 98$; 28.48%). Thoughtful Realists, an introverted learning style, accounted for 28.40% ($f = 97$) of the sample while 11.92% ($f = 41$) were Thoughtful Innovators, an introverted learning style.

Objective two determined relationships between campers' preferred learning style and their attainment of knowledge associated with the curriculum taught during camp. The size of each treatment group and the group mean pre-test and post-test score can be found in Table 1.

Table 1

Mean Raw Pretest and Posttest Scores and Percentages that were Correct by the Treatment Group ($n = 344$)

	Treatment Group	*f*	*M*	*SD*	% Correct
Pre-Test	Action Oriented Realists (ES)	108	5.12	1.93	30.12
	Action Oriented Innovators (EN)	98	5.18	1.85	30.47
	Thoughtful Realists (IS)	97	5.34	1.92	31.41
	Thoughtful Innovators (IN)	41	5.20	2.09	30.59
	Overall	344	5.21	1.92	30.65
Post-Test	Action Oriented Realists (ES)	108	10.13	2.74	59.59
	Action Oriented Innovators (EN)	98	9.52	2.37	56.00
	Thoughtful Realists (IS)	97	9.64	2.64	56.71
	Thoughtful Innovators (IN)	41	9.83	2.61	57.82
	Overall	344	9.78	2.59	57.53

We failed to reject the first null hypothesis developed for objective two. There was no difference between pretest and posttest scores of Oklahoma FFA Alumni Leadership Camp attendees with differing learning styles. Between-subjects effects, learning styles, were not significant [$F(3, 1) = .38$, $p = .77$]. Levene's test of equality of error variances was non-significant; therefore, equal variances were assumed. Because there were only two repeated measures, Mauchly's test of sphericity was not necessitated (Field, 2009). The observed power for the statistical analysis was low (.13) due to a negligible effect size ($\eta_p^2 = .003$).

We failed to reject the second null hypothesis as well. There was no interaction between pretest and posttest scores of Oklahoma FFA Alumni Leadership Camp attendees and their personal learning style. The interaction between learning style and time was not significant [$F(3, 3) = 1.52$, $p = .21$]. Levene's test of equality of error variances was non-significant; therefore, equal variances were assumed. Although the analysis employed a large *n*, the observed power for the statistical analysis was moderate (.40) due to a negligible effect size ($\eta_p^2 = .01$).

The third objective sought to determine the relationship between campers' learning style and their retention of knowledge gained during the camp. Table 2 displays the size of each treatment group and the group mean pre-test, post-test, and delayed post-test score.

Table 2

Mean Raw Pretest, Posttest, and Delayed Posttest Scores and Percentages that were Correct by the Treatment Group ($n = 243$)

	Treatment Group	*n*	*M*	*SD*	% Correct
Pre-Test	Action Oriented Realists (ES)	76	4.97	1.97	29.24
	Action Oriented Innovators (EN)	68	5.16	1.84	30.35
	Thoughtful Realists (IS)	67	5.51	1.94	32.41
	Thoughtful Innovators (IN)	32	5.41	1.88	31.82
	Total	243	5.23	1.92	30.76
Post-Test	Action Oriented Realists (ES)	108	10.13	2.74	59.59
	Action Oriented Innovators (EN)	98	9.52	2.37	56.00
	Thoughtful Realists (IS)	97	9.64	2.64	56.71
	Thoughtful Innovators (IN)	41	9.83	2.61	57.82
	Overall	344	9.78	2.59	57.53
Delayed					

Post-Test	Action Oriented Realists (ES)	76	7.38	2.57	43.41
	Action Oriented Innovators (EN)	68	6.76	2.21	39.76
	Thoughtful Realists (IS)	67	7.19	2.43	42.29
	Thoughtful Innovators (IN)	32	7.41	2.28	43.59
	Total	243	7.16	2.40	42.12

We failed to reject the first null hypothesis developed for this objective. There was no difference between pretest, posttest, and delayed posttest scores of Oklahoma FFA Alumni Leadership Camp attendees with differing learning styles. The between subjects-effects, learning styles, were not statistically significant [$F(3, 1) = 1.12$, $p = .34$]. Levene's test of equality of error variances was non-significant; therefore, equal variances were assumed. Mauchly's test of sphericity was non-significant. Therefore, sphericity was assumed. The observed power for the statistical analysis was low (.30) due to a negligible effect size ($\eta_p^2 = .01$).

We failed to reject the second null hypothesis for this objective. There was no interaction between pretest, posttest, and delayed posttest scores of Oklahoma FFA Alumni Leadership Camp attendees and their personal learning style. The interaction between learning style and time were not significant [$F(3, 2) = 1.02$, $p = .41$]. Levene's test of equality of error variances was non-significant, and thus, equal variances were assumed. The observed power for the statistical analysis was moderate (.41) due to a negligible effect size ($\eta_p^2 = .01$).

The fourth objective was to determine if a relationship exists between campers' learning style and their attitude about the camp experience. Table 3 displays the mean attitude scores of campers by their treatment group (learning style). Mean learning style scores pertaining to camper evaluation of the camp experience were significantly different [$F(3, 340) = 3.11$, $p = .03$]. A pairwise comparisons analysis revealed that Action Oriented Realists (ES) evaluated the camp experience significantly higher than Thoughtful Realists (IS) or Thoughtful Innovators (IN). No statistically significant differences existed when comparing treatment group mean attitude scores associated with the potency of the camp experience [$F(3, 340) = .73$, $p = .54$]. Differences among mean group scores associated with activeness of the camp experience were statistically significant [$F(3, 340) = 3.30$, $p = .02$]. A pairwise comparison indicated that Action Oriented Realists (ES) and Action Oriented Innovators (EN) rated the activity of camp significantly higher than did the Thoughtful Realists (IS). Statistically significant differences existed among overall mean attitude scores by treatment group [$F(3, 340) = 3.22$, $p = .02$]. A pairwise comparisons analysis indicated that the overall attitude scores of Action Oriented Realists (ES) and Action Oriented Innovators (EN) were statistically significantly higher than the scores of Thoughtful Realists (IS) and Thoughtful Innovators (IN).

Table 3

Mean Camper Attitude Scores by Treatment Group ($n = 344$)

Learning Style	Evaluation	Potency	Activity	Overall

	of Camp[a]	of Camp[a]	of Camp[a]	Attitude[a]
Action Oriented Realists (ES)	6.67	4.97	5.48	5.71
Action Oriented Innovators (EN)	6.62	5.03	5.53	5.73
Thoughtful Realists (IS)	6.49	4.95	5.23	5.58
Thoughtful Innovators (IN)	6.45	4.86	5.33	5.55
Total	6.58	4.97	5.42	5.66

[a]Scale: 1.00 – 3.99 = negative attitude; 4.00 – 4.99 = neutral attitude; 5.00 – 7.00 = positive attitude.

Conclusions, Implications, and Recommendations

In conclusion, campers' learning styles roughly mirror the learning styles of the general population (Shindler & Yang, 2003). As with the general population, camper learning styles are varied and in proportion to society at large. Campers from all four learning styles were attracted to the camp and had an overall positive experience. Further research is needed to analyze the learning styles of FFA members who chose to attend camp more than once to determine if a particular type of learner is attracted to the format and programs of camp. According to Jung's (1971) type theory, extraverted learners are more comfortable in a camp setting than introverts due to the considerable emphasis on group work, intense large group interactions. Extroverts may be overrepresented in the return camper category.

Learning style had no effect on the amount of information campers learned or retained after six months during small group breakout sessions. Therefore, we failed to reject both null hypotheses associated with objective two. This conclusion contradicts Jung's (1971) psychological type theory as introverts are predicted to experience a learning barrier when participating in a group-learning environment as was created during small group breakout sessions (Jung, 1971). Theory suggests that small groups are more satisfying for extraverted learners who thrive in group environments and learn best by sharing their thoughts with others (Jung, 1971). The findings of this study add to the divergent field of literature pertaining to learning style in both agricultural education as well as other educational disciplines (Cano, et al., 1992; Garton et al., 1999; Marrison & Frick, 1994; Thornton, Haskell, & Libby, 2006; Whittington & Raven, 1995) and confirms the findings of Marrison and Frick (1994) who found that learning style produced no significant differences in academic achievement.

Preferred learning style had no effect on the amount of information learned or retained by campers when comparing the mean scores of pretests, posttests, and delayed posttests. Further, there was no interaction between time and learning style, which indicates that learning style does not impact the amount of information campers retained six months later. Therefore, we failed to reject both nulls hypotheses formulated for objective three. We conclude that learning style was not a factor in student learning outcomes or retention in a non-formal camp environment. This conclusion aligns with the findings of Hansen and Stansfield (1982), McDonald (1984), Mehdikhani (1983), and Paradise and Block (1984) who also found that learning style did not impact student learning outcomes in formal education environments.

Attitudes toward camp were significantly different among learning style groups; extroverts evaluated the camp higher than introverts, had a more positive attitude, and rated the activity of the camp higher than introverts. All four types of learners rated potency equally, which agrees with the findings associated with objectives two and three. Campers' preferred learning style did not influence their learning outcomes or their attitude pertaining to the potency of camp. We conclude that extroverts, who are drawn to socially charged situations, benefited more from camp in the affective domain than did introverts. Introverts enjoy working alone, need more quiet time for reflection, and are more satisfied with fewer social interactions than extroverts (Shindler & Yang, 2003). Research indicates that attitude development is profoundly important, perhaps more important than cognitive development, when preparing students for their post-school lives (Popham, 2009). We recommend that camp directors, who themselves may be extroverted, better attend to the unique social needs of introverts by planning more activities that support introverted preferences to be completed solo or in very small groups of two people.

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Discussant Remarks: Brian Parr

A Quasi-Experimental Study to Explore the Interaction Between Students' Learning Outcomes and Preferred Learning Style in a Non-Formal FFA Camp Environment

I have chosen to combine the remarks for these papers since they appear to be created out of the same study.

I certainly appreciate the efforts of the researchers to examine and evaluate the effectiveness of instruction in a non-formal environment. The research methodology employed appears to be extremely sound in every aspect.

I appreciate the point that the researchers made concerning the previous published research concerning the impact of learning styles on learning outcomes or the lack of impact. Further, this research failed to uncover evidence that learning styles impact student achievement. My question is; is it time that we as teacher educators begin to change our message on the importance of learning styles?

Or, since your study did support claims that students' learning styles do have an impact on how much they enjoy certain types of educational experiences, is this enough of a reason to maintain the instruction concerning the different learning styles and means by which we appeal to those students through our teacher preparation programs. I think that it would be easy to point out through research and years of anecdotal evidence that students can learn, relatively speaking, through instructional efforts that they find boring and unattractive. If this wasn't true, most of us would still be repeating sixth grade.

I also would like to hear more about the subject matter that was delivered at the camp. My impression from the papers is that the subject matter may be delivered at an "informal" facility but may actually be poorly delivered formal instruction?

As a side note and as a way to document this change, I would like to commend each of you for bringing us to a more correct form of writing for our profession that is written from the first person perspective, thanks!

Measuring Florida Extension Faculty's Agricultural Paradigmatic Preferences

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Abstract

As the demand for sustainable agriculture has increased in policy and communities, colleges and institutions have adopted this agricultural paradigm into their goals and objectives. The University of Florida has identified agricultural sustainability as a major goal. Extension agents have been identified as critical information sources, important to producers who wish to pursue sustainable agricultural growing techniques. However, it is known that an institution's goals may not be represented by the actions and beliefs of its staff members (Eveland, 1986; Minarovic & Mueller, 2000). While Extension faculty have been identified as change agents in the shift to a more sustainable agriculture, little was known regarding Florida Extension agents' perceptions towards this topic. This study utilized a modernized Alternative and Conventional Agricultural Paradigm (ACAP) scale instrument to quantitatively measure Florida Extension agents' agricultural paradigms. The mean Sustainability Score for Florida Extension agents was 80.64 within a potential range from 24 – 120 where higher values indicate a stronger alignment with sustainable agriculture. Three paradigmatic groups were identified: Conventionals, Moderates, and Sustainables. It was determined that University of Florida Extension faculty are supportive of their organization's goals and objectives related to sustainable agriculture, and likely to facilitate teaching about this topic given appropriate training and resources.

Introduction

Sustainable agriculture has been offered as a solution to minimizing the effects of some conventional agricultural practices (USDA, 1999). Many definitions exist; however, it is generally accepted that sustainable agriculture includes components of natural resource preservation, and economic, social, and environmental balance (USDA, 1999). For the purpose of this research, sustainable agriculture was defined as "an agriculture that can evolve indefinitely toward greater human utility, greater efficiency of resource use, and a balance with the environment that is favorable both to humans and to most other species" (Harwood, 1990, p. 4). Simply, sustainable agriculture protects the environment, conserves resources, and supports the community while being profitable to the producer. Further, an agricultural paradigm was defined as an individual's preferred model of agricultural practices. It was acknowledged that an Extension agent's preferred agricultural preference would fall at some point between a strong conventional and a more sustainable paradigm.

The demand for sustainable agriculture has increased in communities (Gonzalez, 2011) as well as colleges (Doerfert, 2011) including the University of Florida (University of Florida, 2008) and national policy. One example is the most recent Farm Bill (H. Res. 2419, 2008), which included incentives for converting land to support sustainable grazing or crop production methods and made funding a priority for those who seek loans to convert land into organic and alternative production systems. This is an indication of the significance and permanence of this agricultural paradigm. Gonzalez identified an "emerging consensus among policy-makers at the international level that promoting sustainable agriculture is necessary to address the environmental and food security challenges of the 21st century" (2011, p. 516). The University of Florida IFAS Extension Statewide Goals and Focus Areas for 2008-2012 identified "Agricultural and Natural Resource Industry Profitability and the Sustainable Use of Environmental Resources" as a primary goal for small farms, agronomic row crops, sugarcane, rice, animal sciences, and fruit and vegetable crops.

The 2011-2015 National Research Agenda for Agricultural Education and Communication recognizes that "a sufficient supply of well-prepared agricultural scientists and professionals is needed to drive sustainable growth" and address 21st century challenges (Doerfert, 2011, p. 9). One such challenge is in supporting the selection of conventional or sustainable production methods by producers and consumers alike. Extension agents have the potential to serve as the responders to this challenge. In fact, the education of Extension faculty has been identified as the primary and most important task in diffusing sustainable agricultural practices (Jayaratne, Martin, & DeWitt, 2001). The 2011-2015 National Research Agenda also asserts that "(a)n informed citizenry, including policy decisions at all levels, will create win-win solutions that ensure the long-term sustainability of agriculture, natural resources, and quality of life in communities around the world" (Doerfert, 2011, p. 8).

Extension agents have been identified as being critical information sources, important to the success of producers who wish to pursue sustainable or alternative agricultural growing techniques. Extension agents such as those employed by the University of Florida have been identified as key sources of information for producers who wish to pursue alternative agricultural methods. However, it cannot be assumed that agents are in agreement with or supportive of their organization's goals (Minarovic & Mueller, 2000), making a case for the need to measure individual preferences within an institution (Eveland, 1986). Agunga and Igodan (2007) explored sustainable agriculture growers' perceptions towards Extension, and found that the producers greatly needed Extension. Extension agents were used only as secondary information sources, due to the fact that producers viewed Extension as lacking in knowledge about sustainable agriculture (Agunga & Igodan, 2007). This paradox points to a substantial opportunity for Extension to become more involved and provides validation for the significance of this study.

The adoption of sustainable agriculture reflects not only changes in production practices, but also represents a shift in paradigmatic preferences, environmental beliefs, attitudes, and values, as noted by Abaidoo and Dickinson (2002). Galt, Clark, and Parr (2012) found that our evolving food system indicated a need for changing paradigms in addition to behaviors. A paradigm can be described as "an example that serves as a pattern" and "the conceptual framework that permits the explanation and investigation of phenomena" (Paradigm, 1997, p. 989). This research suggested that an individual's paradigm falls on a continuous scale at some point between a greatly conventional preference and a greatly alternative or sustainable preference.

Relationships between production preferences and specific attitudes have been identified (Allen & Bernhardt, 1995; Beus & Dunlap, 1994); therefore, it is useful to look at Extension agents' attitudes towards any topic they may be expected to teach. Subject matter does not exist in a vacuum but is deeply connected to those who teach and learn it. Development of "teaching methods that make values and attitudes visible in agricultural education and consider human values as both subjects and agents in relation to … agriculture" (Botelho, 1999, p. 208) is highly important.

The relationship between agents' agricultural preferences and their teaching and learning experiences can be further explained by Mitzel's Model, as described by Dunkin and Biddle (1974). Mitzel's Model described teaching and learning as being influenced by several variables. The outcomes of a teaching and learning experience, or Product Variables, are influenced by Context, Process, and Presage Variables. The Mitzel Model described Context Variables as student characteristics and environmental factors, while Process Variables are described as the specific activities that occur during the act of teaching and learning. Presage Variables are characteristics of educators that can influence the teaching process. Presage Variables include educators' attitudes and life experiences (Parr, Edwards, & Leising, 2006), and would thus include their orientation to agriculture, directly linking their agricultural paradigms to their teaching activities and outcomes.

It is important to understand Extension agents' perspectives towards agriculture in order to recognize an Extension system's informal stance towards the topic. Relationships between agricultural production preferences and specific attitudes have been identified (Allen & Bernhardt, 1995; Beus & Dunlap, 1994); therefore, a measurement of Extension agents' attitudes towards any topic they teach can be extremely useful. Using this information, an individual's likelihood to teach toward one particular agricultural paradigm can be predicted, and training needs can be better understood.

Beus and Dunlap (1991) developed the Alternative-Conventional Agricultural Paradigm (ACAP) scale to measure paradigmatic views towards agriculture, and it was found to significantly discriminate between the two perspectives. However, the original ACAP scale was found to have outdated language and numerous double-barreled statements. The original paired Likert-type scale instrument contained twenty-four "bi-polar items that portray the respective positions of the two paradigms as anchor points on a multi-point scale" (Beus & Dunlap, 1991, p. 438). The scale was found to be "appropriate and useful in studies of the agricultural intelligentsia (agricultural scientists, farm policymakers, organizational leaders…)" (Jackson-Smith & Buttel, 2003, p. 513). Others, including Rasmussen and Kaltoft, have agreed that this instrument "is a suitable method for quantitative assessment of attitudes to agriculture" (2003, p. 2). However, it had not been updated in some time.

Theoretical Framework

This research was guided by the theoretical framework of Roger's diffusion of innovations theory. Under Rogers' diffusion of innovations theory, individuals are described to be more likely to adopt new practices or technology if they found it to have a relative advantage to current methods (Rogers, 2003). Rogers (2003) explained that the "relative advantage of an innovation, as perceived by members of a social system is positively related to its rate of adoption" (p. 233). Thus, if Florida Extension agents feel positively towards sustainable agriculture, they would be more likely to adopt it and teach these methods of productions.

This research was further guided by individual perceptions as a function of the organization. An understanding of the feelings and values held by the persons who make up an organization are critical to understanding the entity's true stance towards their outwardly stated goals. It is known that individuals do not necessarily support the goals and objectives held by their organization (Eveland, 1986; Minarovic & Mueller, 2000). Simply, an understanding of individual preferences towards organizational goals holds significant value when determining if staff are likely to work to achieve them.

Purpose and Objectives

The purpose of this study was to further develop and pilot an updated version of Beus and Dunlap's original ACAP instrument (1991), to explore University of Florida faculty perceptions towards conventional and alternative agricultural paradigms, and to describe this population. The objectives that guided this study included the following:

1. Revise a tool to be used to measure and evaluate agricultural paradigms.
2. Describe University of Florida Extension faculty's demographic and background characteristics.
3. Document University of Florida Extension faculty's agricultural paradigms.

Methods

Beus and Dunlap's (1991) ACAP scale instrument was improved, validated using a panel of experts, and evaluated for reliability in a pilot study of known paradigmatic groups. Then, the electronic survey instrument was administered to a random sample of 188 Extension faculty members in all disciplines statewide to identify and document the paradigmatic preferences of University of Florida Extension educators.

Instrument Development

Beus and Dunlap (1991) developed a Likert-type Alternative Conventional Agricultural Paradigm scale instrument (ACAP scale). The original ACAP scale was found to be reliable and effective in discriminating between conventional and sustainable agricultural paradigms. The instrument contained 24 paired Likert-type scale items that were intended to represent polar opinion on different aspects of agricultural production. Each set of statements was separated by five points, or possible responses, which allowed respondents to identify their position between the two viewpoints. Half of the statements were randomly reversed to reduce response set bias.

Dr. Curtis Beus granted the researchers permission to further develop this tool (personal communication, July 25, 2011). The current researchers evaluated the instrument and identified numerous double-barreled statements as well as outdated language. The instrument was enhanced, updated and improved accordingly. For example, the original instrument used the terms farmers and farmland, two words that may seem archaic to modern agriculturists. Current producers may relate better to terms such as growers or landowners, and therefore these terms were used in the new instrument. Items were added to the instrument to collect descriptive data of the sample, including gender, age, department, education attained, land-grant versus non-land-grant education, and farm versus non-farm background. Further, it was converted into an electronic instrument using Qualtrics (Qualtrics, 2009). A panel of subject and research experts reviewed the resulting instrument for quality, clarity, and validity. Panel experts' revisions were incorporated into the final instrument, which was then evaluated in a pilot test.

Based on the recommendations of Johanson and Brooks (2010), 24 - 30 respondents with 12 - 15 originating from each known group were sought for participation in the pilot test. Twelve respondents belonging to the known conventional group and sixteen belonging to the known alternative group were selected. Representatives from the conventional group were selected based on the authors' and subject experts' identification of conventional traits and practices. Representatives from the alternative group were selected based on their association with a sustainable or organic agricultural organization or the authors' and subject experts' identification of sustainable agricultural traits and practices. Pilot study participants resided in the southeastern United States.

The updated ACAP scale, which is summarized in Table 1, was found to be reliable and able to discriminate between paradigmatic groups, which enabled the researchers to proceed with the use of the instrument.

Table 1
Summarized Scale Items and Item Statistics on Modernized ACAP Scale in a Pilot Study to Determine Reliability and Validity of a Modernized ACAP Scale Instrument

	Summarized Scale Item	Corrected Item-Total Correlation	Cronbach's Alpha If Item Deleted
A	Meeting food needs with fewer farmers is positive versus negative	.646	.936
B	Cropland should be managed for profits versus long-term capacity	.565	.937
C	Dependence on high inputs of energy makes agriculture secure versus vulnerable	.659	.936
D	The primary goal of profitability versus long-term condition of land	.547	.937
E	The amount of agricultural land owned should not versus should be limited	.386	.939
F	Science & policy should develop more technologies versus recognize production limits	.454	.939
G	Success depends on modern technology versus experience & local knowledge	.792	.933
H	Agricultural success will not versus will be affected by decline of small communities	.668	.935
I	Less diverse, larger operations versus diverse, smaller operations meet agricultural needs best	.888	.932
J	Farm traditions and culture are outdated versus essential to modern agriculture	.537	.937
K	Farming is a business versus a way of life	.590	.937
L	Growers should primarily use synthetic versus natural fertilizers and methods	.573	.937

M	Less versus more people should participate in food production	.570	.937
N	Modern agriculture is a cause of minor versus major environmental problems	.836	.932
O	Landowners should farm as much as they can profitably versus personally	.763	.934
P	Agricultural operations should specialize in few crops versus variety of crops	.491	.938
Q	Soil and water should be used as needed. versus conserved	.617	.936
R	Growers should purchase versus produce most of their goods and services	.362	.939
S	The key to agricultural success lies in overcoming nature versus harmonizing with nature	.656	.935
T	Producers should specialize in either versus both crops or livestock	.469	.938
U	Production of food should take place at local versus national levels	.661	.935
V	The successful grower has an above average standard of living versus enjoys growing crops	.528	.937
W	Technology should replace versus enhance agricultural labor	.380	.939
X	The availability of food is evidence that agriculture is successful versus environmental consequences are evidence that it is not successful	.865	.932
Cronbach's Alpha			.939

Survey of Extension Faculty Members

A random sample of 188 was selected from the population of 305 Extension faculty members based on the recommendations of Krejcie and Morgan (1970). Extension faculty members were invited to participate in the study through electronic mail delivered to their University of Florida email address. A random drawing offering two gift cards was presented as an incentive to participate. Respondents were asked to input demographic and background information, and to self identify with one of three paradigmatic groups: a) strong supporters of conventional agriculture; b) supporters of both conventional and sustainable agriculture; and c) strong supporters of sustainable agriculture. The modernized ACAP scale instrument was distributed electronically through Qualtrics (Qualtrics, 2009) utilizing Dillman, Smyth, and Christian's (2009) recommendations to include three contacts: one original and two replacement surveys. The study remained open for a total of 36 days.

Following data collection, the previously reversed items were transformed. The data were coded so that each response equated to a numerical value between 1 and 5. Strongly conventional responses corresponded with 1 and most sustainable responses corresponded with 5 on each of the twenty-four items. A new variable, named the Sustainability Score, was created, and equated to the sum of each individual's 24 responses on the instrument. The possible value of Sustainability Score ranged from 24, which was the most conventional potential score, to 120, which was the most sustainable potential score. Data were imported into SPSS for analysis.

Findings

Instrument Development

The updated ACAP scale instrument was piloted during the months of May and June of 2012 with twenty-six individuals known to belong to each of the polar positions between conventional and sustainable agriculture. Reliability of the updated scale was measured at .94 using Cronbach's alpha coefficient. Cronbach's alpha is an excellent measure of reliability when using scales for research (Santos, 1999) and when measuring tests that are not "scored right versus wrong" (Fraenkel & Wallen, 2008, p. 158). A reliability coefficient greater than 0.70 is acceptable for use (Fraenkel & Wallen, 2008). On a scale from 0.00-1.00, with 1.00 being the greatest level of reliability, this coefficient of .939 was considered to be reliable. Item-total statistics indicated that the removal of any of the individual items would not result in a substantially higher Cronbach's alpha value, and therefore, no items were removed or modified (Radhakrishna & Doamekpor, 2007).

The range of Sustainability Scores within this pilot study was 38 to 119. The range for individuals in the known conventional group was 38 to 81. The range for individuals in the known alternative group was 64 to 119. The alternative group (n=16) had a mean of 93.38 and standard deviation of 19.31. The conventional group (n=12) had a mean of 67.25 and a standard deviation of 12.35.

As presented in Table 2, an independent t-test for equality of means between the two groups indicated that their Sustainability Score means were not equal (t=4.091, p<.001). The sustainable known group's Sustainability Score (M=93.38, SD=19.31) was significantly higher, or more sustainably-oriented, than that of the conventional known group (M= 67.25, SD =12.35). The Cohen's d measure of effect size for this analysis was 1.60, between known groups on Sustainability Score. Based on Cohen's recommendations (1988), this value was interpreted to indicate a large magnitude of relationship. Effect size measures the strength of relationship and is independent of sample size. Based on the significance of the difference between known-group means and the large effect size resulting from this independent t-test, it was determined that the updated ACAP scale does effectively discriminate between known groups. This information paired with the reliability of the updated instrument supported the determination that this tool could be used to collect data on populations of Extension agents and other educators.

Table 2
Independent t-test Comparing Known Agricultural Paradigmatic Group and Sustainability Score in a Pilot Test Evaluating the Reliability and Validity of a Modernized ACAP Scale

	Conventional Known Group	Sustainable Known Group	df	t	p	d[a]
Sustainability Score	67.25	93.38	26	4.091	<.001	1.60
	(12.35)	(19.31)				

Note. Standard deviations in parentheses below means.

[a]Cohen's d value of greater than .80 indicates a large effect size (Cohen, 1988).

Extension Faculty Members Paradigmatic Preference

Study data from Extension faculty members were collected during the months of June and July of 2012. The researchers determined 69 of the 188 distributed surveys, or 37% of the returned surveys to be usable. Nonresponse error was controlled through a comparison between early and late respondents as recommended by Lindner, Murphy, and Briers (2001), and Miller and Smith (1983). This analysis was conducted by using an independent t-test for equality of means. The results were non-significant ($t = 0.89$, $p = 0.38$). Early and late respondents have been found to be similar (Miller & Smith, 1983), and thus the researchers were able to extrapolate findings to the population under study (Lindner, Murphy, & Briers, 2001).

Cronbach's alpha coefficient calculated from the full study data was measured at .871, indicating a suitable level of reliability (Fraenkel & Wallen, 2008). Item-total statistics were calculated and indicated that the removal of any of the scale items would not result in a significantly higher Cronbach's alpha value and therefore, all items were included in the data analysis (Radhakrishna & Doamekpor , 2008).

Measures of central tendency and frequencies were computed to summarize demographic and background characteristics of the responding sample, which is presented in Table 3. The mean age of respondents was 44.93 (SD=12.86). All respondents had earned a minimum of a Bachelors degree while the majority of respondents (66.2%, n=45) held Master's degrees. A few (13.2%, n=9) had achieved Doctoral degrees. Males comprised 38.5% (n=25) while females comprised 61.5% (n=40). Most (86.6%, n=58) of the respondents indicated they had attended a land-grant university. A small percentage (14.9%, n=10) currently owned agricultural land, and nearly one-third (29.9%, n=20) had been raised on a farm.

The sample was composed of Extension faculty from all disciplines: 28.0% (n=19) worked primarily in Agriculture; 32.4% (n=22) worked primarily in Horticulture; 16.2% (n=11) worked primarily in Family and Consumer Science; 16.2% (n=11) worked primarily in 4-H, and 7.4% worked in other disciplines, namely Sea Grant (n=2) and Natural Resources (n=2). Respondents were located in each of the Florida Extension Districts: 34.3% (n=23) in the South; 23.9% (n=16) in Northeast; 13.4% (n=9) in the Northwest; 14.9% (n=10) in the South Central; and 13.4% (n=9) in the Central District.

Table 3
Demographic and Background Characteristics in a Study to Determine Alternative and Conventional Agricultural Paradigms of Florida Extension Personnel

Gender	n	% of Total
Female	40	61.5
Male	25	38.5
Extension Discipline	n	% of Total
4-H	11	16.2
Agriculture	19	28.0
Horticulture	22	32.4
Family/Consumer Sci.	11	16.2
Other	5	7.4
Florida Extension District	n	% of Total
Northwest	9	13.4

Northeast	16	23.9
Central	9	13.4
South-Central	10	14.9
South	23	34.3
Highest Education Attained	n	% of Total
4-Year Degree	14	20.6
Masters Degree	45	66.2
Doctoral Degree	9	13.2
Land-Grant Education	n	% of Total
Attended	58	86.6
Did Not Attend	9	13.4
Age	n	% of Total
20-29	10	16.7
30-39	11	18.3
40-49	14	23.3
50-59	19	31.7
60+	6	10.0
Upbringing	n	% of Total
Farm	20	29.9
Non-Farm	47	70.1
Agricultural Land Ownership	n	% of Total
Own Agricultural Land	10	14.9
Do Not Own Ag. Land	57	85.1
Self-Reported Paradigm	n	% of Total
Sustainables	21	30.4
Moderates	45	65.2
Conventionals	3	4.3

Note. For items with less than 100% response rate, percentages are based on responding total.

The mean Sustainability Score for Florida Extension faculty was 80.64 (SD=12.74), which is slightly above the median value of 72 between the most sustainable (120) and most conventional (24) potential scores. The range of Sustainability Scores for all respondents was 40 to 114.

Extension Faculty were asked to self-identify as: a) strong supporters of conventional agriculture; b) supporters of both conventional and sustainable agriculture; and c) strong supporters of sustainable agriculture. These three self-identified paradigmatic groups were labeled by the researchers as Conventionals, Moderates, and Sustainables. Moderates were those who supported both conventional and sustainable agricultural paradigms; Conventionals were those who supported conventional agriculture; Sustainables were those who strongly supported sustainable agricultural paradigms. Very few (4.4%) of the Florida Extension Faculty identified themselves as belonging to the Conventionals group. The majority (65.2%) identified themselves as Moderates, with approximately one-third (30.4%) identifying themselves as Sustainables. The mean Sustainability Score for the Conventionals group was 59.33. The mean Sustainability Score for the Moderates group was 78.91. The mean Sustainability Score for the Sustainables group was 87.38. Based on the small number of faculty identifying themselves as Conventionals (n=3), it was determined that robust statistical comparisons could not be conducted with this group; therefore, they were not included in further comparisons with Moderates and Sustainables.

An independent t-test for equality of means was used to compare Sustainability Scores between Moderates and Sustainables. A significant difference was identified in the scores between the Moderates (M=78.91, SD=9.76) and Sustainables (M=87.38, SD=13.21); t (64)=2.93, p = 0.005. These results, which are reported in Table 4, indicated that respondents' self-identified paradigmatic group matches their Sustainability Score, and that Florida Extension faculty members were able to accurately gauge their personal agricultural paradigm. The effect size of this difference, as measured by Cohen's d, was .73, which was interpreted as a medium effect (Cohen, 1988).

Table 4
Independent t-test Comparing Sustainability Scores and Component Scores of Florida Extension Faculty by Self-Reported Paradigmatic Group (Equal Variances) in a Study to Determine Alternative and Conventional Agricultural Paradigms of Florida Extension

	Moderates	Sustainables	df	t	p	d[a]
	78.91[a]	87.38[b]	64	2.93	.005	.73
Sustainability Score	(9.76)	(13.21)				

Note. Standard deviations in parentheses below means.

[a]Cohen's d value of greater than .50 indicates a medium effect size (Cohen, 1988).

Conclusions

The updated instrument that emerged from the pilot portion of this study was found to be reliable, relevant, and able to effectively measure an individual's agricultural preference. This instrument was useful in measuring Florida faculty's agricultural paradigms and is a useful tool for other organizations. Three agricultural paradigms were identified as a part of this study: Conventionals, Moderates, and Sustainables. The identification of these three paradigmatic groups may be helpful to organizations in understanding their staff members.

At a time when education was exclusive, the land-grant university system was established to serve all members of American communities and to deliver quality, research-based information regardless of individuals' location, finances, or any other characteristic (Sanderson, 1988). A current goal of the University of Florida Institute of Food and Agricultural Sciences is sustainability of environmental resources (2008). The identification of individual paradigms within an organization can allow for the identification of disparities between organizational objectives and faculty's personal paradigms; however, this was the first study known to the researchers in which University of Florida Extension Faculty's agricultural paradigmatic preferences were quantitatively measured. Valuable insight on University of Florida Extension faculty's agricultural preferences was gleaned from this study.

When asked to report alignment with a specific paradigm, Extension faculty clustered into statistically different groups, indicating validity in self-identification with an agricultural paradigm. The Florida Extension faculty's mean Sustainability Score emerged slightly above the median between the most conventional and alternative potential scores. Most respondents indicated that they consider themselves either Sustainables or Moderates. Very few identified themselves as Conventionals. Based upon this data, it was concluded that faculty at the University of Florida are accepting of a sustainable agricultural paradigm, and prepared to facilitate teaching about sustainable agricultural practices when appropriate.

One objective of this study was to measure individual paradigmatic preferences, based on the framework that individual values do not necessarily reflect the objectives set by their organization (Minarovic & Mueller, 2000). Findings indicated that University of Florida Extension Faculty align strongly with Moderate and Sustainable paradigmatic groups. Very few of the faculty were considered Conventionals. Thus, it was concluded that the orientation of Florida Extension agents' paradigmatic preferences towards a sustainable paradigm indicates that these individuals are well-prepared to operate in a historically-conventional system while teaching about sustainable agriculture.

Implications and Recommendations

Despite an incentive offered to participants paired with multiple replacement surveys, a poor response rate was achieved. The response rate of 37%, while characteristic of electronic survey-based studies, is considered to be quite low. The small sample size may have prevented the identification of certain relationships between variables. This study was further limited to University of Florida Extension faculty who were employed during June and July of 2012, and to those who chose to respond. Although this instrument was randomly distributed to individuals working in all disciplines, the majority of respondents belonged to agriculture and horticulture fields. This may be due to the fact that agricultural paradigms are most interesting to those working in these closely-related areas, and resulted in few responses from faculty in other disciplines.

Further research should be conducted to build upon the findings of this study. Replications may be conducted to measure other land-grant university Extension faculty paradigms. Resulting data may indicate whether there is a national trend towards the sustainable paradigm. A comparison between agricultural professionals in other organizations and other countries, using the modernized ACAP scale, would also be beneficial to understanding perspectives and preferences on various scales.

This study was framed by Rogers' (2003) diffusion of innovation theory, under which individuals are considered to be more likely to adopt a technology or technique if they find it to have relative advantage. University of Florida Extension faculty aligned more towards the sustainable agricultural paradigm than the conventional end of the spectrum, which indicated positive perceptions towards this topic. The identification of the University of Florida Extension faculty's perceptions, or relative advantage, was an indication that they are prepared to facilitate sustainable agriculture (Jayaratne Martin, & DeWitt, 2001).

This research was further framed under the foundation of the function of an organization based on individual preferences. While the University of Florida outwardly supported sustainable agriculture, it was not known whether the Extension faculty subscribed to its goals and objectives. The University of Florida Extension administration should be confident in knowing that the majority of their Extension faculty are considered either Sustainables or Moderates. Now that paradigmatic preferences are documented, an exploration of possible means for improving attitudes towards agricultural sustainability can be conducted. Specifically, the identification of factors that increase one's tendency towards a more sustainable paradigm would be useful to University of Florida administration in planning continuing educational programs. Extension faculty should be provided with training and educational tools related to sustainable agricultural practices to support their teachings on this topic. The researchers suggest that University of Florida faculty are prepared to step forward from their role as secondary sources of information about sustainable agriculture (Agunga & Igodan, 2007) to primary facilitators of this paradigm.

Several studies have identified many barriers to the adoption of sustainable agriculture (Agunga & Igodan, 2007; Hanson, Kauffman, & Schauer, 1995; Rodriguez, Molnar, Fazio, Sydnor, & Lowe, 2009) and in-service training needs (Agunga, 1995) in this area. Qualitative research should be conducted with the University of Florida Extension faculty to explore educational needs and perceived barriers to teaching and adopting sustainable agricultural paradigms.

Every position in Extension is connected to agriculture, and therefore professionals in all subject areas were included in this study. A tendency towards sustainable agriculture was identified in all subject areas, which points to potential opportunities for transdisciplinary teams to work on projects that support and enhance sustainable agriculture.

This study provided a valid and reliable modernized ACAP scale instrument that was found to effectively measure individuals' agricultural paradigmatic preferences. By exploring and documenting paradigmatic preferences held by University of Florida Extension faculty, the researchers addressed a significant information gap. Baseline data about this population has been recorded, allowing for a better understanding about this population and providing a framework for future studies. University of Florida Extension faculty are not opposed to supporting the goals of their organization towards sustainable agriculture, and are likely to teach towards this paradigm given the appropriate resources and training. Implications exist in relation to additional universities identifying agricultural paradigmatic preferences through the use of the developed instrument and thus providing a clearer picture of the national extension system as a whole.

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Discussant Remarks: Brian Parr

Measuring Florida Extension Faculty's Agricultural Paradigmatic Preferences

I would first like to say that this article was very well written and was a pleasure to read. I would also like to commend each of the authors for their efforts in revising a valuable measurement tool that has been proven through previous efforts instead of developing yet another instrument with all the struggles and concerns that come along with a brand new instrument.

The research methodology does appear sound but did leave me with some questions concerning the identification of early and late responders and the number of those late responders that were included in the analysis. However, my greatest concern with this piece of research is my suspicions concerning the large number of non-responders. I do not need to explain non-response error control to this group of authors as Dr. Lindner literally co-wrote the "standard" publication concerning this issue in agricultural education. But, I believe that the very low number of participants that were identified as "conventionals" as well as the popular perception of sustainable practice represents a reasonable suspicion that non-responders may have been very different from responders. If telephone interviews could have been conducted with a sample of non-responders, how do you believe the study may have taken on a different twist? Further, reporting percentages of responding totals creates some confusion as opposed to reporting a non-respondent category. Perhaps we can address these questions at the conference.

Also, as leaders in our field of research, do you have any suggestions concerning the improvement of response rate for online survey research?

A Needs Assessment of Skills, Curriculum, and Technology in the Arkansas Cooperative Extension Service

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Abstract

Digital media and technology integration curriculum was developed and incorporated into an extension personnel training conference in Arkansas. Perceptions of technology and the curriculum were assessed using pre- and post-workshop surveys. Extension personnel participated in lessons covering seven types of media (Social Media, Video Media, Photography Media, Professional Networking Media, Collection Media, Publishing Media, and File Sharing Media). Upon completion of each unit of instruction, extension personnel (N = 23) participated in hands-on learning exercises to contribute to their understanding of concepts and the development of digital media products that would enhance participants' program areas. Participants felt their greatest actual use, ability to use, and expected future use of technology was their use of the Internet. When asked their technology literacy self-rating, 70% of participants rated themselves as "Intermediate". Participants gained the greatest enjoyment from the Photography Media section of the workshop, and the least enjoyment from the Professional Networking Media section. Only 17% of participants reported high interest in teaching technology to their clients, but when asked the likelihood of using media as part of a digital media integration plan, participants rated all but one of the seven media covered as "Very Likely". Participants also noted seeing the least amount of value overall in the Professional Networking Media section of the training. However, research showed the importance of extension personnel professional development and technical expertise. Efforts should be made to provide professional development and technology based training for extension personnel to improve program effectiveness and Extension reach.

Introduction

The Smith-Lever Act of 1914 created the Cooperative Extension Service to assist in diffusing useful and pragmatic information to the people of the United States (Rasmussen, 1989). Today, the Cooperative Extension Service is extremely diverse and widely distributed, offering the largest adult education system in the United States (Franz & Townson, 2008). "Having the ability to create, host, and facilitate access to educational materials and information over the Internet creates many new opportunities for Extension educators" (Rich, Komar, Schilling, Tomas, Carleo, & Colucci, 2011, p. 2).

"Achieving the mission of the Cooperative Extension System and maintaining our strength as educational leaders are hinged on our professional competence and technical expertise. Today as never before, professional development will help us achieve the level of excellence we expect from ourselves and ought to have for Extension in order to make a statewide, national, and global impact" (Stone & Coppernoll, 2004, p. 1). The six areas of Extension professional development needs outlined were: (1) Subject matter expertise with technology integration, (2) Organizational effectiveness, (3) Develop and involve others, (4) Communications, (5) Action orientation, and (6) Personal effectiveness (Stone & Coppernoll, 2004). However, today's extension agent must be a technical expert as well as skilled and competent in diverse, electronic information development and dissemination (Diem, Hino, Martin, & Meisenbach, 2011**;** Telg, Irani, Hurst, and Kistler, 2007).

Extensive research has been conducted regarding the use of technology in education (Kotrlik & Redmann, 2009; Kotrlik, Redmann, & Douglas, 2003; Murphrey, Miller, & Roberts, 2009). In addition, specific aspects of technology use have been studied including the use of the Internet as a source of information (Rhoades, Irani, Telg, & Meyers, 2008;), Web 2.0 technologies (Rhoades, Friedel, & Irani, 2008), and the use of illustrated web lectures (Roberts & Dyer, 2005). Since the early 19th century, however, face-to-face transfer of information from the Land Grant institution has been augmented by mediated channels of communication, ranging from print and broadcast media to the Web (Baker, Abrams, Irani, & Meyers, 2009). Stevens (1991) noted that "traditional delivery methods of Extension programming – conferences, printed material, press releases, radio, and county meetings – are still important," but called for advanced media use through video to enhanced traditional deliveries (p. 1). In the study conducted by Rhoades, Irani, et al. (2008), the authors call for continued research on this topic in order to enable effective use of the technologies.

Electronic media continues to change/improve at a rapid rate, and the social media movement and agricultural-related technologies have exploded over the past decade. This requires Extension to determine its needs related to leveraging this media explosion by determining the needs of its clientele. These needs can best be determined by needs assessments (Witkin & Altschuld, 1995). According to English and Kaufman (1975), a needs assessment is "a tool which formally harvests the gaps between current results (or outcomes, products) and required or desired results, places these gaps in priority, and selects those gaps (needs) of the highest priority for action" (p. 3). Conducting a needs assessment helps organizations identify desired outcomes so that plans may be developed to achieve those outcomes (Witkin & Altschuld, 1995).

According to Diem et al. (2011), "a balanced approach to reaching new audiences and maintaining traditional supporters is key to Extension's future" (p. 3). This approach identified key actions which included (1) Extension leadership needs to model the use of technology, (2) Establish and implement a state Extension technology plan based on Extension leadership directives and a needs analysis, (3) Promote and recognize technology use by faculty, staff, and volunteers, and (4) Dedicate resources and support to improve success. The same authors also noted that Extension has been a leader in field-testing new technologies and adopting new practices (Diem et al., 2009). However, Seger (2011) explained that many barriers exist to the successful implementation of technology in Extension because the organizational structure of Extension does not cater to the short turn-around demands of new technology. LaBelle (2011) explained the "need to create instructional content for mobile platforms is an obvious step towards reaching new and existing Extension audiences" (p. 1).

Many new opportunities have morphed the role of agents and opened up new jobs for people to pursue in the Cooperative Extension Service. Many of those new opportunities are related to use of digital and online communications and educational media. Extension personnel should be striving to "extend the reach of Extension" through digital media integration, according to Extension evaluation specialist Karen Ballard (personal communication, September 4, 2012). Extending the reach of Extension is a need that must be met in the age of digital media and distance education. "People want their information delivered in smaller chunks. We've conducted focus groups who claim to still want fact sheets, but if you look at what they're actually using, it all relates to digital media and small bits of information. We need people to help with professional and organizational development, curriculum development, and continuous support for our agents and the people they serve" (Ballard, personal communication, September 4, 2012).

Formal education and training can assist Extension personnel with improving upon their lack of communications knowledge or skills and can provide an opportunity for media integration and programmatic improvement (Boone, Meisenbach, & Tucker, 2002; Boyle, 1981). This concept can most certainly apply to digital media in the same way it has to traditional print and broadcast media.

Theoretical Framework

Constructivism has been used to represent a collection of theories, including generative learning (Wittrock, 1990), discovery learning (Bruner, 1961), and situated learning (Brown, Collins, & Duguid, 1989). Constructivism is the "learning by doing" theory in which agricultural science programs can base many of their lessons on. Learning is an active process where the learner uses sensory input and constructs meaning with the content based on previous learning and experiences (Hein, 1991). Kolb (1984) proposed a theory of experiential learning that involved four principal stages: concrete experiences (CE), reflective observation (RO), abstract conceptualization (AC), and active experimentation (AE). These teaching methods allow learners to reach application, analysis, synthesis, and evaluation, the higher tiers in Bloom's Taxonomy of learning (Bloom & Krathwohl, 1956). "Learners are expected to understand the applications they are learning" (Edgar, 2012, p. 13) and should be able to do more than simply act on memorization. "Traditional instruction often leads students to believe they are not interested in particular subject areas" (Brooks & Brooks, 1999, p. 16). By participating in hands-on activities, participants engage "in the learning experience and gain a deeper understanding of the task at hand. According to Brooks and Brooks (1999), "deep understanding is the goal" (p. 16).

The diffusion of innovations can be, and usually is, a long, intricate process. Rogers (2003) developed a widely used model for following a new product through the diffusion process. Extensive research has focused on using Rogers' model to study the importance of the technological innovation in Extension and Extension delivery and dissemination methods (Harder & Linder, 2008; Boleman & Dromgoole, 2006; Xu & Kelsey, 2012). Rogers (2003) defined diffusion as "the process in which an innovation is communicated through certain channels over time among the members of a social system" (p. 5).

There are five stages of the innovation-decision process (Rogers, 2003):

1) Knowledge: Knowledge occurs when an individual is first exposed to a new innovation and learns how it functions.
2) Persuasion: Persuasion is when an individual develops an attitude (either favorable or unfavorable) towards the innovation.
3) Decision: The individual now makes a choice whether to adopt or reject the innovation.
4) Implementation: If the individual chose to adopt the innovation, they will now put it to use.
5) Confirmation: After putting the innovation to use, the individual will seek reinforcement of the decision they made. At this point, they want to ensure they were correct in deciding to adopt.

Among the main facets of Rogers' (2003) theory is an important group of people who are key players in launching the adoption of a new technology. Referred to as "early adopters," these individuals are willing to step outside the norm and try something new before it has been proven beneficial. Once early adopters complete the five stages of the innovation-decision process, they are instrumental in spreading the word about the benefits of a new technology throughout a social system. Knowledge of new curriculum can be achieved by developers attending events where early adopters will be as well as conducting meetings with these individuals. In the case of a curriculum unit, the social system would be educators of the same content. "The early adopter is respected by his or her peers and is the embodiment of successful, discrete use of new ideas" (Rogers, 2003, p. 283).

With a continuous stream of new digital media, many extension personnel struggle to use the technology effectively for educational purposes. This educational need can be combatted with joint collaborative initiatives between agricultural communications (ACOM) faculty and staff and state Cooperative Extension Services. Today's Extension agent must be a technical expert as well as skilled and competent in diverse, electronic information development and dissemination (Diem et al., 2011; Telg et al., 2007). Because ACOM faculty typically have experience in and teach about new digital medias, joint relationship between Extension and ACOM can enhance the integration of technology in Extension education. Furthermore, the "creation of programs that develop the skills and competencies necessary to improve the communications and knowledge sharing effectiveness of all in the agriculture-related workforces of societies" (Doerfert, 2011, p. 9) was outlined in the National Research Agenda as a research need area. In addition, developing and assessing "various learning interventions and delivery technologies to increase problem-solving, transfer of learning, and higher order thinking across all agricultural education contexts" (Doerfert, 2011, p. 9) was also identified as a key research goal. Research and collaborative efforts by ACOM and Extension personnel are critical to enhance digital media use for information dissemination.

Purpose and Objectives

The purpose of this study was to assess participants' knowledge and skill level increase in specific electronic communication competencies used to create and promote educational programs in Extension. Three faculty from the University of Arkansas administered the five day intensive training conference (Extension Digital Media Academy) that focused on the following digital media instructional areas: (1) Social Media, (2) Video Media, (3) Photography Media, (4) Professional Networking Media, (5) Collection Media, (6) Publishing Media, and (7) File Sharing Media. The following specific research objectives guided the study:

1) Determine the instructional preferences of Extension personnel.

2) Determine participants' perceived usability and value of technology, especially related to their own self-rated technological literacy.

3) Determine the overall effectiveness and perceived value of the Extension Digital Media Academy (intensive five-day conference) experience.

Methods and Procedures

In the summer of 2012, the University of Arkansas developed curriculum for the "Extension Digital Media Academy" (EDMA), a five-day intensive training program for Extension personnel. The program was based on the foundation of the "Visual Communication on the Road in Arkansas: Video and Photo Creative Projects to Promote Agriculture" program previously developed by the University of Arkansas. The purpose of this program was to enhance and improve extension personnel's digital media competencies to enhance electronic communication skills for educational program development and delivery through knowledge acquisition and experiential activities. This study was limited to the number of participants accepted into the EDMA program. Generalizations based on this study should be limited. Participants ($N = 23$) were selected by state Cooperative Extension Service staff to participate in the conference.

Day one of the training consisted of an open meet-and-greet and introductory instruction. This allowed participants to gain an understanding of new media terms and identify new media topics to be integrated into education plans. Extension personnel participated in self-led media exploration and team collaboration to better understand new media topics and the concept of integrating media into Extension programs.

Day two began with a pre-workshop perception survey administered to determine participant instructional preferences and perceptions of technology. The instrument contained items on a 1 to 4 Likert-type scale designed to determine respondent perceptions. At the completion of the instrument, instructors covered the topics of camera parts and functions, photo composition, and photo editing. Participants captured photographs on the University of Arkansas campus and edited them.

Day three involved participants using PowerPoint presentations, created prior to the training, to create voice-over PowerPoint videos using Techsmith Camtasia. The videos were intended to be incorporated into participants' Extension educational programs. Participants were also introduced to photograph shot sheets and storyboards that were used in their teams to create group videos the following day.

Day four covered topics that included video camera parts and functions, shooting techniques, and video editing. Participants worked in teams to capture footage relevant to a chosen Extension program area and create an instructional video. The videos were rendered and posted to YouTube by each participant group.

On the final day of the intensive training, students developed digital media integration plans that incorporated the skills acquired as part of the conference, in to each of their respective program areas. Participants shared their plans with the larger group and discussed ways to integrate the skills learned in the workshop. Throughout the conference, workshop participants voted on the most successful digital media created as part of the program. At the end of the EDMA, participants were honored in an award ceremony.

One week after the completion of the intensive training, a post-workshop instrument was administered to Extension personnel who participated in the workshop to gauge the effectiveness of the conference, as well as to gain demographic information from participants. Perception questions were adapted from an instrument by Silance and Remmers (1934) to fit the content of this study. The perception section of the survey contained 20 items on a 1 to 7 Likert-type scale (1 = "strongly disagree" and 7 = "strongly agree") designed to determine respondent perceptions about the Visual Communications curriculum. To prevent response set, seven of these 20 items were negatively worded. Negatively worded questions were reverse coded for analysis. Participants were also asked to complete questions regarding the intensive conference training experience. Additionally, the researchers followed Dillman's Tailored Design method (2007) to reduce instrumentation bias in question wording.

A panel of three faculty members (from agricultural communications) examined the instrument and judged it to possess face and content validity. Alpha coefficients, for the researcher developed survey, were assessed on specific content sections and ranged from .62 -.79 for the dependent variables guiding this study. According to Nunnally (1967), a modest reliability of .60 or .50 is sufficient during early stages of research. All constructs revealed acceptable reliability levels. The reliability of demographic section was not assessed, since, according to Salant and Dillman (1994), responses to non-sensitive demographic items "are subject to little measurement error" (p. 87). Data were analyzed using descriptive (means, standard deviations, and percentages).

Results and Findings

The participants (N = 23,) surveyed consisted of seven males (33%), 14 females (67%), and two non-respondents. Of these participants, 86% (18 of 21 respondents) reported a Caucasian ethnic background, 9.5% (2 of 21) reported an African American ethnic background, and 4.8% (1 of 21) reported having a Native American, African American, and Caucasian ethnic background. When asked their education level, 24% (5 of 21 respondents) of participants had earned a four year college degree, 43% (9 of 21) had earned a Master's Degree, and 33% (7 of 21) had earned a Doctoral Degree.

Participants' total years with Extension ranged from less than one year to more than 10 years. Of the 21 responding participants, 4.8% (1 of 21) had been with Extension less than one year, 19% (4 of 21) had been with Extension one to three years, 24% (5 of 21) had been with Extension four to five years, 24% (5 of 21) had been with Extension six to 10 years, and 29% (6 of 21) had been with Extension for more than 10 years.

When participants were asked their program area with Extension, five participants identified Family and Consumer Science (with one specifying Child Care and one specifying Nutrition), two listed Community and Economic Development, one listed 4H Youth Development, one listed Agriculture Business/Agriculture Economics (Economist), one listed Agriculture & Water Quality, one listed Animal Science, one listed Aquaculture/Fisheries, one listed Bio Energy, one listed Forestry, one listed Horticulture, one listed Information Technologies, one listed Natural Resources, one listed Nutrition, one listed Support/Not Program, and two participants did not answer the question.

Participants were asked to identify the primary age of their program's target audience. Five participants did not specify a primary age (with two noting youth and adult, one noting all ages, one noting no primary age, and one not answering the question), four reported a range of 30 to 70 years (with one noting 30 years, one noting 40 to 70 years, one noting 45 years, and one noting 45 to 70 years), three reported a range of 20 to 65 years (with one noting 20 to 50 years, one noting 20 to 65 years, and one stating 25 to 45 years), two reported a range of 50 to 59 (with one noting 50 to 55 years and one noting 50's), one reported a range of 5 to 80 years, one reported a range of 5 to 19 years and adult volunteers, one reported adults, one reported all 4-H, county agents, and citizens, one reported over 40, and one reported SNAP participants/potential recipients.

Instructional Preference

When asked their interest in teaching technology to their clients, 17% (4 of 23) of participants reported "High Interest", 61% (14 of 23) reported "Medium Interest", and 22% (5 of 23) reported "Low Interest". Participants were asked to rate their instructional preference on a 4-point Likert-type scale ranging from "Strong" to "Not at all" for each of the eight categories (i.e., group instruction, intensive session (boot camp), video, audio recordings, computer-assisted tutorial, printed workbooks/handouts, independent study, demonstration with hands-on learning exercises) under study. Table 1 reveals participant instructional preference for demonstration with hands-on learning exercises as "strong" to "intermediate" with a mean of 1.52 (*SD* = .75). The participants instructional preference was "intermediate" to "somewhat" for an intensive session (boot camp) with a mean of 2.38 (*SD* = .87).

Table 1

*Participant Instructional Preference (*N *= 23)*

Item	*n*	*M*[a]	*SD*
Group instruction	21	1.86	.91
Intensive session (boot camp)	21	2.38	.87
Video	21	2.19	.87
Audio recordings	21	2.29	.85
Computer-assisted tutorial	21	1.90	.63
Printed workbooks/handouts	20	1.90	.72
Independent study	21	2.00	.71
Demonstration with hands-on learning exercises	21	1.52	.75

[a]Means are based on a Likert-type scale where 1 = Strong, 2 = Intermediate, 3 = Weak, and 4 = Not at all

When asked to list any topics participants taught or needed to know that should be included in their Extension training, 4.8% (1 of 21) of participants listed building an online course with graphics and design features to make it engaging, 4.8% (1 of 21) listed Camtasia, 4.8% (1 of 21) listed effective evaluation methods for evaluating social media/online education efforts outside of an online course, 4.8% (1 of 21) listed Flash, 4.8% (1 of 21) listed insect and pest ID/Silviculture, 4.8% (1 of 21) listed making simple graphics and use of GoAnimate, 4.8% (1 of 21) listed Praxis, 4.8% (1 of 21) listed tools to animate such as Flash, Articulate, etc., and 62% (13 of 21) participants did not answer the question.

Technology Use

Participants were asked to rate their ability to use technology on a 4-point Likert-type scale ranging from "Advanced" to "Not at all" for each of the fourteen categories (i.e., preparation of instructional materials, data recording and calculation, graphics and drawing, tutorials to explain concepts/methods, drill and practice (experimental), discovery learning/problem solving, word processing, simulations, database searching and research, Internet, CD-ROM for multimedia, distance learning, web resources for learning, web resources for teaching) under study. Table 2 reveals participants reported ability to use the Internet as "advanced" to "mostly advanced" with a mean of 1.30 (*SD* = .47) as compared to participants ability to use graphics and drawing as " mostly advanced" to "somewhat advanced" with a mean of 2.83 (*SD* = .72).

Table 2

*Extension Personnel's Ability to Use Technology (*N *= 23)*

Item	*n*	*M*[a]	*SD*
Preparation of instructional materials	23	1.74	.54
Data recording and calculation	23	1.74	.92
Graphics and drawing	23	2.83	.72
Tutorials to explain concepts/methods	23	2.22	.80
Drill and practice (experimental)	23	2.26	.86
Discovery learning/problem solving	23	2.00	.60
Word processing	23	1.35	.49
Simulations	23	2.61	.84
Database searching and research	23	1.61	.66
Internet	23	1.30	.47
CD-ROM for multimedia	23	1.65	.78
Distance learning	23	2.26	.69
Web sources for learning	23	1.83	.58
Web sources for teaching	23	2.13	.63

[a]Means are based on a Likert-type scale where 1 = Advanced, 2 = Intermediate, 3 = Novice, and 4 = Not at all

Participants were asked to rate their actual use of technology on a 4-point Likert-type scale ranging from "Always" to "Never" for each of the fourteen categories (i.e., preparation of instructional materials, data recording and calculation, graphics and drawing, tutorials to explain concepts/methods, drill and practice (experimental), discovery learning/problem solving, Word processing, simulations, database searching and research, Internet, CD-ROM for multimedia, distance learning, web resources for learning, web resources for teaching) under study. Table 3 reveals participants actual use of the Internet as an "always" to "mostly" with a mean of 1.05 (*SD*

= .22) and the actual use of drill and practice (experimental) as “mostly” to “somewhat” with a mean of 2.84 (*SD* = .83).

Table 3

*Extension Personnel’s Actual Use of Technology (*N *= 23)*

Item	*n*	*M*[a]	*SD*
Preparation of instructional materials	21	1.29	.56
Data recording and calculation	21	1.81	1.03
Graphics and drawing	21	2.24	1.09
Tutorials to explain concepts/methods	21	2.38	.92
Drill and practice (experimental)	19	2.84	.83
Discovery learning/problem solving	21	2.38	.97
Word processing	21	1.24	.54
Simulations	21	2.90	.89
Database searching and research	21	1.52	.81
Internet	21	1.05	.22
CD-ROM for multimedia	21	2.33	.91
Distance learning	20	2.50	1.19
Web sources for learning	21	1.76	.83
Web sources for teaching	21	2.00	.89

[a]Means are based on a Likert-type scale where 1 = Always, 2 = Frequently, 3 = Rarely, and 4 = Never

Participants were asked to rate their expected future use of technology on a 4-point Likert-type scale ranging from “Always” to “Never” for each of the fourteen categories (i.e., preparation of instructional materials, data recording and calculation, graphics and drawing, tutorials to explain concepts/methods, drill and practice (experimental), discovery learning/problem solving, word processing, simulations, database searching and research, Internet, CD-ROM for multimedia, distance learning, web resources for learning, web resources for teaching) under study. Table 4 reveals participants expected future use of the Internet as “always” to “sometimes” with a mean of 1.30 (*SD* = .56) and participants expected future use of simulations as “sometimes” to “rarely” with a mean of 2.65 (*SD* = .65).

Table 4

*Extension Personnel’s Expected Future Use of Technology (*N *= 23)*

Item	*n*	*M*[a]	*SD*
Preparation of instructional materials	23	1.65	.57
Data recording and calculation	23	1.87	.69
Graphics and drawing	23	2.48	.73
Tutorials to explain concepts/methods	23	2.17	.65
Drill and practice (experimental)	23	2.39	.78
Discovery learning/problem solving	23	2.17	.83
Word processing	23	1.35	.49
Simulations	23	2.65	.65

Database searching and research	23	1.74	.75
Internet	23	1.30	.56
CD-ROM for multimedia	23	2.39	.72
Distance learning	23	2.10	.79
Web resources for learning	23	1.70	.56
Web resources for teaching	23	1.96	.56

[a]Means are based on a Likert-type scale where 1 = Always, 2 = Frequently, 3 = Rarely, and 4 = Never

Participants were asked to rate their personal skills or proficiency level in visual communications on a 4-point Likert-type scale ranging from "Advanced" to "Not at all" for each of the 11 categories (i.e., using a video camcorder(s), edit video using computer software, edit multiple captured videos into a new product, creating a story line (storyboarding), video composition (shooting angles, lighting, etc.), using digital camera(s), photo composition (angles, rule of thirds, framing, etc.), edit photos using computer software, copyright and fair use laws, upload files to the Internet, identifying useful social/electronic media web resources) under study. Table 5 reveals participants personal skills or proficiency levels for uploading files to the Internet between "advanced" and "intermediate" with a mean of 1.48 (*SD* = .59) and participants personal skills or proficiency levels for editing multiple captured videos into a new product as "intermediate" to "novice" with a mean of 2.70 (*SD* = .82).

Table 5

*Personal Skills or Proficiency Levels in Visual Communications (*N *= 23)*

Item	*n*	*M*[a]	*SD*
Using a video camcorder(s)	23	2.39	.58
Edit video using computer software	23	2.57	.66
Edit multiple captured videos into a new product	23	2.70	.82
Creating a story line (storyboarding)	23	2.26	.69
Video composition (shooting angles, lighting, etc.)	23	2.61	.58
Using digital camera(s)	23	1.83	.39
Photo composition (angles, rule of thirds, framing, etc.)	23	1.96	.56
Edit photos using computer software	23	2.39	.72
Copyright and fair use laws	23	2.52	.67
Upload files to the Internet	23	1.48	.59
Identifying useful social/electronic media web resources	23	2.00	.85

[a]Means are based on a Likert-type scale where 1 = Advanced, 2 = Intermediate, 3 = Novice, and 4 = Not at all

When asked their technology literacy self-rating, 70% (16 of 23) of participants rated themselves as "Intermediate – will try most technology but not proficient in some" and 30% (7 of 23) of participants rated themselves as "Advanced – knowledgeable and people come to me for assistance". When asked where they learned what they know about technology, 29% (6 of 21) of participants indicated they learned from formal courses, personal informational study, and valued colleague(s), with one specifying learning from a combination of the three, and one specifying learning from peers. In addition, 9.5% (2 of 21) of participants reported learning from formal courses, personal informational study, valued colleagues, and "other", with one indicating other as being the Internet/friends, and one indicating other as being their husband (a videographer). Of the 21 participants, seven (33%) reported they learned from personal, informational study, and 9.5% (2 of 21) reported learning from personal, informational study and “other”, with one specifying other as being trial/error, and one specifying other as being trial and error/success. Finally, 19% (4 of 21) of participants reported learning from personal, informational study, and valued colleague(s).

Conference Effectiveness

Participants were asked to rate the relevance of EDMA training to their job responsibilities on a 4-point Likert-type scale ranging from “Highly relevant” to “Not relevant at all” for each of the seven categories (i.e., social media, video media, photography media, professional networking media, collection media, publishing media, file sharing media) under study. Table 6 reveals the participants mean and standard deviation scores for participant responses. File sharing media was identified as “relevant” with a mean of 1.70 (*SD* = .56) and professional networking media was also noted as “relevant” to “somewhat relevant” with a mean of 2.43 (*SD* = .84).

Table 6

*Relevancy of EDMA Training to Participant Job Responsibilities (*N *= 23)*

Item	*n*	*M*[a]	*SD*
Social Media	23	1.96	1.02
Video Media	23	1.83	1.03
Photography Media	23	1.87	.87
Professional Networking Media	23	2.43	.84
Collection Media	23	1.96	.71
Publishing Media	23	1.83	.65
File Sharing Media	23	1.70	.56

[a]Means are based on a Likert-type scale where 1 = Highly relevant, 2 = Somewhat Relevant, 3 = Not very relevant, and 4 = Not relevant at all

Participants were asked to rate their level of enjoyment of the EDMA training topics on a 4-point Likert-type scale ranging from “Very enjoyable” to “Not enjoyable at all” for each of the seven categories (i.e., social media, video media, photography media, professional networking media, collection media, publishing media, file sharing media) under study. Table 7 reveals participants enjoyment levels. Extension personnel noted that they found photography media “very enjoyable” to “enjoyable” with a mean of 1.70 (*SD* = .88). They also noted that they “enjoyed” to “somewhat enjoyed” professional networking media with a mean of 2.13 (*SD* = .63).

Table 7

*Participant Level of Enjoyment of EDMA Training Topics (*N *= 23)*

Item	*n*	*M*[a]	*SD*
Social Media	23	1.87	.87
Video Media	23	1.87	.81
Photography Media	23	1.70	.88
Professional Networking Media	23	2.13	.63

Collection Media	23	2.00	.52
Publishing Media	23	1.87	.46
File Sharing Media	23	1.87	.46

[a]Means are based on a Likert-type scale where 1 = Very enjoyable, 2 = Somewhat enjoyable, 3 = Not very enjoyable, and 4 = Not enjoyable at all

Participants were asked to rate the likelihood that they would use each of the seven categories (i.e., social media, video media, photography media, professional networking media, collection media, publishing media, and file sharing media) under study as a part of a digital media integration plans in their jobs. This topic was assessed on a 4-point Likert-type scale ranging from "Very likely" to "Not at all likely" for each of the seven categories. Table 8 reveals participants as being "very likely" to "likely" for using file sharing media with a mean of 1.57 (*SD* = .59). Extension personnel also noted that they were "likely" to "somewhat likely" to use professional networking media with a mean of 2.26 (*SD* = .96).

Table 8

*Likelihood of Participant Using Media Learned as part of the Extension Digital Media Academy in Their Digital Media Integration Plans (*N *= 23)*

Item	*n*	M^a	*SD*
Social Media	23	1.78	1.09
Video Media	23	1.78	1.00
Photography Media	23	1.61	.78
Professional Networking Media	23	2.26	.96
Collection Media	23	1.87	.92
Publishing Media	23	1.70	.70
File Sharing Media	23	1.57	.59

[a]Means are based on a Likert-type scale where 1 = Very likely, 2 = Somewhat likely, 3 = Somewhat unlikely, and 4 = Not at all likely

Conclusions, Discussion, and Recommendations

Extension personnel consistently agreed with their overall instructional preference of demonstration with hands-on learning exercises. Demonstration with hands-on learning exercises as described by participants resulted in a mean score of 1.52 (*SD* = .75). Therefore, respondents would be expected to enjoy the instructional style of the "Extension Digital Media Academy". It can further be postulated that participants prefer showing constituents the answers to Extension-related question, rather than having constituents watch a video on the Internet. Only 17% of participants reported "high" interest in teaching technology to their clients, and 62% of participants did not list topics they taught or needed to know that should be included in Extension training. These findings are inconsistent with the opportunities that have morphed the role of agents and opened up new jobs for people to pursue. However, this does not speak of Extension personnel "extending the reach of Extension" through digital media integration (Karen Ballard, personal communication, September 4, 2012).

Further it was found that participants perceived their use of the Internet as their highest ability to use, actual use, and expected future use of digital media technologies. Participants rated their personal skills or proficiency levels in visual communications to be highest in uploading files to the Internet (M = 1.48; SD = .59). Despite their low ratings of interest in teaching technology to their clients, 70% of participants rated themselves as "Intermediate- will try most technology but not proficient in some," and 30% of participants rated themselves as "Advanced- knowledgeable and people come to me for assistance". Additionally, 33% of participants indicated they learned what they currently knew about technology from formal courses and informational study. It can be postulated that while participants were not comfortable teaching technology to clients, they considered themselves proficient in topics concerning technology and recognized the need for formal courses and informational study to gain knowledge of technology integration. Extension personnel must recognize the new opportunities created through having the ability to provide access to educational materials over the Internet (Rich et al., 2011).

In all three categories of conference effectiveness, professional networking media was rated as the least relevant, least enjoyed, and least likely to be used of all "Extension Digital Media Academy" topics. The study conducted by Stone and Coppernoll (2004) hinged the ability of Extension to achieve its mission and maintain its strength as an educational leader on professional competence and technical expertise. Professional development was stated as the key to achieving the level of excellence expected from Extension "today as never before" (p. 1). However, this study showed that extension personnel do not find value in this type of professional development.

Practitioners must assist Extension personnel with finding value in these types of activities in order to further the "creation of programs that develop the skills and competencies necessary to improve communications and knowledge-sharing effectiveness" (Doerfert, 2011, p. 9) of the Cooperative Extension Service. Today's extension agent must remember the importance of being a technical expert, in addition to recognizing the need for diverse skills and competencies in electronic information development and dissemination (Diem et al., 2011; Telg et al., 2007). Participant results may have been affected by a lack of understanding to the professional development uses of this intensive training curriculum in digital media. In future trainings with extension personnel the instructional preferences of participants should be considered when identifying new modes of instruction to engage agents in professional development in the future. This will continue to develop the "problem-solving, transfer of learning, and higher order thinking" (Doerfert, 2011, p. 9) of Extension.

It is unknown at this time whether Extension personnel have continued to develop and refine any of the skillsets covered during the intensive training, and, if so, how the new technologies are being received by Extension constituents. If research indicates the continued use of skills gained through the EDMA, research should be conducted with the clientele of the extension personnel completing the intensive training. It should be determined whether the integration of technology has improved the education and overall experience of extension clientele. It should also be explored as to whether or not clientele feel more engaged with their respective extension personnel since the implementation of developed digital media integration. Therefore additional research should be conducted regarding the actual integration of technology skills from the EDMA. Additionally, with digital media technology being a relatively new topic for Extension training, initial benefits may have been difficult for participants to initially predict. Research should seek to improve the curriculum and identify areas of technology training weaknesses.

Extension personnel should have access to resources that will allow them to expand their knowledge of digital media integration. The EDMA participants had the strongest interest in learning through hands-on activities and were the most confident in their use of the Internet. Therefore, resources should be provided via the Internet that allow for hands-on activities that encourage the development of skills in technology, specific to use by extension personnel. Agents must continue to learn about changing technology, and the use of the Internet provides an outlet for all of Extension to disseminate the information necessary to educate agents via a positive medium. Not all agents are innovators (Rogers, 2003), but they should be technologically savvy to meet the changing needs of their clientele. There is a growing need for agents to increase and refine their skills in digital media that can only be met through education of the agents themselves. The assessment of conference effectiveness showed that participants enjoyed the curriculum as a whole. Therefore, trainings of this type should be implemented throughout the U.S. and further research on this type of curriculum in training extension personnel should be completed.

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Discussant Remarks: Brian Parr

A Needs Assessment of Skills, Curriculum, and Technology in the Arkansas Cooperative Extension Service

This piece of research did provide some valuable insight to the perceptions of technology held by Arkansas Extension agents.

My major question concerning this research is "what can we take away from this"? Specifically in terms of Rogers' diffusion model that you used as a piece of your theoretical framework. You make reference to the extension agents as possibly not being innovators or even adopters in some forms of technology but perhaps this is a perception issue? I think that the framework does support what you found here in several ways. The first is the importance of relative advantage. These educators see the value of internet use and employ this tool. However, it appears that they do not see the relative advantage of professional networking media. I must admit that I feel their pain. I am Linked-In but not exactly sure why.

I would also imagine that the relative advantage that the agents' clientele perceive concerning technology may be affecting their desire to teach them about technology.

I am very interested in a further explanation of how Rogers' theory will guide you in future professional development plans for this group.

Session G: STEM Instruction in Agriculture

Discussant: Dr. Don Johnson

Uncovering Academic Emphasis Through Agricultural Education: Knowledge of Pre-service Teachers in STEM Integration - A Cross-Case Comparison of Three Agricultural Education Pre-service Teacher Education Programs

Dr. J. Chris Haynes, University of Wyoming
Dr. Bart E. Gill, Western Illinois University
Dr. Steven Boot Chumbley, Eastern New Mexico University
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Abstract

The purpose of this qualitative, cross-case comparison was to explore agricultural education pre-service teachers' perceptions in regards to integrating science, technology, engineering and mathematics (STEM) into an agricultural education curriculum. This study included three teacher certification programs in agricultural education in the United States. It was revealed those pre-service teachers queried held perceptions similar regarding the integration of STEM related concepts into an agricultural education curriculum. (a) Participants felt agriculture was a natural integration and emphasis vehicle for a range of academic subjects. (b) Participants felt it was important to emphasize the core subject matter inherent to agriculture, but care must be taken to not fundamentally alter the purpose of the agricultural education program. (c) A consensus was reached lessons should be "hands-on" and relate the material to real world applications. It was recommended prior knowledge was important for successful integration of core content into an agriculture curriculum. Examination of how many credit hours of mathematics, science, and English pre-service agricultural education teachers are required to take to be effective at integration of core material should occur. Further, collaboration between university faculty of agricultural education and other departments outlining ways to achieve successful integration of academic content was needed.

Introduction

Educational reform vis-à-vis science education in the United States has stagnated. Despite ten years of efforts aimed at improving student achievement in science, technology, engineering, and mathematics (STEM) content, science achievement by students in the U.S. has been underwhelming (Davis, 2002). U.S. students' level of science literacy according to the program for international student assessment (PISA) is discouraging and ranks U.S. students, 23rd among the organization for economic cooperation and development (OCED) and non-OCED countries (Fleischman, Hopstock, Pelczar, & Shelley, 2010). The report *A Nation at Risk: The Imperative for Educational Reform* (1983) identified that academically; U.S. math and science standards have declined, as evidenced by increasingly poor test scores achieved by American youth. The National Center for Education and the Economy (2007) and the National Academy of Science (2007) have acknowledged the need for new and innovative approaches to education, more specifically, science education. According to Marx (2012), ". . . the United States is in danger of calamitous economic, security, and even social disasters (p. 420), further corroborating the call by the National Research Council (1996) for the need of increased scientific literacy.

A considerable amount of political voice has been targeted toward educational programs aimed to improve the achievement of students in STEM (Rose, 2007). Sanders (2009) stated ". . . integrative STEM education includes approaches that explore teaching and learning between/among any two or more of the STEM subject areas, and/or between a STEM subject and one or more other school subjects" (p. 21). Conroy and Walker (2000) posited agricultural education provides an educational context ideally suited towards student accomplishment in core academic areas (i.e., mathematics, science, reading, etc.), moreover, delivering relevance between academics and career and technical education, satisfying Perkins funding requirements towards the integration of academics in CTE (Myers & Thompson, 2009). As posited by researchers, students exhibit a higher level of achievement when exposed to agricultural and academic concepts such as science through an integrated approach, more so than those students exposed to more traditional methods of instruction (Chiasson & Burnett, 2001; Myers & Dyer, 2006; Parr, Edwards, & Leising, 2006; Roegge & Russell, 1990). With the emphasis on STEM integration across the curriculum (Sanders, 2009), agricultural education is a natural "fit" for the integration of math and science concepts (Balschweid, Thompson, & Cole, 2000; Young, Edwards, & Leising, 2009).

It has been theorized, "teacher preparation and in-service education programs must be revised and expanded to develop more competent teachers" (National Research Council, 1988, p. 6-7). The emphasis on the development of more competent teachers in pre-service teacher programs could hold great potential for a more positive and effective impact on their future pedagogical teaching practices, principally during the residency teaching experience (Ginns & Watters, 1998). With a considerable number of teachers lacking a source of support after their first role as an inservice teacher, the chance of a successful experience as a novice teacher diminishes considerably (Johnson & Birkeland, 2003; Kauffman, Johnson, Kardos, Liu, & Peske, 2002), potentially contributing to high levels of attrition experienced in the profession, especially among first year teachers (Grissmer & Kirby, 1987; Knobloch & Whittington; 2002; Lortie, 1975; Veenman, 1985). According to Grissmer and Kirby (1987), teacher attrition is described as those educators who leave the teaching profession willingly after a minimum of one calendar year and seek employment in another vocation, explore other educational opportunities, or assume domestic duties in the home; or those teachers who leave involuntarily, either through a denial of tenure or school or budgetary constraints.

Growth and reinforcement of pre-service teacher self-efficacy in teacher preparation programs could potentially serve as a catalyst for the opportunity that ". . . some crucial experience or some particularly influential teacher produces a richly-detailed episodic memory which later serves the student as an inspiration and a template for his or her own teaching practices" (Nespor, 1987, p. 320). Additionally, those beliefs gained through the teacher preparation program are essential in the ". . . acquisition and interpretation of knowledge and subsequent teaching behavior" (Pajares, 1992, p. 328). What is more, those teachers who have developed a higher self-efficacy in their preparation programs are more likely to utilize a constructivist approach to their teaching, emphasizing inquiry based learning, as well as additional educational strategies targeted at student centered learning (Czerniak, 1990). With the increased push for agriculture teachers to incorporate STEM concepts (Myers and Dyer, 2004), teachers have indicated the need for teacher education programs to provide increased pedagogical training for science emphasis in the curriculum (Gill, 2009). As well as provide pre-service teachers the opportunity to gain self-assurance and an increased level of efficacy during their residency teaching experience (Robinson, Krysher, Haynes, & Edwards, 2010). In a time when teacher education programs are increasingly becoming outdated (Lytle, 2000), the importance of program reflection has an increased role in the didactic preparation of teachers competent at emphasizing science in agricultural education (Hillison, 1998).

Theoretical Framework

This study utilized Bandura's self-efficacy theory (1986) coupled with human capital theory to serve as the theoretical framework for this study. Self-efficacy as defined by Bandura (1997) ". . . refers to beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments" (p. 3). Further, Bandura identified efficacy can indeed have effects that are varied. Effects that can inspire or sway decisions, determine the force they earmark to tasks they undertake, what amount of effort they are willing to commit to when failure is a distinct option, and whatever achievements they have realized in the past or in the future (1997).

The self-efficacy of the agricultural education pre-service teachers' aptitudes to teach science is examined in an attempt to determine pre-service teacher confidence level in their abilities. Acknowledged by theoretical researchers, real experience gained through successful involvement in a practice, supports the increase of self-efficacy over experiences gained vicariously (Albion, 1999, Bandura, 1986). It was suggested by Pintrich and Schunk (1996) ". . . self-efficacy beliefs are assumed to be much more dynamic, fluctuating, and changeable beliefs . . . " (p. 93). Pintrich and Schunk's statement lends credence to research identifying teachers who will succeed if they feel confident in their actions, but potentially fail under low levels of self-efficacy (Saklofske, Michaluk, & Randhawa, 1988). With the likelihood for teacher attrition in the beginning years of their careers, apprentice teachers efficacious in their assigned teaching area are more likely to persevere in their chosen vocation (Knobloch & Whittington, 2002).

The theory of human capital states individuals much like other commodities are capable of being developed (Aliaga, 2001; Becker, 1993) and implies there is a potential benefit economically to both individuals and the community in which they live (Sweetland, 1996). Methodical investments in individuals through educational opportunities such as pre-service, in-service, or inductive year professional development are viewed positively, inspiring growth and the possibility of professional advancement in an individual (Nafukho, Hairston, & Brooks, 2004). Moreover, these educational opportunities provide a benefit that could potentially decrease the probability of attrition and early career change (Kelsey, 2006). Schultz (1963) posited education is a consistently researched investment in human capital, because of the potential for education to develop an individual not only intellectually, but also economically (Schultz, 1971). With that being said, it is only natural that teacher preparation programs should be developing human capital in their pre-service teachers through courses they believe will "…significantly enhance the quality of their [pre-service teachers] labor skills…" (Beaulieu & Mulkey, 1995, p. 4).

Purpose and Objectives

The purpose of this study was to explore pre-service teachers' perceptions in regards to integrating science, technology, engineering and math into an agricultural education curriculum. Exploring the perceptions of pre-service teachers regarding STEM integration aligns with the

National Research Agenda of the American Association of Agricultural Scientists (Doerfert 2011). The following research questions were used:

1. How do pre-service agricultural education teachers define academic (STEM) integration?
2. To what extent do pre-service agricultural education students understand the purpose of academic (STEM) integration in the agricultural education classroom?
3. What strengths and weaknesses do pre-service agricultural education teachers believe they possess in relation to the implementation of academic (STEM) integration?

Methodology

A comparative holistic multiple-case study design was employed for replication purposes (Yin, 2009, p. 46). Three separate case studies were conducted by using focus groups coupled with a structured interview format (see Figure 1.1).

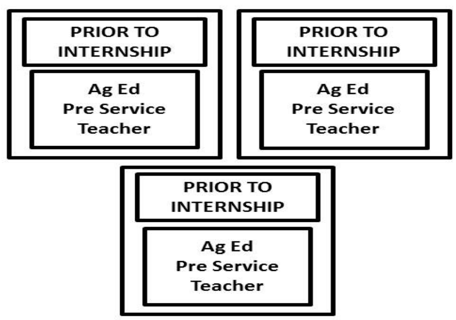

Figure 1.1 Holistic Multiple-case Study Design for Ag Education Pre service Teachers

A multiple case study design was chosen for literal replication: gathering similar results in each case study (Yin, 2009). Structured interviews were used because, "In a structured interview, the problem is defined by the researcher before the interview. The questions have been formulated ahead of time, and the respondent is expected to answer in terms of the interviewer's framework and definition of the problem" (Guba & Lincoln, 1981, p. 155-156). Structured interviews, in a focus group setting, were chosen because the researchers knew "…what he or she does not know and can therefore frame appropriate questions to find it out…" (Lincoln & Guba, 1985, p. 269). The focus groups began with a series of questions and additional questions were asked for further clarification and probing (Merriam, 2009). Field notes were utilized to collect data from the interviews. The following questions were asked during the structured interview:

1. How do pre-service teachers' define academic integration?
2. How do pre-service teachers feel that academic integration benefits students enrolled in agriculture education?
3. Which core subject do you feel that you can integrate strongly into the agricultural education classroom?
4. What "tools" do pre-service teachers need to regularly integrate academics into the agricultural education curriculum?

5. What barriers are present when attempting to integrate core content into the agricultural education curriculum?

A typical purposive sample (N=17) was used for this study. A typical purposive sample is a sample that is selected ". . . because it reflects the average person [pre-service ag education teacher], situation [entering the student teaching internship], or instance in the phenomenon" (Merriam, 2009, p. 78). All participants were agricultural science pre-service teachers who had recently completed their senior level teaching methodology course in the Fall of 2011 and were preparing to begin their student teaching internship at three different universities. The first university, focus group one (FG 1), is a southwestern regional university and included six participants. The second university, focus group two (FG 2), is a western land grant university and included seven participants in the group. The third university, focus group 3 (FG 3), was a midwestern regional university and included four participants in the group. Participants were selected based on the following selection criterion: 1) Are they agricultural science majors? 2) Are they pursuing teacher certification? and 3) Are they enrolled in the student teaching experience during the current semester? Each focus group session was conducted at the respective universities and was approximately an hour in length. A moderator was enlisted at each institution to facilitate the focus group sessions and responses were recorded and transcribed by the researcher. When using focus groups, confidentiality must be ensured in the reporting of results, thus responses were coded as FG 1, FG 2, or FG 3 to denote the setting of data collection, but not individual identifiers. Member checks were conducted through the distribution of the transcribed data to the focus groups participants, with a request of confirmation of the information provided.

A within-case analysis was performed for each individual case study. Interviews were transcribed and the constant comparative method was employed in order to unitize and categorize the data. Three researchers analyzed the data using the constant comparative method described by Glaser and Strauss (1967) that employed unitizing and categorizing of the data. The constant comparative method allowed the researchers to repeatedly compare the responses with previous responses in an attempt to discover new relationships (Dye, Schatz, Rosenberg, & Coleman, 2000). Following the unitizing of the data, the data were coded and the codes were included in the results section, in parenthesis after the quotations, as part of an audit trail to ensure confirmability (Erlandson, Harris, Skipper & Allen, 1993).

The units of data were sorted into emergent themes of ideas; titles were developed to distinguish each theme from the others (Erlandson et al., 1993). Continual revision, modification, and amendment were used until all units were placed into an appropriate theme. Following the analysis of the data each researcher compared their results to the other two researchers and debriefing of the results took place. Following the within-case analysis, a cross-case analysis was performed to compare the results of the within-case analyses and establish converging lines of inquiry (Yin, 2009). Matrices outlining the themes from each single case study were developed to "…allow the researcher to analyze, in a condensed form, the full data set, in order to see literally what is there" (Huberman & Miles, 1994, p. 437). Following the development of the matrices, a content analysis of the matrices was conducted to identify converging lines of inquiry across the individual case studies. Conclusions and implications were drawn based on the results of the cross case analysis. The results of this study are reported with rich description using the voice of focus group participants. The researcher kept a methodological and reflexive journal to track the details and nuances of the study as it emerged and to catalogue the researchers' reflections including bias. The results of this study are limited to the participants and are not to be generalized.

Findings and Results

The findings are arranged in the order of the research questions. Converging lines of inquiry based on emergent themes are underlined in the text. Pre-service teachers must be able to explain the purpose of academic integration before they can effectively implement academic integration. When asked to define academic integration the three focus groups mentioned that academic integration is <u>using more than one subject</u> in your curriculum to teach students the <u>application of concepts</u> both in agriculture and other subjects.

Using More Than One Subject Quotes

> In my agriculture class we had history, math, and English. We did everything. That is what academic integration is to me. Agriculture classes are probably the most beneficial classes you will have because it teaches everything; it doesn't just go with agriculture, just finance, cows, it's everything. You learn everything. You have to write papers; learn about history, agriculture history, everything. (FG 1.2)

"I'd say it is, integrating your basic core classes into everything; using science in other classes, using math problems in your science classes, even. Just integrating and interweaving all of them I guess you would say" (FG 2.2).

> I don't think it is necessarily teaching science or social studies… I think it is like showing how your lesson can relate to a prior class that they had in science or social studies or math. (FG 3.3)

Application of Concepts Quotes

"Half classroom, half hands-on" (FG 1.1)

> I think integration, in the opposite direction of elected courses, whether it is Vo. Ed. Or it is, you know music classes, that those can be big helps for teachers that are teaching the core classes because [the core teachers] may have a hard time, sometimes knowing the real world applications and we [ag teachers] can help supply some of those applications for them. (FG 2.5)

"Not necessarily teaching it but showing how it relates to other things" (FG 3.2).

When exploring to what extent pre-service agricultural education students understand the purpose of academic (STEM) integration in the agricultural education classroom. The focus groups were asked how academic integration benefits students enrolled in agricultural sciences. The pre-service teachers in the focus groups stated academic integration engages students in the classroom and <u>gives meaning to both agriculture and core subject concepts</u> because academic integration <u>allows students to apply the concepts through hands-on activities</u>.

Gives Meaning Quotes

"Just being able to apply what you learn in the classroom" (FG 1.9).

> I think [academic integration] definitely helps for your students that are not typical learners; you know, they can go into Ag Shop and do something that is hands-on that they like. They can remember then, as opposed to just learn it out of a book. (FG 2.23)

> Well, let's take the Pythagorean Theorem for example, A-squared plus B-squared equals C-squared. You can tell that to a kid so many times and write it on a board or you can come to an Ag class and apply it, say, we're going to stick a tongue on a trailer and we need it to be centered-dead center. So what we do, instead of go ahead and find that midpoint, we can teach them to build two triangles, and off of that we can the A-squared plus B-squared equals C-squared, and we'll get the dead center of that tongue, so you're getting the hands-on application and they don't even know they are doing it. You tell them at the end, by the way, this is Pythagorean's Theorem, heard you guys were doing this in math, and they go: Wow we really are using this stuff!! (FG 2.19)

"It is relying on concepts that they understand previously or more just because they have a more mechanical mind and they have mechanical knowledge" (FG 2.21).

> I think [academic integration] allows students the opportunity to be engaged that they are able to use the skills they learned in math, they are able to use problem solving skills such like the hypotheses and degree searches they learned in science class… (FG 3.6)

"I think by integrating other classes in an ag classroom, you are transferring [core subject] knowledge from short term into long term memory, they have better reason to remember . . ." (FG 3.11).

Apply Concepts through Hands-on Activities

"It is a hands-on experience. I think that is the most important part; actually getting to do it" (FG 1.6).

"I think it has a lot to with hands-on. It is really important for the kids to learn and understand what they are doing" (FG 1.8).

> It is relying on concepts that they understand previously or more just because they have a more mechanical mind and they have mechanical knowledge, so by having to do it with their hands, they can figure this thing out, and when they make this connection to the math application it just makes a deeper connection with them because it is connecting something A) that they care about, and B) that they can manipulate with their own hands and with problem solving methods that they have used for years to mess and tinker with things. (FG 2.21)

"Students in an ag science class would hopefully get the opportunity to do something physical, thus allowing them another, a different opportunity or another opportunity to learn what they have done in a different setting" (FG 3.14).

When discussing the strengths and weaknesses pre-service agricultural education teachers believe they possess in relation to the implementation of academic (STEM) integration, three questions were asked: 1) Which core subject do you feel that you can integrate strongly into the agricultural education classroom?; 2) What "tools" do pre-service teachers need to regularly integrate academics into the agricultural education curriculum?; 3) What barriers are present when attempting to integrate core content into the agricultural education curriculum?

When asked which core subject they can strongly integrate into an agricultural science curriculum, much of the conversation centered on what each pre-service teacher was more comfortable with or which core subjects they struggled with, but a few of them talked more generally. The converging lines of inquiry were emphasizing vs. integrating, language arts and English, science, technology, engineering and mathematics.

Emphasizing vs. Integration Quotes

"I think it all kind of goes hand in hand, science, technology engineering , mathematics, language arts, you can add them all into it . . ." (FG 1.13).

"There is science, technology, engineering, and math in everything we do as ag teachers and ag students" (FG 2.25).

> To me, it is not as much integrating [core subjects] it is more emphasizing what is already there. Because all of those subjects are already in ag, but you [as a teacher] just have to emphasize that [core subject concepts] are there, so that students don't kind of just pass over it. (FG 2.30)

Language Arts and English Quotes

> There are some great agriculture literature if you want kids to read a non-fiction or fiction book and do a report on it, there is some incredible stuff out there that you could easily integrate into subject areas and there is lots of ways to do that as long as you make a point as a teacher to integrate it. (FG 2.29)

"But language arts like you mentioned, the ag issues class, parli pro, creed speaking, public speaking, extemporaneous speaking. That seems pretty easy to integrate also" (FG 2.39).

> I'd say language arts and English because, I mean, I like to write and I understand why writing is important, and I know that writing is not everything, but that is just what I am strong at and I think it is really important to integrate that into every class. (FG 3.20)

Science Quotes

> Science is basically every time you go out to feed your pigs, feed your lambs, if you give them this much, you have to feed them this. Nutrition values, protein, basically all the science stuff. How much you have to walk your animal. (FG 1.12)

> I would say science because it is in there. You have courses like Animal Science, Plant Science, Soil Science. It is the easiest one to put in there because they are very scientific in nature, so you are basically just teaching science there in a different manner. (FG 2.31)

> And with engines class and mechanics class, there is a lot of science going on with that, like reactions, and you know, to get that weld to stick, a reaction occurs and stuff like that. So I think it applies to a lot of classes. (FG 2.33)

"I think my lessons are better when I incorporate science in them, but I would consider myself better at science" (FG 3.22).

Technology Quotes
"And technology, they have to be able to use more things. We cannot just limit ourselves to what we have always known. We have to keep expanding and gain more knowledge to get a better result" (FG 1.15).

> The technology you are going to use, we [agriculture] have new technology in reproduction, such as artificial insemination, embryo transfer. Kids these days like to learn about this stuff that is interesting; they can go make a career out of it, so it is easier to sit there and tell them that, than sit in the classroom and tell them. (FG 2.27)

> Yeah there is crazy technology out there in agriculture these days. You might not be able to get all that technology in your class, because it is really expensive, but you can certainly talk about it, find ways to integrate the ideas and that is pretty fun too. (FG 2.48)

Engineering and Mathematics Quotes
"Well, math, you have welding. You have to cut your metal, measure your metal out" (FG 1.11).

" I think anything you are going to do in the shop, whatever project they are going to make, they have to come up with the plan for it, or at least an idea, engineer it somehow" (FG 2.53).

> Engineering is a scientific method. My husband is an engineer and all that they do is make a plan, try a plan, figure out what is wrong with the plan, and go back and fix it; which is the scientific method at the same time as engineering. (FG 2.57)

"Incorporate mathematics, because that is a strong subject" (FG 3. 27).

After describing the core subjects they believed they could integrate, the pre-service teachers were asked to describe the tools they would need to regularly integrate academics into their agricultural science curriculum. <u>Administrative support</u>, <u>collaboration with core subject teachers,</u> and <u>training support</u> were the converging lines of inquiry identified by the focus groups as tools they would need to be successful with academic integration.

Administrative Support Quotes

> You have to get support from the administration, because you can't just expect to say, ok this is what I am going to add to my curriculum, are you going to let me do it? You have to come up with a well thought out plan… (FG 1.18)

> [Administrators, in some instances] don't know that we [ag educators] integrate all these things and do real life application and that is why we have so many more kids usually

> come through our programs because they enjoy doing hands-on stuff rather than sitting in classroom and doing book work all day; they actually get to get out and do it, and I think it would be great if every teacher had to come down and sit through an ag class and see exactly what we do and then I think they might be a little more on board. (FG 2.67)

Need support from administration too, that they understand that agriculture science is just as important as a core science" (FG 3.34).

Collaboration with Core Subject Teachers Quotes

> I think you would need the support from the other teachers, because you would have to know what they were teaching at that time, so that you kinda had it aligned with them so that you are teaching the same basic concepts at the same time. (FG 2.63)

"You need to collaborate with other science teachers to make sure that you are not overlapping too much, but be overlapping enough that it is not completely different material" (FG 3.32).

Training Support Quotes

"Training and support from colleges and universities. Basically like a big update for our teachers. Keep them updated on technology and resources they can use to teach their students" (FG 1.19).

> I think opportunities for continuing education would be really helpful as [agricultural educators] move forward because all of these fields are constantly growing and becoming more complex and it is tough to stay on top of what is happening, and research in our fields. (FG 2.80)

"More guidance, or guidelines, as far as how to incorporate, or what specifically the state or government feels like needs to be incorporated, so you know exactly what to teach" (FG 3.40).

After describing the tools that would be needed to integrate academics into their classroom, the pre-service teachers were asked to describe the barriers they feel hinder their abilities to integrate academics into their agricultural science curriculum. Financial status, lack of support, and time were identified as the converging lines of inquiry from the pre-service teacher focus groups.

Financial Status Quotes

"Financial status" (FG 1.22)

"Funding and support from your administration definitely would make an effect" (FG 2.83).

Lack of Support

"You might be taking away somebody else's job. There are other science teachers and you want to integrate their courses. There are English teachers and you cannot just expect them to get full credit for it" (FG 1.25).

"…the science department does not like to share their graduated cylinders and their grand scales and those sorts of things would be important for us to have if we were really going to be able to integrate that science or technology" (FG 2.87).

"I think for an ag program, community support could be one. If you are doing something in an ag program that just involves kids in a classroom, the community doesn't necessarily see what some kids are able to do. Then your support for the ag program may dwindle…" (FG 3.58).

Time Quotes
"Time is very important for teachers" (FG 1.27)

"When you are in ag ed, you have so much time to take out of classes aside from your own core classes" (FG 3.55).

Conclusions and Recommendations

The researchers found pre-service teachers across different universities expressed many of the same feelings and perceptions in regards to integrating science, technology, engineering and mathematics into an agricultural education curriculum. Participants believe there is a natural integration of core academics in the agriculture curriculum. Opinions were mixed about exactly what subjects could be integrated within the agriculture curriculum. Those polled agreed agriculture courses hold the possibility to integrate a wide range of subjects; from English to math and science. It was important to participants that teachers related the knowledge learned in agriculture courses to math and science, not strictly teaching core academic subject matter like biology or chemistry. Participants believed it was important when integrating science to keep the lessons "hands-on" and to relate the material to real world applications. These findings are similar to ones found by Thompson & Balschweid (2000) and Roegge & Russell (1990).

The majority of respondents agreed that integrating STEM concepts in the agriculture courses helps students to recall the material better. Integrating core subject matter was identified by participants to be a great way to functionally apply math and science skills. The agriculture science classroom was identified as a learning environment that reaches a multitude of learners and learning styles. The study implies integrating STEM concepts in agriculture courses will help teachers to reach a larger number of students, including students labeled "at risk". Participants believed students were more likely to want to learn STEM concepts when being taught in the context of agriculture. Balschwied (2002) found similar findings in relation to students learning of biology through agriculture courses.

Overall, participants believed their needs to be more focus on emphasizing the science and math skills already in the agriculture curriculum in contrast to trying to add more STEM concepts. According to the participants, the teacher's background is what ultimately affects the amount of core academic standards integrated into an agricultural science course. No particular course, within agricultural education warrants math and science integration over another, according to the participants. Several participants believed it is easy to integrate English content when training a CDE team or when teaching leadership lessons. The results of the study imply it is important to have support from administrators, core academic teachers, parents and community stakeholders. Some barriers to core content integration are time, resources and a lack of support. These ideas reflect similar findings of Arkansas teachers (Johnson, 1996).

Academically integrated projects and laboratory activities expand the program of study in agricultural education. The study found math, science and other core content standards should be further utilized while teaching in agricultural education. Efforts should be made to ensure pre-service teachers have a full understanding of academic integration. Following Bandura (1997) this effect can inspire or sway decisions future teachers have in the way they deliver science instruction within agriculture courses. This can be accomplished through increased in-services, instructional materials, and specific courses built around this subject matter. As evident from collected statements, the integration of core academics needs to be carefully implemented. Care must be taken not to fundamentally alter the purpose of the agricultural education program. State leaders and university faculty need to create "buy-in" from future teachers towards the integration of math, science and reading into the curriculum. Teachers need assistance in developing collaborative relationships with administrators and core content teachers. One way this can be accomplished is by inviting state academic leaders and campus administrators into the classroom to see the advantage of an integrated agriculture science curriculum. The expansion of CDEs that specifically relate to agriscience and other core academic standards will assist teachers in relating the relevance and importance of integration within the agriculture curriculum.

Pre-service teachers are clearly confident and believe strongly in academic integration within agriculture courses. The hands-on learning and varied approach to teaching that is equivocally agricultural science is a logical venue for academic integration. It is clear by the students' statements about teachers prior knowledge having an effect on their ability to integrate core academic courses; there needs to be an examination of how many credit hours of math, science, and English pre-service agricultural education teachers are required to take. Furthermore, university leaders must evaluate the type of core academic classes agricultural education majors are selecting to enroll. To be effective in integrating science and math into their coursework, agriculture instructors need more content knowledge. This is concurrent with past research (Warnick et al., 2004).

Soliciting funding for students to attend science integration programs like the Curriculum for Agricultural Science Education (CASE) would aid future teachers and academic integration. Likewise, the use of academically enhanced textbooks, integrated projects and other laboratory activities would add to the agricultural education program. Instruction of academic integration needs to be delivered in multiple forms of collaboration. This includes collaboration between agriculture and core academic teachers as well as working with those within the agriscience industry. These recommendations are limited to the areas that were used for this specific study.

The findings of this research help elicit future ideas to further the study. One such study should be an examination of current in-service opportunities available that focus on academic integration. An assessment of how career development events and supervised agriculture experiences affect academic integration should occur. One question that is raised by this research is: Does the emphasizing of these subjects fit with the provisions of federal funding for career and technology programs like agricultural education? Programs that are exemplary models of academic integration need to documented and shared with fellow teachers. One of the next steps in this research is identifying the effect of academic integration on student achievement. University faculty in agricultural education should be encouraged to collaborate with faculty from other academic departments for input on successful ways academic content can be integrated. This research project involved methods that sought to gain a more complete understanding of academic integration and its impact on agricultural education. Such research, which uses a variety of designs and methods, should be continued with a larger sample population.

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Discussant Remarks: Donald M. Johnson, University of Arkansas

Uncovering Academic Emphasis through Agricultural Education: Knowledge of Pre-Service Teachers in STEM Integration - A Cross-Case Comparison of Three Agricultural Education Pre-Service Teacher Education Programs

The authors conducted a qualitative study at three universities to examine pre-internship agricultural teacher education students' perceptions about STEM integration in agriculture courses. They found the "within" university findings were consistent with the "between" university findings, indicating similar perceptions among all students, regardless of university. To the best of my knowledge, appropriate qualitative research protocols were followed.

The researchers used a structured interview protocol during focus group interviews at each university to elicit student responses to five guiding questions. I noted a discrepancy here: the paper title, literature review, and conclusions and recommendations all refer to "STEM integration," but each of the five actual questions refers to "academic integration." While there is obviously substantial overlap between the two terms, they are not the same thing. For example, "Language Arts and English" can rightfully be considered academic integration, but not as STEM integration. Unambiguous definitions are important in all types of research.

There were few surprises in the pre-service students' definitions of academic integration, perceived benefits of academic integration, core subjects to be integrated into agriculture courses, the tools needed for academic integration, or the barriers to academic integration. To summarize in very simplified form: Academic integration is teaching (or simply pointing out the application of) an academic subject in an agricultural context; academic integration gives meaning and application to academic content; all academic subjects can be taught through agriculture; more time, in-service education, and administrative support are needed to integrate academic content; and the primary barriers to integration are a lack of time, money, in-service education, and administrative support. While not surprising, these things are helpful to know.

In reading this paper, I was somewhat surprised at the surface quality of some student quotes. As prospective agriculture teachers, many students did not seem to have thought very deeply about academic (or STEM) integration in agriculture. That said it was encouraging to see that some students realized academic integration requires both explicit instruction about the academic concept and its agricultural application. Interestingly, quite often the relatively deep thoughts and the rather shallow thoughts were offered by different students from the same university. What implications do the researchers draw from this?

Finally, I wonder why pre-service teachers were selected for study instead of currently employed teachers. Would currently practicing teachers have provided different (and possibly more substantive) insights? Given that pre-internship (prospective) teachers were studied, the authors may be stretching their conclusions and recommendations for practice too far. Perhaps, these findings should rightly be used to make conclusions and recommendations about how these three universities prepare agriculture teachers.

The researchers have provided insight on an increasingly important topic. I encourage them to continue their efforts in this area.

Agriscience fair participants' perceptions of science and agriculture

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Abstract

As the demand for a workforce skilled in scientific and problem solving skills increases, the opportunities to strengthen ties between agriscience education and science education need to become more evident. The purpose of this study was to ascertain the perceptions of science and agriscience held by student participants of the [state] Agriscience Fair. The participants indicated that their perceptions of science and agriscience were positive and the findings indicate there was a substantial correlation between the two attitude constructs, with the agriscience perceptions being slightly stronger than the science perceptions. Respondents also indicated most often that teachers and family were the ones to provide support and assistance in the development of the project. When choosing a topic for a project, most participants indicated the idea arose from a life experience or observation. While implications and findings from this study do not suggest drastic changes in the Agriscience Fair practices, and generalizations should not be made past the respondents, the study can serve as a foundation for future research expanding the possible relationships between agriscience fair participation and student attitudes toward science and agriscience and the potential careers within.

Introduction/Theoretical Framework

Scientific literacy, or the basic understanding of scientific concepts, is lacking in our society today. Assessments show science knowledge as stagnated or decreasing in high school students while they need those skills more than ever to be functioning members of our society (Singer, Hilton, & Schweingruber, 2006). There is an increasing demand for workers who are capable of scientific thinking and problem solving using concepts developed from scientific principles and skills.

It has been accepted that agricultural education curriculum and programs can highlight the science content that is a naturally occurring part of agricultural practices (Balschweid & Thompson, 2002; Dyer & Osborne, 1999; Myers, Thoron, & Thompson, 2009; Myers & Washburn, 2008, Thompson, 1998). Agricultural education programs have been found to offer opportunities to utilize agriculture as a context for teaching scientific principles and concepts (Israel, Myers, Lamm, & Galindo-Gonzalez, 2012; Thompson & Balschweid, 2000). Those opportunities exist not just in the classroom curriculum but are evident in the intracurricular FFA organization as well; exemplified by the National FFA Organization's annual Agriscience Fair (Grady, Dolan, & Glasson, 2010).

According to the National Research Council (2005), students have preconceived notions about science and how scientific inquiries are conducted. These assumptions about science can be shaped by students' experiences with science and agriculture (Grady, Dolan, & Glasson, 2010). Prior research indicates that agricultural education could serve as a gateway for teaching scientific principles, terminology and other concepts that are evident in the botanical and zoological content that agriculture contains (Parr & Edwards, 2004). While research has investigated the integration of scientific reasoning skills into agricultural education experiences (Myers & Dyer, 2006; Myers, Washburn, & Dyer, 2004; Osborne, 2000; Parr & Edwards, 2004), little is known about how the participation in science based extracurricular activities affects student perceptions of science and agriculture. A study of the effects of student participation in the FFA Agriscience Fair could help provide a basis for understanding the role student involvement in extracurricular science based activities has on their attitudes toward science and agriscience.

Though there has been little to no research on the effects of specific agriscience fair participation, we can look to the research on the effects of science fair participation to lay a foundation for this research. Yet in that area too, there is a shortage of research that provides peer-reviewed studies that examine the effects of science fair participation (Abernathy & Vineyard, 2001; Czerniak, &Lumpe, 1996; Yasar, 2002). Bencze and Bowen (2009) suggest that though research in this area is sparse "one can imagine other important learning outcomes from participation in them[science fairs] – such as deep understandings of subject matter knowledge, awareness of some characteristics of science, including its competitive nature and technical skills" (p. 2461). A review of literature indicates that results concerning the effects of participation in a science fair have on student attitudes towards science is inconclusive (Bencze & Bowen, 2009).

Many educators believe that involvement in a science fair is one of the best ways to develop the skills, attitudes and knowledge that will lead to a successful career in the future (Czernaik & Lumpe, 1996). Science fairs have been around for decades, with research supporting the idea that students' participation in science fairs increases their interest and enjoyment of science (Yasar, 2002). Some researchers have found that students are more apt to consider careers in science if they have participated in a science fair (Yasar, 2002). Despite potential problems with judging and concerns around an overemphasis on competition, educators continue to perceive science fairs to be beneficial for students (Abernathy & Vineyard, 2001).

Project-based science focuses on student-designed inquiry that is organized by investigations to answer driving questions, includes collaboration among learners and others, the use of new technology, and the creation of authentic artifacts that represent student understanding (Marx, Blumenfeld, Krajcik, & Soloway, 1997). Project-based science provides a basis for the importance of science fairs in scientific learning. Through science and agriscience fair projects, students should gain abilities that project-based learning supports such as collaboration, use of technology, implementation and use of the scientific method, and presenting projects to increase both oral and written communication skills (Moje, Collazo, Carrillo, & Arx, 2001). Research indicates that project-based learning and inquiry oriented teaching develop students' critical thinking skills, vocabulary knowledge, and conceptual understating, scientific literacy and also promotes positive attitudes towards science (Yasar, 2002).

According to the National FFA Organization (2012), the goal of Agriscience Fair is to provide "an exciting opportunity for students interested in scientific principles and emerging technologies in the agricultural industry" (p. 2). As the curriculum content has shifted to align more with the scientific principles found in agriculture, the National FFA Organization has created the Agriscience Fair to "give students a chance to demonstrate and display agriscience projects that are extensions of their agriscience courses" (National FFA Organization, 2012, p. 2)

This provides a means to incorporate science processes and principles into a student's FFA participation and create a strong connection between science class, agriculture class and FFA.

This study is meant to begin to explore the student participation in the FFA Agriscience Fair and describe the participants' attitudes towards science and agriscience. This study provides support for the third priority area of the National Research Agenda (Doerfert, 2011), which calls for research exploring opportunities to create a "sufficient scientific and professional workforce that addresses the challenges of the 21st century" (pg.18). By gaining insight into Agriscience Fair participants perceptions of science and agriculture, research can begin to explore how to better teach and advise students who are capable of and interested in critical thinking and problem solving using scientific concepts needed in today's workforce.

Purpose and Objectives

The Agriscience Fair is an opportunity for teachers to incorporate agriscience based curriculum into a student's FFA participation. But does this competition have a positive impact on student's perceptions of science and agriculture? As teachers and advisors come to expect more of their students to participate in the Agriscience Fair, it is important to look at the effects the participation has on the student's perceptions of science and agriculture

The purpose of this study was to identify [state] Agriscience Fair participants' attitudes toward science and agriculture and how they determine participation and project topics. In order to achieve this purpose, the following objectives were created:

1. Describe Agriscience Fair participants' attitudes regarding science and agriculture.
2. Determine the relationship between students' attitudes toward science and agriscience based on demographic factors.
3. Determine who assists students with Agriscience Fair projects and to what extent help is given.
4. Describe how Agriscience Fair participants chose the project topic.

Methods

This study was conducted through the use of a nonexperimental, descriptive survey design. The population for this study was all participants of the [state] Agriscience Fair in 2012.

There were 77 students registered to participate in the 2012 [state] Agriscience Fair. Twelve students were removed from the study at the request of their advisor and/or parents, yielding a final population size of 65. Since this is a census study, results can only be used to describe those who participated in the study.

A researcher-developed paper based questionnaire consisting of Likert-type items with a four-point scale was used to collect participant responses regarding their attitudes towards science and agriculture. This questionnaire was created by slightly modifying the Scientific Attitudes - Questionnaire (SA-Q) instrument created by Senay Yasar (Yasar, 2002). The researcher-developed instrument focused on student's attitudes and feelings toward: science and agriculture, doing and learning science and agriculture within school and outside of school, taking more science and agriculture course, and pursuing careers in science and agriculture. Possible responses ranged from 'strongly disagree' to "strongly agree." Students also responded to a series of open ended questions concerning, who assisted them with their project, why they participated, and what their past experiences and future plans were in relation to their agriscience fair projects. The questionnaire was examined by a panel of university faculty members for face and content validity. Cronbach's alpha was also calculated post hoc for each construct to determine a reliability coefficient and were found to be 0.82 for the science construct and 0.92 for the agriscience construct.

The respondents' demographic data are displayed in Table 1. Over half of the respondents were female (n = 36). The greatest percentage of respondents reported being in the 8th grade, although it was evident by the responses that more than half of the participants were in high school grade levels. The participants ages spanned 8 years; the youngest participant was 11 (n = 1), while the oldest participants were 18 (n = 4). The most frequent age of a participant was 14 (n = 19). A majority of respondents indicated they were from rural and suburban schools, while only a few (n = 5) indicated they represented an urban school system. Three respondents did not supply their school community information.

Table 1

Demographic Data of Respondents

Demographic	***f***	**%**
Gender		
Male	29	44.6
Female	36	55.4
Grade Level		
6	5	7.6
7	5	7.6
8	20	30.3
9	8	12.1
10	8	12.1
11	8	12.1
12	11	16.7
Age		
11	1	1.5
12	6	9.1
13	8	12.1
14	19	28.8
15	9	13.6
16	10	15.2
17	8	12.1
18	4	6.1
Community		
Urban	5	7.6
Suburban	17	25.8
Rural	40	60.6
Unknown	3	4.5

Note. N= 65; Totals may not reach 100% due to rounding.

In addition to traditional demographic data, students were asked to identify additional information that could be used as factors that impact Agriscience Fair participation. This data is displayed in Table 2. Over three quarters of participants have also participated in traditional science fairs (*n* = 51). There was a balanced divide between respondents who had participated in the Agriscience Fair before (*n* = 32) and those who had not (*n* = 33). A majority of respondents indicated their Agriscience Fair projects were not part of their Supervised Agriculture Experience (SAE) programs (*n* = 36) and that their Agriscience Fair project did not count as a grade for a class (*n* = 45).

Table 2

Additional Demographic Data of Respondents

Category	*f*	%
Traditional Science Fair Participation		
Yes	51	78.5
No	14	21.5
Prior Participation in FFA Agriscience Fair		
Yes	32	49.2
No	33	51.8
Part of their SAE program		
Yes	29	44.6
No	36	55.4
Course Grade		
Yes	20	30.7
No	45	69.3

Note: N = 65

Data was collected via paper-based survey and analyzed using descriptive methods, including frequencies, means, standard deviation and correlations where appropriate through SPSS. Magnitude of the correlations was reported using Davis's convention (1971).Relationships between .01 and .09 were reported to be negligible, those between .10 and .29 were low, those between .30 and .49 were moderate and those greater than .50 were reported to be substantial (Davis, 1971).

Findings

Objective 1 sought to describe students' attitudes towards science and agriscience. The grand mean based on student responses for the statements within the science construct was calculated at 3.26 with a standard deviation of .46, indicating a vast majority of students had positive attitudes towards science. The statements and percentages can be seen in Table 3.

Table 3

Student Attitude Reponses within the Science Construct

	Percent			
Statement	Strongly Disagree [b]	Disagree [c]	Agree [d]	Strongly Agree [e]
I like science.	1.5	4.6	50.8	43.1
I participate in extracurricular science activities.	1.5	13.8	50.8	33.8
I would like to take more courses in science.	1.5	7.7	50.8	38.5
I don't like science because my everyday life requires very little science. [a]	56.9	30.7	9.2	3.0
I would like to participate in science activities such as science fairs and science clubs.	1.5	13.8	38.5	46.2
I think that participating in science activities such as science fairs makes students consider taking more classes in science.	1.5	6.2	44.6	47.7
Learning science is boring. [a]	60.0	30.7	6.2	3.0
I like competing with other students during science activities.	3.0	3.0	44.6	49.2
I like learning new things in science.	1.5	0.0	41.5	56.9
I think students learn a large amount during science activities such as science fairs and science clubs.	0.0	3.0	41.5	55.4
Learning scientific concepts is very hard for me. [a]	28.5	55.6	9.2	4.6
I read books and magazines about science at home for fun.	13.8	43.1	27.7	13.8
I would like to have a career in science.	9.2	26.1	26.1	38.5
I enjoy doing science projects.	3.0	3.0	47.7	46.2
Science is my favorite class.	7.7	27.7	38.5	24.6
Only smart students like science.[a]	63.1	33.8	1.5	1.5
I think participating in science activities such as science fairs and science clubs makes students start reading more about science.	3.0	23.1	44.6	27.7
I feel smart while doing science.	1.5	9.2	47.7	41.5
You won't be popular if you like science.[a]	72.3	23.7	4.6	0.0

I think participating in science activities such as science fairs makes students consider having careers in science.	0.0	6.2	47.7	47.7
I like science because there is a lot of science in our everyday life.	1.5	3.0	55.4	38.5

Note. *N* = 65. Grand mean = 3.26 (SD =.46) [a] reverse coded for analysis. [b] Coded as 4, [c] Coded as 3, [d] Coded as 2, and [e] Coded as 1.

The percentages revealed that only a small fraction indicated negative attitudes towards science. The responses also specified that 93% of the students indicated they like science and see the connection between science and their everyday lives. Student responses also show students agree that participating in activities such as science fairs make students consider having careers in science (92%), reading more about science (72.3%), and consider enrolling in more science courses (93.8%). Respondents also indicated that students felt smarter when doing science (89.2%), in addition to indicating that student respondents did not believe learning science is boring (90.7%).

A majority of student responses also indicate students like learning new things in science (98.5%), either through interest in more coursework pertaining to science (89.2%), extracurricular science activities (84.6%) and participation in science activities such as science fairs and science club (84.6%). Responses also indicated students were interested in a career in science (64.6%) and they liked the competitive element of a science fair project (93.8%).Over two thirds of the respondents (72.3%) indicated they strongly disagreed with statements linking science to not being popular. A majority also strongly disagreed that only smart students like science (63.1%).

The grand mean based on student responses for the statements within the agriscience construct was calculated at 3.54 (SD = .33), indicating a vast majority of students had positive attitudes toward agriscience. The statements and percentages can be seen in Table 4.

Table 4

Student Attitude Reponses within the Agriscience Construct.

	Percent			
Statement	Strongly Disagree[b]	Disagree[c]	Agree[d]	Strongly Agree[e]
I like agriscience.	0.0	0.0	21.5	78.5
I participate in extracurricular agricultural activities.	0.0	3.0	16.9	78.5
I would like to take more courses in agriscience.	0.0	3.0	24.6	72.3
I don’t like agriculture because my everyday life requires very little agriculture.[a]	84.6	12.3	1.5	0.0
I think that participating in science activities such as science fairs makes students consider taking more classes in agriscience.	0.0	12.3	40.0	47.7

Learning agriscience is boring.[a]	87.7	12.3	0.0	0.0
I like competing with other students during agriscience activities.	1.5	0.0	38.5	60.0
I like learning new things in agriculture.	0.0	3.0	12.3	81.5
Learning agricultural concepts is very hard for me.[a]	66.2	26.1	4.6	3.0
I read books and magazines about agriculture at home for fun.	4.6	18.5	47.7	27.7
I would like to have a career in agriculture.	0.0	13.8	30.7	53.8
I enjoy working on agricultural projects.	0.0	1.5	29.2	67.7
Agriscience is my favorite class.	1.5	4.6	29.2	60.0
Only smart students like agriscience.[a]	66.6	27.7	3.0	1.5
I think participating in science activities such as science fairs and science clubs makes students start reading more about agriscience.	1.5	23.1	47.7	26.1
I feel smart while working with agriscience.	1.5	6.2	43.1	47.7
You won't be popular if you like agriculture.[a]	78.5	16.9	4.6	0.0
I think participating in science activities such as science fairs makes students consider having careers in agriculture.	0.0	7.7	43.1	47.7
I like agriculture because there is a lot of agriculture in our everyday life.	0.0	0.0	47.7	52.3

Note. N = 65. Grand mean = 3.54 (SD =.33) [a] reverse coded for analysis. [b] Coded as 4, [c] Coded as 3, [d] Coded as 2, and [e] Coded as 1.

The percentages showed the respondents had similar attitudes toward agriscience as they did science; however the responses indicate stronger attitudes for agriscience as evident in the differences between the grand means. The responses in the agriscience construct indicated 100% of the students reported liking agriscience and see the connection between agriscience and their everyday lives.

Objective 2 sought to determine the relationship between students attitudes toward science and agriculture and demographic data, such as whether or not their project was part of their Supervised Agricultural Education (SAE) program, course grade or if they had previously participated in the FFA Agriscience Fair. Pearson's point-biserial correlations were calculated to compare the variables as displayed in Table 5.

Table 5

Relationship Between Students' Attitudes Towards Science and Agriscience and Demographic Characteristics

	Pearson's r	Magnitude
Science Constructs		
Agriscience Construct	.54	Substantial
Part of SAE Program	.29	Low
Prior Participation in Agriscience Fair	.11	Low
Participation in traditional science fair	.08	Negligible
Agriscience Fair project as part of a course grade	.13	Low
Gender	.10	Low
Agriscience Constructs		
Part of SAE Program	.43	Moderate
Prior Participation in Agriscience Fair	.14	Low
Participation in traditional science fair	.08	Negligible
Agriscience Fair project as part of a course grade	.07	Negligible
Gender	.22	Low

Positive relationships were found between students' attitudes toward science and agriscience and the demographic data gathered. The strongest correlation appeared between the two attitudinal constructs, in that as students attitudes of agriscience strengthened, their attitudes toward science also strengthened (r = .54). The second highest correlations occurred between students attitudes of agriscience and whether or not they indicated that their Agriscience Fair project was part of their Supervised Agricultural Experience (r = .43), as well as their attitudes toward science as indicated by SAE responses (r = .29). The relationship between students' attitudes in either construct in relation to whether they have participated in a traditional science fair previously, participated in the Agriscience Fair, or if the project was part of a course grade all showed low to negligible correlations.

Objective 3 hoped to ascertain who assists Agriscience Fair participants with the processes involved with planning, implementing and reporting their projects. Table 6 shows student responses to the question: "Who helped with your Agriscience Fair project?" As these were open ended questions, students could include multiple people in their responses.

Table 6

Who Helped with Agriscience Fair Participants Projects?

	f
Teacher	26
Advisor	12
Agriculture teacher	8
Other Teacher	3
Family	42

Parent	17
Mother	22
Father	13
Partner	2
Other	7
Unmarked	7

Note. Respondents could indicate multiple responses

When asked who helped them with their project, student responses mostly indicated their families and agriculture instructor/advisor assisted the most. There were a number of respondents who left the field blank and also some responses that could not be coded based on researchers lack of knowledge. For example if a respondent indicated that Mr. John Smith assisted, it was difficult to ascertain the relationship of Mr. Smith with the Agriscience Fair Participant.

Students were also asked to respond to a question asking them to indicate how much these people helped in their project. As expected with an open ended response, answer varied widely. From "minimally" to "1/3 of the project" to a "whole bunch" the assistance each participant received varied greatly. Respondents indicated that those who helped them did so in a variety of ways as well. Some responses indicated that their "Ag teacher" helped by "providing science fair info", while others indicated their assistance came in the form of "they bought most of my materials".

The purpose of Objective 4 was to describe how Agriscience Fair participants chose their project topic. Table 7 shows their responses to 'Where did you get the idea for your project?'

Table 7

Influences on Topic Choice

	f
Life experience/observation	21
Recommended by someone	10
Personal interest	10
Previous research topic	8
Online	6
Other	5
Brainstorming session	4
Unmarked	1

Note. Respondents could indicate multiple responses

Most students chose their topics due to a life experience or observation (n = 21) of what was around them. For example one respondent reported that they "got the idea because my friends would always have rotten apples at school." While another said that they had been "raising chicks for years and wanted to know difference in feeds." Some others said that the idea came from the "annual rose and carnation sale", "when our school was planting a garden and we were wondering what would be the best way to start the seeds", and from "family fish fry." Many students also indicated that the topic was recommended to them. In some cases it was recommended by a teacher or parent, in others the idea came from university faculty or a friend.

Additionally some student indicated that it was an area of personal interest by responding "myself", "I had one of those 'what if' moments and decided to act on it", and "it's my ongoing passion."

Conclusions and Implications

This study found student responses indicated a majority of students have positive attitudes toward science and agriscience. Fifty-five percent of the [state] Agriscience Fair participants were female, while almost a third of the participants were in the 8^{th} grade. Only 8% of participants indicated they were from an urban school. Seventy eight percent of agriscience fair participants also participated in a traditional science fair, while only 49% had previously participated in the FFA Agriscience Fair. These demographics describe a diverse population of participants, indicating there is no standard or stereotypical student that participant in the [state] Agriscience Fair.

Sixty-nine percent of the respondents indicated their project was not a portion of a course grade, which may signal a lack of interconnectedness between classroom practices and the Agriscience Fair projects. When working to establish stronger ties between science principles and concepts and agriculture curriculum, the Agriscience Fair should be considered a tool to assist in enabling students to apply the scientific principles outside of the classroom. Agriscience Fair participation can provide a link within the FFA between science skills and the agriscience classroom.

This study found a strong relationship between the participants' attitudes toward science and their attitudes toward agriscience. Though it was also noted the students indicated stronger attitudes when describing agriscience than science. For example, though 93% of students indicated they liked science, 51% chose agree over strongly agree (42%); Out of the 100% that indicated that they liked agriscience, only 21% chose agree over strongly agree (78%). This inclination to stronger attitudes toward agriscience than science may indicate the potential agriscience curriculum provides educators when exciting students about scientific subject matter.

The role of agriscience fair research projects can have in SAE programs should be further explored. The correlation coefficients show a moderate positive relationship between Agriscience Fair projects being part of an SAE program and the agriscience attitudes construct. This suggests as students utilized their project as part of their SAE program their perceptions about agriscience increase. Whether or not the project was part of an SAE program also showed a correlation, albeit low, with the science perceptions construct as well. This could indicate that amongst these participants SAE programs strengthened the potential link between the projects and the students' perceptions.

The role of the agriscience instructor, FFA advisor and parents in students Agriscience Fair projects became clearer through this research. As most participants indicated it was family members who helped with the project most often, with teachers being the second most cited. Teachers and family members also influence student participant topic choice. It is essential the role of family is explored further so supports can be provided to guide parents and family members in this process.

Recommendations

While findings and implications of this study do not suggest drastic alterations in agriscience fair practices, important insight can be gained. As the National FFA Organization expands to offer more science skill based activities and awards, such as the Agriscience Research Proficiencies, Star in Agriscience and the Agriscience Research Career Development Event, it would prove beneficial to better grasp the participants' attitudes and perceptions of science and agriscience to provide support. The potential of these opportunities to strengthen the science skills and knowledge of the participants could assist in providing an increasing scientifically literate workforce.

Further research in agriscience fair participation on a broader scale can help clarify student participants' attitudes to science and agriscience. Therefore it is recommended this study serve as a foundation for expanding future research exploring agriscience fair participation and its relationship to student attitudes of science and agriscience across state boundaries and over a period of time. It is also suggested that future research expand to include more information about the structure of planning and implementing agriscience fair projects in addition to how Agriscience Fair participation correlates with Supervised Agricultural Experiences (SAEs) and career aspirations of participants.

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Discussant Remarks: Donald M. Johnson, University of Arkansas

Agriscience Fair Participants' Perceptions of Science and Agriculture

The purpose of this study was to describe perceptions of state agriscience fair participants towards science and agriscience, determine the relationship between perceptions and demographic variables, identify individuals assisting students with agriscience fair projects, and describe how participants chose their projects. All-in-all, the researchers have chosen a timely and relevant project.

The manuscript was clearly written, easy to follow, and was free of excessive jargon. Because the writing was clear and logically structured, it was easy to focus on the authors' research as opposed to attempting to decipher an alien language. Well done, authors!

I also commend the authors for using the science education literature to inform their study. It is a positive sign to see agricultural education researchers citing publications such as the *Journal of Research in Science Teaching, School Science and Mathematics*, and *The Elementary School Journal*. I would further challenge these and other researchers to extend this positive development by explaining the implications of their research to the broader educational community and submitting articles for publication in journals outside of agricultural education.

The study was conducted using appropriate research methods. I was particularly happy to note the researchers' correct application of coefficient alpha, which is appropriate and meaningful only for describing the reliability of summated scales. The authors made correct use of simple descriptive statistics and avoided the temptation to use inferential statistics with census data. The only extremely minor suggestion I have in this regard is that using the median values for grade level and age in text might be more informative.

The researchers found a substantial positive correlation between participants' attitudes toward science and their attitudes toward agriscience. What does this tell us? I encourage the researchers to explore this further. The authors also found that students were positive toward both science and agriscience, but more positive toward agriscience. My calculations indicate that the effect size for this preference was moderate to large (*Cohen's* $d = 0.70$). Given research (Patterson, 2011) indicating that student enjoyment of STEM content (as opposed to depth of STEM content) is the best predictor of subsequent enrollment in college STEM majors, what are the potential implications of this finding?

I do have one item of personal curiosity about Table 6. The authors indicate that 26 teachers assisted with science fair projects. Yet the total for Advisor ($n = 12$), agriculture teacher ($n = 8$), and other teacher ($n = 3$) is only 23. Given that "agriculture teacher" and "other teacher" seem to describe the total possible universe of "teachers," (with "advisor" thrown in for good measure) where did the other three teachers come from?

I extend compliments to the researchers for a very well-conducted and well-written study. I encourage them to continue in this line of inquiry. Also, please consider sharing your research with the broader educational research community.

Identifying STEM Concepts Associated with Junior Livestock Projects

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Abstract

Science, technology, engineering, and mathematics (STEM) education is intended to provide students with a cross-subject, contextual learning experience. To more fully prepare our nation's students to enter the globally competitive workforce, STEM integration allows students to make connections between the abstract concepts learned in core subject classrooms and real-world situations. FFA and 4-H programs are intended to provide students with hands-on learning opportunities where abstract core subject principles can be applied and more fully understood. Junior livestock projects through FFA and 4-H can provide rich connections for students between what they learn in school and how it is applied in the real world.

Using a modified Delphi technique, this study identified 21 STEM concepts associated with junior livestock projects. According to the panel of experts, math and science concepts were more prevalent in junior livestock projects. Conversely, experts identified fewer technology and engineering concepts as being present within junior livestock projects. The link between science, technology, engineering, and mathematics, core subject education, and the concepts present in junior livestock projects should be emphasized in curricular and programming efforts.

Introduction

Traditionally, the United States' education system has been based on the separate-subject approach offering one distinct subject per classroom period. This method, relied on for over a century in this country, is systematically failing to prepare students for the highly technical, globally competitive workforce (Dickman, Schwabe, Schmidt, & Henken, 2009). Based on the results of a 2006 national survey of over 400 employers, high school graduates are "woefully ill-prepared" to enter today's highly technical workplace (Casner-Lotto & Barrington, 2006, p. 9). More specifically, employers responded that young people lack many basic skills and often, the ability to apply skills and knowledge once employed (Casner-Lotto & Barrington, 2006).

Science, technology, engineering, and mathematics (STEM) integration, an initiative of modern education aims to provide a "robust learning environment" (Sanders, 2009, p. 21) through integration of science, technology, engineering, and mathematics concepts into other related subjects, broadening student knowledge through context and application (President's Council of Advisors on Science and Technology, 2010). Implementation of "integrative STEM education" (Sanders, 2009) involves the inclusion of inquiry and project-based approaches, as opposed to lecture-style instruction (Breiner, Johnson, Harkness, & Koehler, 2012).

Agricultural education courses provide the context and the content to help students be successful in STEM areas (Melodia & Small, 2002). Similarly, 4-H encourages members to acquire project and life skills through project-based learning (Boleman, 2003). These organizations operate based on the belief, similar to that of STEM, that the application of knowledge through experience in context allows students to learn at a higher, deeper, more realistic level (Melodia & Small, 2002).

FFA and 4-H livestock projects allow students the opportunity to participate in all aspects of livestock production and witness abstract science, technology, engineering, and mathematics concepts in real-life situations. Grounded in science and mathematical principles, raising a livestock project provides students with firsthand experience in animal anatomy and physiology, genetics, nutrition, health, marketing, accounting, and record keeping, all of which are related to STEM concepts (Gamon, Laird, & Roe, 1992; Melodia & Small, 2002).

Theoretical Framework

John Dewey (1938), referred to as the most influential educational theorist of the twentieth-century (Kolb, 1984), believed that there is an intimate and necessary relationship between experience and education. Demonstrations and projects were methods commonly used by Extension and agricultural educators to allow agriculturalists "practical, applied, and hands-on" experience with new methods and products (Knobloch, 2003; Mabie & Baker, 1996). Seaman A. Knapp, known as the father of Extension, lived by the motto, "what a man hears, he may doubt; what he sees, he may also doubt, but what he does, he cannot doubt" (Lever, 1952, p. 193). Similarly, Rufus W. Stimson, known as the father of the project method, encouraged agricultural education to reach beyond text books, and encouraged actual practice on the farm (Knobloch, 2003).

These experiential learning opportunities have been referred to as a form of "authentic learning" where tasks completed are comparable to realistic problems (Knobloch, 2003). Knobloch (2003) asserted that these authentic experiences "reflect the type of cognitive experiences that occur in real life" (p. 23), fostering innovation and creativity, and setting the stage for problem solving in the future. Kolb [(as cited in Baker & Robinson, 2011, p. 186] pointed out the abundance of experiential learning opportunities present throughout agricultural education, saying "more education should be occurring outside of the classroom because classrooms are some of the most sterile environments imaginable".

More specifically, the STEM education initiative involves bridging concepts of science, technology, engineering, and mathematics into other disciplines in schools (Morrison, 2006). According to Dickman, Schwabe, Schmidt, and Henken (2009), the United States' future workforce lacks the technological skills and knowledge necessary to enter new jobs or replace today's workforce. Similar to the United States' reaction after the Soviet's launch of Sputnik in 1957 (Kliever, 1965), the modern STEM initiative is intended to increase student knowledge and interest in studying and entering careers associated with science, technology, engineering and mathematics and boost U.S. output in these areas (President's Council of Advisors on Science and Technology, 2010). Touted as a cure-all for our nation's educational lag, the basic principles of STEM education are not necessarily innovative; many educators realize that STEM concepts have always been present within each of the subsequent subjects (Budke, 1991). The advancement lies within the purposeful focus on STEM knowledge outcomes during educative experiences (Sanders, 2009).

Blumenfeld et al., (1991) suggested that as students participate in project-based learning by investigating and solving problems, they develop a more wholesome picture of the concepts associated with the project and are better able to build bridges between classroom instruction and real-life experiences. The President's Council of Advisors on Science and Technology's report (2010) details recommendations to improve and rejuvenate STEM education, knowledge, and interest for the Federal Government, schools, teachers, and students. Breiner et al. (2012) suggested that STEM education replaces the traditional lecture-style teaching approaches with inquiry and project-based strategies. Budke (1991) suggested that making the shift toward increased scientific and mathematical instruction would not be a great challenge for agricultural education, as so many science and math concepts are already part of the curriculum. Utilizing an agricultural context to implement biological and physical science principles such as genetics, photosynthesis, nutrition, pollution control, water quality, reproduction, and food processing is ideal as students can observe and apply knowledge to a real life situation (Budke, 1991).

Rooted in Stimson's philosophy of the "project method," supervised agricultural experience (SAE) allows students to take the knowledge acquired in the classroom and apply it to agricultural projects at home (Moore, 1988). A SAE is "a practical application of classroom concepts designed to provide 'real world' experiences and develop skills in agriculturally related career areas (National FFA Organization, 2012). Mandated as a requirement of the Smith Hughes Act of 1917, SAE is designed to provide supervised practice in agriculture for each student either at home or at the school for at least six months of each year (Stimson, 1919).

Knobloch (2003) posited that, "Agricultural educators who engage students to learn by experience through authentic pedagogy will most likely see the fruits of higher intellectual achievements, not only in classrooms and schools, but more importantly, in their roles as adults as contributing citizens of society" (p. 32). Much of the research available on the benefits of junior livestock projects has focused on the attainment of life skills. Limited research is available on specific science, technology, engineering, or mathematics (STEM) skills gained through participation with livestock projects.

Sawer's (1987) study provided some evidence that students are learning knowledge beyond life skills. He found that 75% of students utilized the knowledge and skills gained through participation in a livestock project to care and maintain another livestock animal. Similarly, Rusk, Summerlot-Early, Machtmes, Talbert, and Balschweid (2003), found that 4-H members who exhibited livestock "have higher skill levels in the areas of animal health care, animal grooming and animal selection" (p. 9). Rusk et al. (2003)'s results align with Gamon, Laird, & Roe (1992) who found that 4-H members who raised livestock projects developed skills related to "training, grooming … selecting proper equipment, choosing feed rations, and keeping accurate records."

Interestingly, Rusk et al. (2003) found that 32% (47 of 147) of Indiana 4-H members admitted to using animal physiology knowledge gained through livestock projects during science courses in school. One student commented, "What many kids read in books, I've seen and done" (Rusk et al., 2003, p. 7). The qualitative responses Rusk et al. (2003) obtained provided insight into some specific skills students learned through their livestock project: reproduction, birth, mortality, disease, nutrition, energy conversion, the digestive system, and genetics. Rusk's study is one of the few studies which begins to uncover the link between STEM and junior livestock projects.

Agriculturalists have long touted the scientific and mathematics principles involved in many animal science-related courses and SAEs. Stimson (1919) predicted the effectiveness SAEs would have in science education when he said, "project-study … will probably prove to be one of the most effective means of accumulating first-hand data for the successful study of science…" (p. 96). Livestock projects, in particular, offer students an often full-circle view of livestock production with aspects of health care, nutrition, reproductive techniques, animal behavior, record keeping and accounting (Rusk et al., 2003). SAEs such as livestock projects provide the context which allows students the opportunity to apply the once disconnected concepts learned through single-subject courses to real life situations.

Priority area four of the 2011-2015 National Research Agenda (Doerfert, 2011) emphasizes meaningful, engaged learning in all environments. The agenda specifically calls for studies that "Examine various meaningful learning environments in assorted agricultural education contexts for their impact on specific cognitive, affective, and psychomotor learning outcomes" (Doerfert, 2011, p. 9). Identification of STEM concepts within various agricultural education contexts is an important aspect in the overall study of meaningful learning environments.

Purpose

The purpose of this study was to identify STEM concepts associated with junior livestock projects. A modified Delphi technique was used to achieve this purpose.

Methods and Procedures

This was a descriptive study that employed a survey research design using the Delphi technique to identify STEM concepts in junior livestock projects. The Delphi method allows an expert panel to identify, react to, and assess differing viewpoints on the same subject (Turoff, 1970). This method allows a group of experts, who might be geographically scattered, to exchange viewpoints and ultimately reach consensus about a problem (Stitt-Gohdes & Crews, 2004). Because face-to-face interaction is not necessary, all panel members have equal input, preventing bias due to title, status, or dominant personalities. The success of the Delphi technique relies not on random selection, but on the informed opinion of the expert panel (Wicklein, 1993).

In order to create a panel which was representative of the diversity of regions and livestock species, a purposive sample of 26 livestock project experts including college professors, agricultural educators, Extension personnel, livestock evaluation experts, and livestock producers from across the country was created. Recruitment for this study was grounded in three specific requirements. Panel members must have met two of the three following qualifications: 1) 10+ years of experience in livestock and/or education, 2) national reputation in evaluation of junior livestock projects at the state level or higher and, 3) knowledgeable of STEM concepts related to livestock projects as evidenced by publishing or education in the field.

The panel members for this study were "uniquely suited to the intent of the study" (Fraenkel & Wallen, 2009, p. 426). Due to the nature of the necessary qualifications of panel members for this study, the researcher gauged the demographic makeup of the judges from three of the premier national livestock shows in America: the North American International Livestock Exposition (NAILE) in Louisville, KY, the American Royal in Kansas City, MO, and the National Western in Denver, CO. The gender and ethnicities of the judges for the past five years of these livestock shows was similar to the demographic makeup of the expert panel.

Utilizing three rounds of researcher-designed questionnaires as the instruments, the Tailored Design Method (Dillman, Smyth, & Christian, 2009) was followed for data collection. The questionnaire was distributed by email through Qualtrics™, an online survey program. The question from round one was open-ended, while questions from rounds two and three were Likert-type 6-point scale rating items designed to reach a certain level of agreement which was set *a priori*.

Agricultural Education faculty members at [State] University established both content and face validity for the initial instrument used in this study. The number of panel members necessary, according to Taylor-Powell (2002), depends more on the diversity of the target population than the purpose of the study and suggests 10 to 15 participants may be the adequate number when participants are not greatly varied. A panel size of 13 would provide reliability within a 0.90 correlation coefficient (Dalkey, Rourke, Lewis, & Snyder, 1972). In order to create a panel which equally represents the diversity of regions and livestock species, a 26 member panel was chosen for this study.

Round One

Panelists were sent a pre-notice prior to the beginning of the start of the first round. For round one, panelists were asked to respond to one open-ended question regarding the STEM concepts students learn through participation through a junior livestock project. The first round question was, "STEM is an interdisciplinary approach to learning where rigorous academic concepts are coupled with real world lessons as students apply science, technology, engineering, and mathematics in context that make connections between school, community, work, and the global enterprise (Tsupros, Kohler, & Hallinen, 2009). As an integral component of agricultural education, junior livestock projects allow students an opportunity to gain livestock production knowledge. Thus, the question must be asked: Do these projects incorporate STEM (science, technology, engineering, and mathematics) concepts? As an expert, we are asking you to identify essential STEM concepts embedded within junior livestock projects. Please list all STEM (science, technology, engineering, and mathematics) concepts that you believe to be associated with junior livestock projects."

Electronic reminder messages were sent to panelists approximately one week prior to the assigned due date to encourage the return of round one responses. From round one 25 panelists responded for a 96% response rate and 316 statements were provided by panelists. The researcher analyzed each statement. Similar or duplicate responses (i.e., concepts) were combined or eliminated and compound statements were separated (Shinn, Wingenbach, Briers, Lindner, & Baker, 2009). Of the 316 original statements, 116 were retained for presentation to panelists in round two. Of the 116 retained statements, the researcher collapsed the responses into 30 categories which best represented the statements.

Round Two

The round two instrument asked panelists to rate their level of agreement on the STEM concept categories retained from round one. On the round two instrument, panelists were asked to respond to 30 classified concept categories. Panelists were asked to use a 6-point summated scale to rate the 17 categorized concept categories: "1" = "Strongly Disagree," "2" = "Disagree," "3" = "Somewhat Disagree," "4" = "Somewhat Agree," "5" = "Agree," "6" = "Strongly Agree." In order for an item to reach *consensus of agreement*, the item had to receive a mean score of ≥ 5.0 from the panelists. Items not reaching *consensus of agreement* were sent back to panelist in round three. Twenty-four panelists responded to round two for a response rate of 92%. One panelist in round two asked to be removed from the study.

Round Three

The round three instrument asked panelists to rate their level of agreement for those concept categories that at least 51% but less than 75% of panelists had selected "Agree" or "Strongly Agree" in round two. The round three instrument included the mean score for each concept in round two. Electronic reminder messages were sent to panelists approximately one week prior to the assigned due date encouraging the return of round three responses. Twenty-four panelists responded to round three for a response rate of 92%. Compared to the previous round, only a slight increase in *consensus of agreement* among the panelists was expected (Dalkey et al., 1972).

Findings

The 316 concepts provided by STEM and junior livestock project experts in round one were: Science = 136; Technology = 46; Engineering = 38; and Mathematics = 96. After removing duplicate items and compound statements (Linstone & Turoff, 2002), 116 items were retained and collapsed into 30 categories for presentation to panelists in round two. Table 1 shows all STEM concepts along with descriptors used to define specific concepts.

Table 1

STEM concepts categories and descriptors

Science

- Anatomy and physiology (i.e., structure, muscle biology, growth and development, and ruminant physiology)
- Animal behavior
- Animal handling techniques
- Animal health (i.e., Disease diagnosis and treatment, parasite control and treatment, biosecurity, analyze urine and stool samples, digestive health, medicine withdrawal times, vaccinations, implants, and animal care and management)
- Chemical analysis of soils

- Chemical analysis of water
- Entomology
- Genetics (i.e., Specific breed reproduction, artificial insemination and embryo transfer, sire selection, gene purity and consistency, selection of replacement and cull animals, read pedigrees, cloning, DNA samples, and EPDs)
- Livestock evaluation
- Meat Science (i.e., Food safety and market readiness)
- Nutrition (i.e., Determining appropriate feed rations, adjusting protein and energy requirements, importance of water and roughage, nutrition's impact on growth and development, feed additives, rate-of-gain, growth and carcass merit, feed utilization, and optimum weight and finish)
- Principles of heating and cooling
- Reproduction (i.e., Reproductive physiology, gestation, reproductive health, and sound husbandry)
- Understanding of flight zones

Technology

- Animal husbandry (i.e., Check estrus and gestation, artificial insemination, embryo transfer, palpation, ultrasound, and EPDs)
- Herd Management (i.e., Scales, electronic animal ID, vaccinations, mixing and preparing grain, feed additives, growth promotants, and carcass estimates)
- Marketing and networking (i.e., Use internet to buy and sell livestock, marketing, build websites/marketing programs, communicate through social media, find resources to support projects, and delivering and disseminating education materials)
- Record keeping (i.e., Use of laptops, cell phones, and iPads to communicate, find new information, and store records)
- Technology needed to properly apply fertilizer
- Utilizing older youth to teach younger students

Engineering

- Building facilities (i.e., Design and construction of livestock housing or enclosures, working pens, building fence, setting up barn or stalls, determining and installing environmental controls, installing protection systems, and selection of materials for construction)
- Electricity (i.e., motor inner-working, selection and use of generator, why breakers flip, and what is a circuit)
- Hauling livestock (i.e., Selection of proper trailer—aluminum or steel)
- Presentation of the animal (i.e., Relationship of animal's dimensions to achieve balance—width, depth, length, position of exhibitor when presenting animal, and presentation of the animal in terms of angles, leg placement, touching loin to straighten top line)
- Rubber feed pans on ground or feed pans hanging on fence

Mathematics

- Animal health (i.e., Angle of joints in feet and legs, scales, measurements, and calculating medicine dosage)
- Genetics (i.e., EPD comparison, carcass predictions, days to parturition, days from birth to rebreeding, animal performance, and growth and development)

- Marketing (i.e., Comparative analysis of animals, economic impact, and marketing and purchase of livestock)
- Nutrition (i.e., Feed efficiency, stocking rates, determining amount and type of feed for an animal, average daily gain, adjusting rations for different stages of animal development, feed efficiency, calculate weigh backs, balance rations, meat science, and determining energy and protein content of feeds)
- Record keeping (i.e., Financial literacy, cost analysis of insurance and farming programs, accrued interest, track costs associated with raising and showing animals, profit and loss, business analysis, budgets, return on investment, profitability, and financing)

In round two panelists were asked to rate their level of agreement on 30 concept categories. On the instrument, each subject area (i.e., Science, Technology, Engineering, and Mathematics) contained several categories. The number of categories reaching *consensus of agreement* (m ≥ 5.0), by subject were Science = 8; Technology = 4; Engineering = 1; and Mathematics = 4. In total, 17 categories reached the level of agreement defined as "*consensus*" *a priori.* Table 2 displays STEM concepts that reached consensus with a mean score of ≥ 5.0. Livestock evaluation posted the highest mean score in the science category at 5.70. Herd management had the highest score under technology at 5.57. Presentation of the animal received the highest engineering score at 5.87 and nutrition was the highest score under mathematics at 5.35.

Table 2

STEM Concepts that Reached Consensus in Round Two (N = 24)

STEM Concept Categories Associated with Junior Livestock Projects	Mean
Science	
Livestock evaluation	5.70
Animal health	5.57
Nutrition	5.48
Animal handling traits	5.48
Animal behavior	5.48
Anatomy and physiology	5.22
Genetics	5.00
Reproduction	5.00
Technology	
Herd management	5.57
Record keeping	5.35
Utilizing older youth to teach younger students	5.22
Marketing and networking	5.00
Engineering	
Presentation of the animal	5.87
Mathematics	
Nutrition	5.35
Animal health	5.35
Record keeping	5.30
Marketing	5.04

Note. Scale: “1” = “Strongly Disagree,” “2” = “Disagree,” “3” = “Somewhat Disagree,” “4” = “Somewhat Agree,” “5” = “Agree,” “6” = “Strongly Agree.”

Each category that failed to reach consensus in round two is listed below in Table 3. The science categories which did not reach consensus were: Meat science; Chemical analysis of soils; Chemical analysis of water; Entomology; Understanding flight zones; and Principles of heating and cooling. The technology categories which did not reach consensus were: Animal husbandry and Technology needed to properly apply fertilizer. The engineering categories which did not reach consensus were: Building facilities, Electricity, Hauling livestock, and Rubber feed pans on ground or feed pans hanging on fence. The mathematics category which did not reach consensus was: Genetics.

Table 3

STEM Concepts that Failed to Reach Consensus in Round Two (N = 24)

STEM Concept Categories Associated with Junior Livestock Projects	Mean
Science	
Meat science	4.87
Understanding flight zones	4.65
Principles of heating and cooling	4.04
Entomology	3.91
Chemical analysis of soils	3.26
Chemical analysis of water	3.13
Technology	
Animal husbandry	4.91
Technology needed to properly apply fertilizer	3.26
Engineering	
Building facilities	4.96
Hauling livestock	4.87
Rubber feed pans on ground or feed pans hanging on fence	4.35
Electricity	4.04
Mathematics	
Genetics	4.83

Note. Scale: “1” = “Strongly Disagree,” “2” = “Disagree,” “3” = “Somewhat Disagree,” “4” = “Somewhat Agree,” “5” = “Agree,” “6” = “Strongly Agree.”

The panelists were asked to rate their level of agreement on the 13 concept categories that failed to reach the established “level of agreement” $m \geq 5.0$ for consensus in round two. Four concept categories reached consensus in the third and final round (Table 4).

Table 4

STEM Concepts that Reached Consensus after Round Three (N = 24)

STEM Concept Categories Associated with Junior Livestock Projects	Mean
Science	

Meat science	5.26
Technology	
Animal husbandry	5.22
Engineering	
Building facilities	5.17
Hauling livestock	5.17

Note. Scale: “1” = “Strongly Disagree,” “2” = “Disagree,” “3” = “Somewhat Disagree,” “4” = “Somewhat Agree,” “5” = “Agree,” “6” = “Strongly Agree.”

The nine concept categories which failed to reach the established “level of agreement” m ≥ 5.0 for consensus in round three are found in table 5.

Table 5

STEM Concepts that Failed to Reach Consensus after Round Three (N = 24)

STEM Concept Categories Associated with Junior Livestock Projects	Mean
Science	
Understanding flight zones	4.61
Principles of heating and cooling	4.26
Entomology	3.65
Chemical analysis of soils	3.09
Chemical analysis of water	3.06
Technology	
Technology needed to properly apply fertilizer	3.09
Engineering	
Rubber feed pans on ground or feed pans that hang on fence	4.87
Electricity	4.26
Mathematics	
Genetics	4.96

Note. Scale: “1” = “Strongly Disagree,” “2” = “Disagree,” “3” = “Somewhat Disagree,” “4” = “Somewhat Agree,” “5” = “Agree,” “6” = “Strongly Agree.”

After three rounds of the modified Delphi, 21 concept categories reached consensus (m = 5.00 or higher) with the panel of experts. Nine concept categories failed to reach consensus (m = ≤ 5.00).

Conclusions

A panel of experts in the field of livestock evaluation and STEM education reached consensus of agreement on 21 STEM concepts which students may be exposed to or experience during participation in a junior livestock project. Panelists reached consensus of agreement on the highest number of concepts from the subject of science. Accordingly, it may be concluded that there are more science-related concepts present in junior livestock projects. These results align with Sawer (1987) who identified animal science knowledge as a benefit of raising livestock. However, the highest mean score (M = 5.87) was received on the engineering concept of presentation of the animal. It can be concluded that the panel of experts believe students who participate in junior livestock projects have a greater opportunity to learn about proper presentation of the animal. While an engineering concept received the highest mean, this subject area had the lowest number of concept categories identified in round one, thus the lowest number of concepts which reached consensus. What is the cause of this disconnect between engineering concepts and STEM competencies? This subject requires further investigation.

The second highest concept category is livestock evaluation ($M = 5.70$). It may be concluded that the expert panel sees a great opportunity for students involved in junior livestock projects to gain knowledge in the area of livestock evaluation. Being around livestock and attending shows, students have ample opportunity to learn characteristics which make a livestock animal desirable or valuable. Listening to judges' oral reasons or justifications for placing a class often involves meat science or reproduction terminology. This knowledge can help develop the student's ability to select desirable livestock in the future.

Three concepts reached consensus at the lowest mean ($M = 5.00$): Reproduction, genetics, and marketing and networking. Although junior livestock projects can deal with reproduction, genetics, and marketing and networking, it is concluded that many of these higher level processes are handled by adults involved in the project. These projects are often completed before the animal is bred, therefore the student may miss the reproduction or genetic selection of a mate for the animal. Also, students may not be involved in the sale of the animal after the show season is complete, therefore lacking the marketing or networking knowledge.

Per Rusk et al. (2003), students who participate in junior livestock projects are able to see parallels in their core subject classrooms. The concepts on which the panel reached consensus of agreement are often taught in a core subject classroom. If each concept is re-taught in a different manner during participation in a junior livestock project, these projects can provide a context for those abstract core concept principles. This connection may help agricultural education and 4-H stay current in our educational system as a way to apply complex concepts.

Recommendations

Recommendations for Practice

The link between science, technology, engineering, and mathematics core subject education and the concepts present in junior livestock projects should be emphasized. It is the responsibility of the teacher/advisor to highlight STEM concepts while supervising junior livestock projects, but the student is also responsible for being involved in all aspects of raising livestock.

Teachers/advisors should work with core subject teachers to use a standardized STEM curriculum. Using a standardized curriculum increases the likelihood of formulas or vocabulary repetition, helping students make a connection between the core subject concepts they learn in math or science with the livestock production concept. This connection allows students to see how these concepts are used in the real world. It may also be recommended that the current curriculum in place be updated to include STEM connections. Providing the connection for teachers could help increase the consistency with which STEM concept connections were made.

Neither leaders nor advisors are provided with STEM curriculum in the area of junior livestock projects. If leaders and advisors had a standardized curriculum from which to pull, teaching these concepts would be much easier. Knowing which concepts are to be taught and the STEM connections to each concept, teachers would feel less stress trying to teach STEM concepts during project supervision.

Recommendations for Future Research

Rusk et al. (2003) found that 32% of respondents admitted to using animal physiology knowledge gained through livestock projects during science courses in school. Results of this study suggest that concepts such as animal physiology, and many others, are associated with participation in junior livestock projects. However, research should be conducted to determine which concepts and to what degree students are actually learning through involvement in these projects. Also, do students who participate in livestock projects score higher on mathematics and/or science standardized exams? If 4-H leaders and FFA advisors are responsible for teaching these concepts, research should be conducted to determine best practices for teaching STEM concepts to students. Moreover, how are teaching STEM concepts through participation in junior livestock projects benefitting students in the core subject classroom? One student from the Rusk et al. (2003) study specifically said, "In biology, my 4-H animal experience has given me more of a hands-on approach to various life processes like reproduction, birth, death, disease, etc." (p. 7). Another respondent said, "I was able to relate to the [advanced biology] class what I already knew from being involved with my own 4-H livestock and I was able to fully understand what was being taught" (Rusk et al., 2003, p. 7). This warrants additional inquiry.

According to the panel of experts, math and science concepts were more prevalent in junior livestock projects. Conversely, experts identified fewer technology and engineering concepts as being present within junior livestock projects. Additional study is needed to understand more clearly the potential for STEM integration in all areas through junior livestock projects.

The concepts which did not reach consensus of agreement may reflect the nature of junior livestock projects. Rusk et al. (2003) pointed out that "knowledge gained and experience gained" during livestock projects are closely related (p. 1). It is quite possible that those concepts which failed to reach consensus are areas which the expert panel felt students were not involved in as actively. The amount of STEM concept knowledge a student gains through participation in junior livestock projects depends on how deeply the student was involved in all aspects of their project. Further investigation is necessary to determine the level to which students are involved with their livestock project.

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Discussant Remarks: Donald M. Johnson, University of Arkansas

Identifying STEM Concepts Associated with Junior Livestock Projects

Livestock projects are likely the most popular of all projects among FFA and 4H members. Likewise, STEM education is undoubtedly the hottest topic in all of education. The researchers have conducted an exploratory study to determine the extent to which participation in the former involves experiences with the latter. This study, especially its recommendations for further research, has potentially important implications for agricultural education.

The authors conducted a three round Delphi study to determine the STEM concepts associated with junior livestock projects. The 26 "experts" involved in the Delphi were described as meeting two of the following three criteria:

- 10+ years of experience in livestock and/or education,
- A national reputation in evaluation of junior livestock projects at the state level of higher, and
- Knowledge of STEM concepts related to livestock as evidenced by publishing or education in the field

Since the results of a Delphi are so dependent on the expertise of the participants, it would be tremendously helpful to know which pairs of criteria were represented (and to what degree) in the panel. For example, a panel comprised of individuals meeting the first and second criteria (but not the third) would likely reach a different consensus than a panel comprised of individuals meeting criterions one and three (but not two). Also, the inclusion of "or" in the first criterion is interesting since experience in livestock and experience in education are not really that interchangeable (at least on most days!).

The panel reached consensus that 21 STEM "concept categories" were "associated" with junior livestock projects. Science and math concepts were more likely to be present than engineering or technology concepts. Most of the STEM concepts appeared to be legitimate (e.g. the science concept, 'chemical analysis of water') while a few others appeared less so (e.g. the engineering concept, 'rubber feed pans on ground or feed pans hanging on fence'). It would take a great deal of discussion to convince me that the latter (and a few similar items) are legitimate STEM concepts.

The authors' use of the verb "associated" in the paper's title instead of "learned" was most appropriate. The authors were correct to recognize that just because STEM concepts were associated with junior livestock projects that did not necessarily mean that students learned these concepts. While these concepts may be embedded in livestock-related activities, they may lack the explicitness necessary for student concept learning.

The authors have conducted an interesting and relevant study. Their recommendations for both educational practice and further research are sound and well supported by their findings. I look forward to the results of their continued research in this area.

Teachers' Confidence to Integrate Biology in Agriscience Courses

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Abstract

The primary purpose of this study was to determine the confidence levels of agricultural science teachers to integrate biology concepts in plant and animal science classes. The researchers also sought to describe the demographic characteristics of New Mexico agricultural science teachers. This study utilized a descriptive-correlational research design. Teachers were asked to identify their confidence levels to teach the state standards of the animal science and plant science course that matched course objectives in biology and life science. Most participants were found to be teachers with the average age of 39 who had a mean of 13 years teaching experience. The majority of New Mexico agricultural science teachers had received their secondary science teacher certification and over 70% had obtained their masters degree. Teachers felt the least confident to teach the processes of cell division, including binary fission, mitosis, and meiosis. Teachers felt the most confident integrating biology concepts within lessons dealing with; the nutrients required by plants, how they obtain and transport those nutrients, as well as teaching the evolution of plants from green algae. The findings suggest that there are some relationships between years of teaching experience, school size, and teachers receiving the science certification.

Introduction

Since its beginnings, agricultural education programs have utilized the integration of science skills into their curriculum. Legislation like the Hatch Act of 1887 broadened the scope of agriculture education (Hillison, 1996). This legislation established experiment stations with many of them serving as educational centers for programs that focused on practical and scientific applications of agriculture principles. John Dewey, 20th century educational reformer, believed strongly in the importance of curriculum integration. Dewey (1944) also felt that to separate the core curriculum subjects and vocational academic programs was a detriment to student success. Vocational agriculture programs helped citizens of Texas and the United States to become the world leaders in agriculture production (Cepica, M., Dillingham, J., Eggenberger, L., & Stockton, J., 1988). These successes could not have been accomplished without an established background in science. The 1988 publication of Understanding Agriculture: New Directions for Education by the National Research Council encouraged agricultural educators to incorporate more science-based instruction (NRC, 1988). Two areas within the secondary agricultural education program, Supervised Agricultural Experience (SAE) and classroom instruction, hold high potential for student's learning of science concepts, both formally and informally (Ramsey & Edwards, 2004).

The need for increased science skills in agriculture programs is apparent, when only 2% of those employed in the field of agriculture work specifically in production farming. Many states have endeavored to include science in their agriculture classes (Thompson & Schumacher, 1998). The 1990 Carl D Perkins Vocational and Technology Act called for and reinforced the integration of academic and vocational (agriculture) education (Wirt, 1991). It has been found that students who enrolled in agricultural science courses that integrated biology, demonstrated a higher overall level of achievement as well as a more positive attitude toward learning experiences (Roegge & Russell, 1990; Dormondy, 1993).

The first step in developing quality science instruction in agriculture courses is to understand the areas that teachers are confident in and the areas where they believe their skills need to be strengthened. Previously, researchers have found that overall, agricultural science teachers feel confident in their abilities to include science credit in their courses (Balshwied & Thompson, 1999; Connors & Elliot, 1995; Dyer & Osborne, 1999; Newman & Johnson, 1993; Welton, Harbstreit & Borchers, 1994). There is not any current research on New Mexico agricultural science teachers and their confidence to teach the advanced animal science class for secondary science credit. As a new development, it is important to understand the level of confidence teachers have in integrating these science concepts into their classes. It is also important to identify what programs are offering these courses, the teacher's certification and experience, as well as which grade levels of students taking this course.

The theoretical model for this study focused primarily on the perceptions of agricultural science teachers to integrate biology into the plant and animal science courses. This was based around the theory of planned behavior (Azjen, 1985), which is an extension of the theory of reasoned action (Fishbein & Azjen, 1975; Azjen & Fishbein, 1980). The theory of reasoned action depicts the psychological process by which attitudes cause behavior (Fishbein, 1967). Both were designed to exhibit the relationship between informational and motivational influences on behavior (Connor & Armitage, 1998). The theory of planned behavior suggests that behavioral intentions can be best viewed as consequences of an individual's attitude. The theory of planned behavior suggests that demographic variables and knowledge, influences values, and beliefs. These in turn affect attitude, intention, and behavior. The theories impact the study of confidence levels and the factors that influence agriculture teacher success in teaching the advanced animal science course. The theory of planned behavior represents behavior as a function of behavioral intentions and perceived behavioral control (PBC) (Azjen, 1991). This concept is similar to Bandura's (1984) concept of self-efficacy.

Teacher confidence is routinely linked to Bandura's concept of self-efficacy. This can be described as a teacher's judgment of their capabilities to organize and execute courses of action required to types of performance (Bandura, 1984). Self-efficacy can enhance or impair performance through their effects on cognitive, affective, or motivational intervening processes. It is important to note that a person's beliefs about their capabilities are not the same as actual ability, but they are closely related. If a person has low efficacy or confidence in a task, then their performance in that task is expected to be low (Bandura, 1997). Conversely, higher ability levels would tend to increase their confidence levels and as a result, their level of performance.

As adapted for this study, these theories suggest that agricultural science teachers past experiences and demographic characteristics influence their decisions to integrate biology concepts into their plant and animal science courses. By understandng teacher confidence and perceptions of teaching the advanced animal science course, researchers will more likely be able to determine how confident there are to successfully implement these concepts into their courses and agriculture programs. This study addresses Research Priority Three of the American

Association for Agricultural Education (AAAE) National Research Agenda – Sufficient Scientific and Professional Workforce That Addresses the Challenges of the 21st Century (Doerfert, 2011).

Purpose and Objectives

The purpose of this study was to determine the confidence level of New Mexico agricultural science teachers to integrate and teach biology concepts into their animal and plant science courses. The researchers also sought to provide demographic data on the teachers, including gender, age, years teaching, initial undergraduate degree, and attainment of advanced degrees. Within this study, the researchers also felt it was important to describe the agricultural science programs with information relating to school size, the offering of science credit, courses credit was offered in, and years offering science credit.

The following research objectives were employed to conduct this study:

1. Describe characteristics of New Mexico teachers teaching the advanced animal science course for science credit.

2. Describe characteristics of the agriculture programs as they relate to this study.

3. Identify teachers' confidence levels in teaching biology concepts in plant and animal science courses.

4. Determine if there are relationships between agriscience teachers' confidence levels and teacher characteristics.

5. Determine if there are any relationships between teachers' confidence levels and program characteristics.

Methods

The target population for this study was New Mexico agricultural science teachers and programs. A list of all state agricultural science teachers was obtained from the New Mexico department of education. Subjects were selected based upon the criteria that they were teaching at least one agricultural science course. A modified version of Dillman's Mail and Internet Surveys (2007) was used for data collection and correspondence with sample participants. The researcher contacted 84 teachers identified as teaching an agricultural science course in the state of New Mexico. This was concluded as the total number of agriculture science teachers in the state. There were fifty-eight respondents to the survey, giving the researchers a response rate of 69%. Results were collected using Surveymonkey, an online survey software.

This study utilized a descriptive-correlational research design. According to Gall, Gall, and Borg (2007), correlational research is defined as "A type of investigation that seeks to discover the direction and magnitude of the relationship among variables through the use of correlational statistics" (p. 636). This study is descriptive as it also employs a methodology that allowed secondary agricultural science teachers to describe their agricultural science program's characteristics and to gauge level of preparedness.

The researcher developed instrument was a 36 item instrument consisting of nominal and ordinal scales of measurement to individual and rank order questions that asked the participant to indicate level of confidence in teaching biology within animal and plant science; containing questions based on a Likert-type scale. The instrument was developed specifically for this research. The content for this instrument was developed using referenced materials from previous studies and accepted scholarly publications in agricultural education. The instrument was pilot tested in order to determine reliability. Cronbach's alpha coefficients were used to measure internal consistency in order to establish reliability. The pilot test data revealed a reliability Cronbach's alpha coefficient of .623. Nunnally (1967) suggested that Cronbach's alpha coefficients of .5-.6 are acceptable in the early stages of research. Reliability of the pre-test and final instrument is presented in Table 1.

Table 1

Pilot Test and Final Instrument Reliability Scores

Instrument	Cronbach's Alpha
Pilot Test	.623
Final Instrument	.860

Findings

Objective 1: The first objective was to describe demographic characteristics of New Mexico agricultural science teachers. This included questions about participant gender, age, years of teaching experience, what the teachers initial certification was, if they had received an advanced degree, had they received the secondary science teacher certification, and how many years, if any, had the participant taught a core secondary science course (biology, chemistry, physics, etc.). The majority of participants were found to be males (74%) compared to females (26%). This was found to be comparable with previous demographics of New Mexico agriscience teachers. Table 2 describes the findings of teachers' age and years of experience.

Table 2

Agriscience Teachers' Age and Years of Teaching Experience

Variable	*M*	*Min*	*Max*	*Standard Deviation*
Participant Age	39.5	20	64	11.1
Participant Years of Experience	13.1	0.5	34	13.1

Most teachers were found to have received their initial degree in agriculture education (*n*= 50, 86.2%). Those teachers who did not have agricultural education degrees varied in with degrees in agriculture business (*n* =4, 6.9%), animal science (*n*= 2, 3.4%), horticulture (*n*= 1, 1.7%), and agricultural communication (*n* = 1, 1.7%). The majority of participants (*n = 41,* 70.7%) had received their masters. Of those with advanced degrees, three (5%) had received their doctorate in either agricultural education or educational administration. Most teachers (*n*=41, 70.7%) indicated that they had received their science endorsement. The average number of years teaching a core science course was 4.6 years with a minimum of 0 and a maximum of 25 years.

Objective Two: Objective two sought to describe characteristics of the agricultural programs as they related to this study. This included questions about school size, if they were offering science credit, class's science credit was offered in, and number of year's science credit had been offered. Table three describes the findings on school size and offering science credit in ag courses.

Table 3

School Size and Offering Science Credit in Agriculture Courses

	f	%
School Size		
1A	23	40.4
2A	5	8.8
3A	7	12.3
4A	13	22.8
5A	9	15.8
Offering Science Credit		
Yes	22	36.8
No	36	63.2

Those teachers who were offering credit did so in a number of different agricultural science courses. The most common courses were animal science (n = 9, 37.5%) and horticulture (n =8, 33.3%). The other course that science credit was offered in included agricultural mechanics (n= 2, 8.3%), environmental science (n = 2, 8.3%), general agriculture (n =2, 8.3%), and botany (n = 1, 4.2%). The average program had been offering science credit in their courses for 3.5 years with the longest amount of time being 25 years. The researcher found that 18 (31%) of the programs were offering science credit for the first time. The programs were split with 25

(43.9%) indicating they would continue to offer science credit and 32 (56.1%) indicating they would not offer science credit in their agriculture courses the next year.

Objective Three: The third objective sought to evaluate teachers' level of confidence to teach biology in the plant and animal science courses. Table four and five distinguish the course objectives in life science that relate to plant and animal science.

Table 4

Biology Course Standards Related to Plant Science

Standard	Description
1.08	Know the functions of cellulose, starch, glycogen, and chitin in cells.
2.02	Understand the distinctions between diffusion, facilitated diffusion, osmosis, and active transport in a cell system. Know the role of membranes in these functions (e.g., fluid mosaic model).
2.05	Know the basic functions of the light-dependent and light-independent reactions of photosynthesis, and their compartmentalization in a cell.
2.09	Understand the basic structures and functions of the following: nucleus, nucleolus, nuclear pore, cytoskeleton, cytoplasm (cytosol), mitochondrion, chloroplast, large central vacuole, contractile vacuole, peroxisome, ribosome, cell wall, cell (plasma) membrane, cilium and flagellum.
2.10	Describe the processes of cell division, including binary fission, mitosis and meiosis
8.01	Describe the evolution of plants from green algae and discuss the adaptations that allowed plants to live on land. Explain the differences among gymnosperms, and angiosperms, and identify the plants that belong to each group.
8.02	Describe the general structure of a flowering plant; explain the structure and function of plant organs and the major tissue types.
8.04	List the most important nutrients required by plants, and explain how they obtain and transport those nutrients. Discuss the relationship between Rhizobium and legumes.
8.07	Describe the reproductive structures in flowering plants, and identify the parts of a seed and explain how seeds germinate.
8.08	Discuss asexual reproduction in plants; explain how it occurs in both nature and agriculture.
8.09	Discuss the role of plant hormones and their role in tropic responses and flowering during specific seasons (e.g. IAA, gibberellins, phytochrome, and ethylene).
8.10	Describe the cellular structure of a leaf, and discuss how this facilitates photosynthesis. Explain how transpiration occurs and how it is regulated.

Table 5

Biology Standards Related to Animal Science

Standard	Description
1.10	Know the many possible roles of proteins in cells.
1.12	Understand how fatty acids are classified (saturated, unsaturated), and the general structures and functions of triglycerides, phospholipids, and steroids.
3.02	Understand how genotype causes phenotype. Predict the probability of each possible genotype and phenotype in a genetic cross.
3.03	Understand exceptions to and extensions of Mendelian rules of inheritance, including incomplete dominance, co-dominance, epistasis, pleiotropic, and sex-linkage.
3.04	Construct and analyz pedigrees to determine the mode of inheritance.
3.05	Explain how to carry out genetic crosses to determine genetic linkage, and interpret genetic maps of chromosomes.
4.05	Explain the steps involved in transcription; identify the types of proteins required and the role of each.
4.06	Describe the steps involved in translation; explain the roles of mRNAs, tRNAs, ribosomes (RNA), and amino-acyl tRNA synthetases
6.01	Describe the levels of organization, including cells, tissues, organs, organ systems, and the whole animal.

Teachers' confidence levels were evaluated upon a five-point Likert-Type scale with responses of: 1= *no confidence*, 2= *very little confidence*, 3= *moderately confident*, 4= *confident* and 5= *very confident*. The overall summated score a teacher could receive for plant science was from 0-60 and a range of 0-45 for animal science objectives. Table six describes teacher overall confidence levels teaching biology in plant and animal science.

Table 6

Overall Teachers Confidence Scores

PLSC Objectives	*M*	*SD*	ANSC Objectives	*M*	*SD*
1.08	2.45	0.94	1.10	2.33	1.06
2.02	2.47	0.98	1.12	**2.95**	1.04
2.05	2.69	0.91	3.02	2.63	1.06
2.09	2.60	1.03	3.03	2.56	1.05
2.10	2.26	1.08	3.04	**2.84**	1.07
8.01	**3.17**	0.96	3.05	2.40	1.05

8.02	3.02	0.87	4.05	2.61	1.04
8.04	**3.23**	0.80	4.06	2.40	1.02
8.07	2.94	0.94	6.01	2.37	1.20
8.08	2.36	1.06			
8.09	2.75	0.99			
8.10	2.73	0.96			
Summated Score	33.42	11.52	Summated Score	23.09	9.59

Researchers found that teachers had a higher confidence level in integrating biology concepts into plant science over animal science. There was a higher amount of variability in teachers' confidence to integrate biology in animal science. Participants' were found to be the most confident in integrating biology concepts that involved the identifying nutrients required by plants, and explain how they obtain and transport those nutrients and the evolution of plants from green algae and discussing the adaptations that allowed plants to live on land. Within animal science concepts they were found to have the most confidence in teaching how fatty acids are classified (saturated, unsaturated), the general structures and functions of triglycerides, phospholipids, and steroids and constructing and analyzing pedigrees to determine the mode of inheritance.

Teachers felt the least amount of confidence to teach the processes of cell division, including binary fission, mitosis, and meiosis within plant science. Within the area of animal science, teachers felt the least amount of confidence in teaching the many possible roles of proteins in cells and the levels of organization, including cells, tissues, organs, and organ systems within the whole animal.

Objective Four: The fourth objective sought to determine if there were relationships between agriscience teachers' confidence levels and teacher demographics. Nominal demographic data was correlated to confidence levels with a point-biserial coefficient while ordinal demographic data was correlated with a Pearson product correlational coefficient. There were found low to negligible variables in relation to teacher gender or age and confidence level. The strongest correlations were found between teaching experience and confidence. The highest relationships were found between plant science objectives 8.04: *nutrients required by plants, and explain how they obtain and transport those nutrients* (.326), and 8.08: *asexual reproduction in plants; explain how it occurs in both nature and agriculture* (.304). The relationship between demographic variables and teachers confidence to integrate biology in animal science was found to be negligible.

Objective Five: The fifth objective sought to determine any relationship between teachers' level of confidence and specific program characteristics. Table seven describes the relationship between program characteristics and teacher confidence levels.

Table 7

Relationship between teacher confidence, school size and receiving science credit integrating biology in plant science

Course Objective	School Size	Science Credit
	r_s	r_s
PLSC (1)	.309	-.172
PLSC (2)	.319	-.310
PLSC (3)	**.368**	-.233
PLSC (4)	.240	-.218
PLSC (5)	-.031	-.145
PLSC (6)	**.360**	**-.382**
PLSC (7)	.267	-.303
PLSC (8)	.274	-.339
PLSC (9)	**.385**	**-.372**
PLSC (10)	.119	-.222
PLSC (11)	**.432**	**-.352**
PLSC (12)	.268	**-.359**

There were significant relationships found between the school size and teachers ability to integrate biology concepts into plant science. Teachers from larger schools had more confidence integrating concepts of the basic functions of the light-dependent and light-independent reactions of photosynthesis, and their compartmentalization in a cell, the reproductive structures in flowering plants, and identify the parts of a seed and explain how seeds germinate and the role of plant hormones and their role in tropic responses and flowering during specific seasons (e.g. IAA, gibberellins, phytochrome, and ethylene).

Those teachers who were offering science credit were more confident to integrate biology concepts into their plant science courses. They felt most confident teaching concepts relating to the evolution of plants from green algae and discuss the adaptations that allowed plants to live on land. Explain the differences among gymnosperms, and angiosperms; and identify the plants that belong to each group; the reproductive structures in flowering plants; identify the parts of a seed and explain how seeds germinate; the role of plant hormones and their role in tropic responses and flowering during specific seasons; the cellular structure of a leaf; and discuss how this facilitates photosynthesis.

Table 8

Relationship between teacher confidence, school size and receiving science credit integrating biology in animal science

Course Objective	School Size r_s	Science Credit r_s
ANSC (1)	.005	-.088
ANSC (2)	.252	**-.304**
ANSC (3)	**.296**	-.253
ANSC (4)	**.295**	-.241
ANSC (5)	.009	-.166
ANSC (6)	.026	-.154
ANSC (7)	-.099	-.124
ANSC (8)	.061	-.123
ANSC (9)	.216	-.264

Teachers who taught at larger school were found to be more confident in integrating concepts of biology into their animal science courses. Some of the concepts they had the most confidence in; include the teaching of how genotype causes phenotype and exceptions to and extensions of Mendelian rules of inheritance; including incomplete dominance, co-dominance, epistasis, pleiotropic and sex-linkage.

Teachers who were offering science credit in their classes were also found to be more confident in integrating biology concepts into their animal science curriculum. The concepts that their highest confidence levels surrounded topics involving understanding how fatty acids are classified (saturated, unsaturated), and the general structures and functions of triglycerides, phospholipids, and steroids.

Conclusions

The majority of participant's were males in their late 40's with over ten years of teaching experience. Almost 90% of the teacher's had received their initial teaching certification in agricultural education. The majority of the teachers had received a master's degree with most of their advanced degrees being in agricultural education or educational administration. Over 70% of the teachers had received their science endorsement. Even with their science endorsement, there were low numbers of teachers providing science credit in their agriculture courses. This could be because those teachers were already teaching a core science course. This contradicts previous findings that suggested teachers were wary of receiving their science endorsement. This does show that there are some barriers for these teachers to offer such credit in their courses. As this sample related to 69% of the agriculture science teachers in the state, this provided the researchers with an acceptable snapshot of the demographics of New Mexico agricultural science teachers.

The majority of teachers, who did offer science credit in agriculture classes, did so in animal science and plant science oriented classes. This is consistent with previous research (Balshwied & Thompson, 1999; Connors & Elliot, 1995; Newman & Johnson, 1993; Dormondy , 1993). It was interesting to see that teachers were offering science credit in agricultural mechanics and "general agriculture". Under state course headings there is not a course titled "general agriculture". The average program had been offering science in agriculture courses for 3.5 years. Over half the participants who were offering science credit indicated that they would not be doing so the following year. This brings up the research question: Why are these teachers not planning on continuing the offering of science credit in their courses?

Teachers felt the most confident in integrating biology concepts into plant science. There was the most variability between teachers' confidence levels to integrate biology into animal science. The second lowest confidence score of teachers of plant science was in teaching concepts of asexual reproduction. This is a concern as these concepts make up a large portion of horticulture course objectives as well as the importance of these skills in the agriculture industry. Participants' were found to be the most confident in integrating biology concepts that involved the identifying nutrients required by plants, and explain how they obtain and transport those nutrients. This indicates that while teachers understand the importance of nutrients, they do not have the proper knowledge of their role in asexual reproduction. Within animal science concepts they were found to have the most confidence in teaching how to analyze pedigrees to determine the mode of inheritance. This is an important skill especially when preparing students for success with their supervised agriculture experience (SAE) projects.

There researcher found low to negligible variables in relation to teacher gender or age and confidence level. The strongest correlation was found between teaching experience and confidence. These findings are similar to those of Myers & Dyer (2004) in that those teachers with more experience were more confident to teach higher level science concepts. The researchers should work with teachers to share this information. By doing so they can not only share the weaknesses that need to be improved upon, but provide encouragement to the teachers in the form of their strengths. State leaders as well as university faculty can use this data to establish professional development focusing on the areas of biology content integration in plant and animal science in which teachers need improvement. Further research should be conducted to continue to investigate confidence as more programs begin integrating biology concepts into their courses. The results of this research should be distributed to teachers, administrators, teach educators and other stakeholders. Those who are involved in agricultural education should have a better understanding of where teacher confidence lies and what barriers teachers are facing in effectively integrating science into their curriculum. A relationship with industry leaders and collaboration with science teachers would aid this practice

It is important to remember that confidence to teach science should not be confused with competence to teach science. The larger the school, the more confident teachers felt to apply the principles of biology into their animal and plant science courses. These findings are similar to those of Myers & Dyer (2004). This could be because of access to better equipment and instructional materials that are available to larger schools. This also could be that the larger schools had access to more livestock than the smaller schools which allowed more hands on opportunities to teach these specific concepts. Teachers at smaller school should work with teachers at larger school to share ideas and information. By working collegially teachers can better prepare all students for advanced science concepts in agriculture. There should be further research into why teachers are not offering science credit in their courses in the future. What are the perceived barriers of integrating these concepts and continuing to offer this credit?

Less experienced teachers should be encouraged to teach integrate these concepts into their courses and work with science teachers to better understand how to best teach these concepts. Inexperienced teachers should take advantage of instructional programs like the Curriculum for Agricultural Science Education (CASE) that involves hands on learning activities. These types of professional development will help new teachers feel more confident to teach these concepts and integrate biology into their courses. Teacher should also consider receiving the secondary science certification to enhance their understanding of science principles. The agricultural science program is the best place to incorporate such teaching strategies. Teachers should utilize their animal project centers and learning labs. Involvement in the science fair is a suggested practice for teachers. Ideal areas for the distribution of this information include state agriculture teachers conference, professional development workshops and in agricultural education courses.

The integrating of biology and other science concepts in the secondary agricultural education curriculum must be carefully weighed and considered. As educational leaders we must be aware of the impact such practices can have on the future of our programs. The increased academic integration within agricultural science courses can have an effect on many different areas, including teacher certification, in-service programs, and even the relationship between career development events and supervised agriculture experiences. With any activity that has an impact on students, we must get buy in from all stakeholders to see the idea to fruition.

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Discussant Remarks: Donald M. Johnson, University of Arkansas

Teachers' Confidence to Integrate Biology into Agriscience Courses

The purpose of this study was to examine science credit for agriculture in New Mexico, determine teachers' confidence in teaching core biology concepts in plant and animal science courses, and examine demographic and situational characteristics potentially related to science credit and confidence. I commend the researchers for investigating a topic with continuing importance and relevance.

The authors did a nice job of establishing the need and developing the theoretical framework for the study. In a discipline that is sometimes chided for not grounding research within a theoretical framework, the authors provide three different, albeit related, theory bases for their study: the theory of planned behavior (Azjen, 1985), the theory of reasoned action (Azjen & Fishbein, 1980), and self-efficacy theory (Bandura, 1984). The theoretical framework provides an obvious justification for examining teachers' confidence in their ability to teach biology concepts in agriculture courses.

Overall, the research methods used were fairly solid. I do have some questions about the survey instrument. Readers need more than the statement that, "The content for this instrument was developed using referenced materials from previous studies and accepted scholarly publications in agricultural education." Which specific materials and publications were used? This information, along with details about (at a minimum) the face and content validity of the instrument should be provided. I was pleased to note the researchers correctly used coefficient alpha to assess the reliability (internal consistency) of their summated scales. This is the (only) correct use of coefficient alpha! The researchers are to be commended for conducting a pilot test; however, it would be helpful to provide readers details about the participants and any instrument modifications made as a result of the pilot test. Finally, since the researchers received a 69% response rate and made no effort to control for non-response error, they should explicitly state that the results from the respondents cannot be generalized to the entire population of New Mexico agriculture teachers.

The researchers found that 36.8% of the respondents offered science credit for one or more agriculture courses, teachers were slightly more confident of their ability to teach biology content in plant science courses, and the correlations between respondent and school characteristics and confidence in teaching biology concepts were negligible to moderate. One major finding, contained in the tables but not discussed in text, is that the means for teacher confidence in teaching biology concepts in plant science (M = 2.78) and animal science (M = 2.57) were in the 'little' to 'moderate' confidence range. Further analysis, comparing the confidence of teachers offering and not offering science credit, is warranted. Additionally, what are the implications of these findings for preservice and inservice education programs in New Mexico? Finally, I challenge the authors to re-evaluate their conclusion that "over half of the teachers offering science credit indicated that they would not be doing so in the following year." I do not believe the results actually support this conclusion.

The authors are to be commended on a study with potential importance to agricultural education in New Mexico. I encourage them to continue their efforts in this area.

Session H: Introspective Teaching Methods

Discussant: Dr. Rick Rudd

The Use of Concept Maps to Facilitate Reflection in Agricultural Leadership Programs

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Abstract

Concept maps aid in the organization and representation of knowledge. The practice of concept mapping can be beneficial to facilitate the process of learning complex ideas, as an assessment tool, and can be used to stimulate the process of reflection within learners. The purpose of this study was to describe the outcomes of using concept mapping as a tool of reflection in an agricultural leadership program. Guided by the theories of constructivism and experiential learning, researchers utilized qualitative methods to identify and analyze concepts leadership program participants used in constructing concept maps at three different stages of the two year leadership program. Findings indicated that through the three different stages, definitions of leadership showed greater depth and detail and referenced concepts taught in the leadership program curriculum. Through the three stages, some new categories were created, while others were combined, with some category topics being eliminated. The practice of concept mapping and the results of this study can influence how leadership is being taught within agricultural leadership programs by giving credit to the role that experience and context has on a participant's definition of leadership.

Introduction

Concept maps are "graphical tools for organizing and representing knowledge" (Novak & Canas, 2008, p. 1). According to Mezirow and Associates (1990), "Any subject matter or discipline can be organized according to a conceptual hierarchy in which elements of knowledge are associated with or subsumed under larger, more general concepts" (p. 337). Therefore concept maps can hold a high degree of detail and scope to provide a summary of an individual's beliefs and values at any point in time. McAleese (1998), stated concept maps are used by researchers and practitioners to "diagnose misunderstandings, improve study methods, and glimpse at how learners come to know" (p. 1). They also provide the tool to assess where learners are (Novak & Gowin, 1984) and an indication of how individuals construct their understanding from past knowledge and experiences (Blackwell & Williams, 2007). According to McAleese (1998), concept mapping leads to reflection and provides a learner the opportunity to process complex ideas. Blackwell and Williams (2007) stated that the use of concept maps can be beneficial in studying and understanding leadership as they provide representation of what an individual attributes to leadership. Multiple concept mapping activities on leadership can also explain how the definition can evolve over time. Therefore, concept maps can be a beneficial tool for leadership program facilitators to use as a guide for the learning complex ideas, such as leadership, to stimulate reflection with its participants and as an assessment tool.

In agricultural leadership programs, adult leaders study issues facing their industries and prepare themselves for leadership roles (Diem & Nikola, 2005). The purpose of these programs is to develop leaders with an increased understanding of the economic, political and social issues confronting the United States and rural society (Miller, 1976). To develop these leaders, these programs have been established in 39 states, provinces and countries around the world (Lindquist, 2010) and use a variety of teaching methods (Strickland & Carter, 2007) to develop leadership abilities and raise issue awareness and understanding (Carter & Rudd, 2000; Abington-Cooper, 2005). Roberts's (2006) experiential learning model provides agricultural leadership programs with model for the facilitation of leadership training that can be applied to various learning environments (Strickland, 2011).

As part of experiential learning, learners construct meaning from their experiences (Roberts, 2006). Through the reflective process, information is analyzed, interpreted, and transformed through intention, which allows the learner to internalize the experience. This reflection process allows the learner to make generalizations, which can then be tested through experimentation. Integrating reflection in leadership development programs allows individuals the opportunity to evaluate the significant outcomes of their experiences and gain an understanding of how to perceive and interpret their observations (Densten & Gray, 2001). Reflection can also provide potential leaders "insights into how to frame problems differently, to look at situations from multiple perspectives or to better understand followers" (p. 120). Adult learners can add richness to the reflection process since learning relates back to an adult learner's experiences, their occupation, community or voluntary roles, and their personal interests and needs (Newton, 1977). Additionally, experienced learners often bring more knowledge to the problem (Sternberg and Horvath, 1995) and this experience allows these learners to reflect, view, and solve problems at a deeper level (Merriam, Caffarella, & Baumgartner, 2007). In terms of agricultural leadership programs, "reflection is an important component of the leadership program process" (Van De Valk, 2010, p. 155)

The purpose of this research study was to describe the outcomes of using concept mapping as a tool of reflection in an agricultural leadership program. Guided by the theories of constructivism and experiential learning, the researchers identified and analyzed concepts leadership program participants used in constructing concept maps defining leadership at three different points of the two year leadership program. Since increasing understanding of teaching and learning processes and assessing the effectiveness of adult educational programs to encourage positive community change are both part of the National Research Agenda for Agricultural Education 2011-2015 (Doerfort, 2011), a study of reflection methods in an agricultural leadership program can provide valuable data, a description of the needs of adults in agricultural leadership programs, and future directions for research.

Conceptual Framework

Constructivism

In the creation and understanding of concept mapping, researchers have relied on the learning theory of constructivism to provide its theoretical framework (McAleese, 1994). Through constructivism, the individual learner constructs meaning based on the socially defined nature of the knowledge they have obtained (Doolittle & Camp, 1999). Learners take responsibility for their own learning and construct meaning and their own knowledge through experience (Doolittle & Camp, 1999; Densten & Gray, 2001; Kolb, 1984 & Roberts, 2006) and through the integration of new ideas and previous experiences cognitive structures in one's mind can be changed. According to Doolittle and Camp (1999), through constructivism reality is defined by the learner. Constructivism is concerned with the process of how we construct knowledge and a concept map comes about as a physical result of engaging in or constructing understandings (McAleese, 1998).

Through constructivism, the knowledge learners acquire is constantly going through reconstruction and transformation. Therefore, under the premise of constructivism, knowledge is created, rather than discovered (Kinchin, Hay & Adams, 2000). According to Roberts (2006), experiential learning can align itself with constructivism which contents that learns construct meaning from their experiences. Constructivism can be applied to experiential learning through the process of connecting new experiences and knowledge to a learner's pre-existing personal knowledge. Concept mapping can aid in constructivism by having facilitators reconstruct knowledge leading to meaningful learning and reveal to the learner connections among concepts that may not have been recognized earlier. In sum, learners and facilitators "constructing concept maps often remark that they recognize new relationships and hence new meanings or at least meanings they did not consciously hold before making the map" (Novak and Gowin, 1984, p. 17).

Experiential Learning

John Dewey (1938) stated that "amid all uncertainties there is one permanent frame of reference, namely the organic connection between education and personal experience" (p. 25). Through the study of experiential education, it is determined that learning can be a process and not only a product (Roberts, 2006 & Kolb, 1984). The theory suggests that through this process a learner can construct meaning through their experiences (Roberts, 2006).

The theory of experiential learning "begins with the initial focus of the learner" (Kolb, 1984, p. 22). Followed by focusing on the leader, experiential learning follows the process through initial experience, reflection, and generalization (Roberts, 2006). Once concepts are generalized, learners then move throughout the cycle to test and retest those generalizations in other learning opportunities. This process continues and builds upon prior experience and knowledge (Beard & Wilson, 2006). Through the processes of experience and reflection, information is transformed through intention, which allows the learner to internalize the experience. This reflection process allows the learner to make generalizations, which can then be tested through experimentation.

Strickland (2011) indicated the importance of outside influences and demographic variables on the experiential learning cycle. These are often brought forth in the reflective process of the cycle of learning. Reflection holds as much weight as the experience as reflection allows participants to develop an understanding of themselves and the experience (Roberts, 2006). McAleese (1998) suggested that reflection is the process of the learning experiences that is under the learner's control. The process of reflection involves "a commitment to questioning assumptions are taken for granted embodied in both theory and professional practice" (Densten & Gray, 2001, p. 119). The ability to reflect relates to how effectively individuals can learn from their personal experiences and the process provides a meaningful way for leaders to gain genuine understanding. According to Densten & Gray (2001), the objective of integrating reflection in leadership development programs is provide opportunity for individuals to evaluate their experiences in the context of leadership. Through reflection they gain understanding and are given insight into framing issues, examining situations from multiple perspectives, and through analysis are given greater understanding of their followers (Densten & Gray, 2001). To aid in the construction of meaning and connecting concepts into complex structures concept maps can be implemented.

Concept Maps

Concept maps can physically how new ideas become meaningful as they are linked to existing concepts and are organized (Lawless, Smee & O'Shea, 1998). The distinctive feature of the use of concept mapping is the emphasis on relationships between concepts and the visual display of these relationships (Lawless, 1994). According to Mezirow and Associates (1990), concept maps can assist individuals in "transforming linear material into more holistic visual imagery and therefore help us to evaluate, synthesize, and perceive new ways" (p. 338). Concept maps are not snapshots of just what is known; but also allow an unloading of information and act as a display knowledge construction (McAleese, 1998). They are not only used to evaluate thinking but also engage learners in thinking (Lawless, Smee & O'Shea, 1998). Consequently, concept maps are process oriented in which they can be continually modified and added to, therefore, they are not just representative of what is already known, but how one organizes their knowledge (McAleese, 1998).

One of the purposes of concept mapping is to assess current knowledge about a particular subject and help a learner tap into their own existing cognitive structures (Mezirow & Associates, 1990). The exercise of concept mapping can be implemented in three different situations including; the reclassification of previous knowledge with the addition of new material, the recording of ideas as a result of learning a new concept, and the consideration of context on a known idea (McAleese, 1998). In education, maps can be used as an instructional display, an evaluation tool, a curriculum organizer and as a method of understanding participants learning (Lawless, 1994). Through these practices, these maps can assess and evaluate learning (Lawless, 1994; Lawless, Smee & O'Shea, 1998; McAleese, 1998). In leadership development, "concept maps create strong visuals of how students' mental models of leadership are arranged and then how their mental models might change after exposure to the class curriculum and to the collaborative learning environment of the class" (Blackwell & Williams, 2007, p. 1).

Concept map creation entails multiple steps (McAleese, 1998). This includes the creation of a main concept, which is referred to as a seed node. Following the creation of a main concept, the learner creates associated concepts to the seed node. Following this, learners can create clusters of nodes and then join them through a series of arcs. According to Kinchin, Hay and Adams (2000) through qualitative analysis, concept maps can be grouped into three structural types; spoke, chain and net (Figure 1). As part of their research the authors described was originally recognized when reviewing reproduction in flowering plants with a group of students. They used this topic and the students' work to provide examples for their research. A spoke structure indicates a radial structure where all related concepts of the topic are considered the second set of nodes and are related to the core concept or seed node but not to each other. The chain structure is a linear sequence of concepts in which each concept is only linked to two other concepts (above and beneath). The net structure is a highly integrated network of secondary nodes and arcs. This structure demonstrates a deep understanding of seed node or core concept (Kinchin, Hay & Adams, 2000).

In their methodology, Kinchin, Hay and Adams (2000) contended that these three structures differentiate concept maps in degrees of complexity, ability to accommodate additions to the map, the use of context, and the creator's acknowledgement of a wider viewpoint. With this, the authors of this methodology imply that the structure of the framework help learners by serving as a mechanism for further learning. In the spoke framework, learners focus on the simple association without focusing on processes and interactions. Concepts can be added to the map without consequences or change to other nodes within the structure, and an additional concept or link has little effect on the overall view of the main concept. Within the chain structure there is only a consecutive sequence of terms without interaction. Additions cannot be made to the structure, particularly near the beginning of the sequence which indicates isolated understanding of the main concept. Loss of a link can lose meaning of the whole chain. The net structure is a mix of interactions through various levels of the map. There is room for additional knowledge and adding one or more concepts to the map has few consequences on the other nodes. This indicates a larger 'world view' because more knowledge can be added to the existing structure (Kinchin, Hay & Adams, 2000).

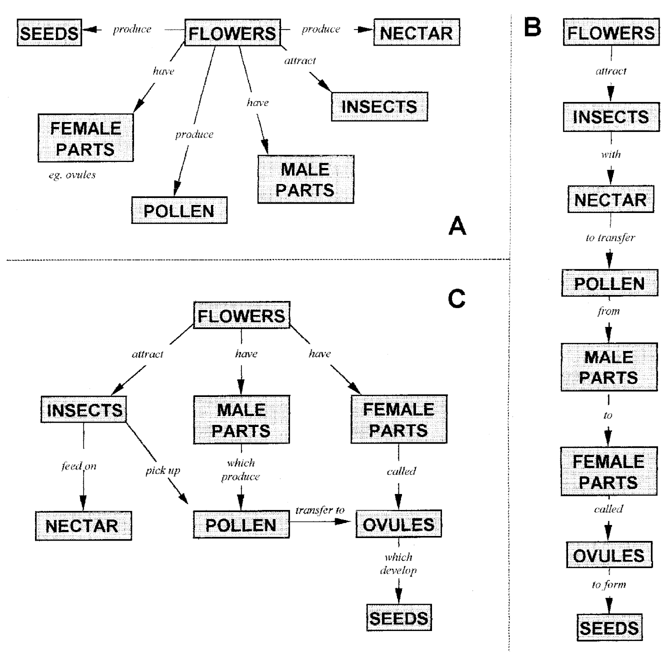

Figure 1. Examples of concept maps using the spoke structure (Map A), the chain structure (Map B) and the net structure (Map C). Adapted from "How a Qualitative Approach to Concept Map Analysis can be used to aid Learning by Illustrating Patters of Conceptual Development," by I. M. Kinchin and D. B. Hay and A. Adams, 2000, *Educational Research, 42*(1), p. 47.

Prior to this study, concept mapping has not been reported as a learning activity in agricultural leadership programming, but has been reported as an evaluation tool. Van De Valk (2010) used concept mapping to identify constructs of an agricultural leadership program as indicated by past participants and develop a theoretical framework for the program. Program alumni and board members identified outcomes of the leadership program and their relationships to one another. As a result of the practice, research reported that the program theory developed was "contextualized, explicit, and may be more readily accepted by practitioners in similar settings" (p. i). Additionally, as a result of the concept mapping, the research was able to provide a deeper understanding of the theoretical concepts through identifying how they relate to each other (Van De Valk, 2010).

Purpose and Objectives

The purpose of this study was to describe the outcomes of the use of concept mapping as a tool for reflection in an agricultural leadership program.

The research objectives were to:

1. Determine how program participants construct definitions of leadership though concept mapping.
2. Analyze the three phases of concept maps collected during the agricultural leadership program.

Methodology

This study was qualitative in nature. Qualitative research is defined by Creswell (1998) as:

> "an inquiry process of understanding based on distinct methodological traditions of inquiry that explore a social or human problem. The researcher builds a complex, holistic picture, analyzes words, reports detailed views of informants, and conducts the study in a natural setting" (p. 15).

Dooley (2007) studied the approach within the context of agricultural education and reasoned that interpretive approaches emphasized the study of how individuals construct meaning and understand their actions and surroundings. She contended "life does not come to us like a math problem, but more like a story. There is a setting or context, there are characters or respondents, and there is conflict or a problem to address" (Dooley, 2007, pp. 33-34). Herrera (2010) suggested that qualitative research is well suited for understanding experiences and the meaning that individuals create from those experiences.

Researcher Subjectivity Statement

Subjectivity is not "composed of lenses that you can put on or take off, but rather that each of us live at the complex and shifting intersections of identity" (Glesne, 2011, p. 154). Creswell (1994) stated that researchers "report faithfully these realities and to rely on voices and interpretations of informants" (p. 6). The two authors that conducted this research have extensive knowledge and experience in facilitating agricultural leadership programs.

Epistemology and Theoretical Perspective

Constructionism was used as the epistemology for this study. Constructionism is defined as "the view that all knowledge, and therefore all meaningful reality as such, is contingent upon human practices, being constructed in an out of interaction between human beings and their world, and developed and transmitted within an essentially social context" (Crotty, 2003, p. 42). Meaning in this context is not discovered but rather created and constructed through interaction between the object and the subject engaged within that setting (Crotty, 2003; Denzin & Lincoln, 2000). Constructionism allows the researcher to understand and explain, however, constructionism is separate from subjectivism because meanings emerge from the interaction and how the subject relates to something and not just the meaning they impose on it (Crotty, 2003).

Constructivism was employed as the theoretical perspective for the study. Constructivism aligns itself with social constructionism in that it "means that we do not find or discover knowledge so much as we construct or make it" (Denzin & Lincoln, 2000, p. 158). Researchers employing constructivism are "oriented to the production of reconstructed understandings of the social world" (p. 158). Within this epistemology and theoretical perspective, "the only reality is that constructed by the individuals involved in the research situation. Thus multiple realities exist in any given situation" (Creswell, 1994, p. 4).

Design of the Study

Concept mapping was as a tool of reflection within a class of an agricultural leadership program, the Wedgworth Leadership Institute for Agriculture and Natural Resources (WLIANR), in the state of Florida ($N = 30$). Participants were professionals within the food, agriculture and natural resource industries of the state. A concept mapping assessment was implemented within the inaugural seminar, at the midpoint of the two year program, and in the final seminar. In the inaugural seminar, participants were asked to submit concept maps for analysis after facilitators had described the program objectives and research guiding the theoretical framework of the program. The concept maps would answer the question "What is Leadership?" Concept mapping was explained and images of concept maps were provided through a short presentation, but the types of maps (spoke, chain and net) were not explained. The participants were instructed that "leadership" should be the word in the seed node. Participants were given 20 minutes to prepare their individual maps.

For the second round of data collection, participants were asked to submit a concept map to the program at the midpoint of the program. Instructions were provided before a travel seminar and participants were allowed to email concept maps to the program coordinator or they could submit their concept maps at the beginning of the travel seminar. The concept maps would once again answer the question "What is Leadership?" A handout was provided in a packet of information that was mailed to them before the seminar. The term "leadership" was once again the seed node. Unlike the first seminar, participants were not given a set time to work on these concept maps since they would be on their own before the seminar. However, participants were asked to please complete the assignment in one sitting and were asked not to revise their work or submit multiple drafts.

For the third round of data collection, participants were constructed their concept maps during their final seminar, in a similar setting as the first seminar. Once again, they were asked to answer the question "What is Leadership?" A handout describing what a concept map was and providing instructions for the practice was provided to them during the session. The term "leadership" was again the seed node. Similar to the first round, participants were given 20 minutes to complete the exercise.

The three sets of concept maps were analyzed for type as outlined by Kinchin, Hay and Adams (2000). In addition to type, a content analysis was conducted on the maps to draw out themes of leadership offered by the class as a whole. Glaser's constant comparative method (Glaser, 1965) was used in the analysis. The research sought to find information on the use of concept maps and changes in both concept map type (which indicated through process) and changes in themes of leadership as a result of participation in the WLIANR program.

Findings

For the first round of concept maps, data were collected during the first seminar of the leadership program. Results from the first round of concept maps included all three structures; spoke, chain and net with spoke being the structure the majority of the participants utilized. Multiple maps utilized two different methods of construction. For example, some maps began as a spoke with the seed and secondary nodes. From the secondary nodes, chains were formed to display terminology related to the secondary nodes. Other maps utilized both the spoke and net structures. The secondary concepts were only related to the seed nodes and not each other, but then lines were drawn between the following concepts that supported the secondary nodes.

Using the constant comparative method (Glaser, 1965), four main themes emerged from the first round of concept maps: *teamwork, goal setting and vision, inspiring and motivating,* and *communication and listening. Teamwork* was displayed as teamwork and working with others. *Goal setting and vision* was displayed as the quality of visionary leader, having goals and guidelines, forward thinking, knowledge building, and organizing. The *inspiring and motivating* construct was displayed through the concepts of inspirational, motivates others, gives guidance, and humble. *Communication and listening* were displayed in concepts such as good listener, effective communicator, and understanding.

For the second round of concept maps, data were collected at the mid-point of the program. Results from the second round displayed that more concepts were used within the maps. Larger maps were submitted which could be results from time devoted to the project, a deeper understanding of concept maps and also a richer and deeper pool of concepts and terms related to leadership as a result of the program. In terms of concept map structure, a majority of the participants chose the spoke structure of concept maps. However, in the second round, more individuals moved from chain structures to spoke structures and there were more participants that used the net structure to define leadership. Some maps submitted provided examples of leaders (as in specific people), types of leaders such as adaptors and innovators, how leadership is either born or made, described the presence and absence of leadership and perceptions of leadership. For the most part, individuals outlined the attributes of leadership. There were also structures related to what leadership takes into consideration such as context and followers.

The second round of concept maps also indicated richer themes of leadership which were also assessed using the Constant Comparative Method (Glaser, 1965). Results from the constant comparative method indicated a greater number of themes from the concepts in the maps. Seven themes emerged from the second set of concept maps: *teamwork; goals, vision, and commitment; personality and qualities of leaders; leaders are resourceful and proactive; critical thinking; organization and responsibility;* and *leaders have integrity and values*. *Teamwork* was displayed within concepts such as common purpose, team oriented, empowering, and good communicator. *Goals vision and commitment* was displayed in terms such as strategic, long term outlook, and community involvement. *Personality and qualities of leadership* was displayed in the concepts of passion, leadership based on personality type, motivating, dynamic, and memorable. The theme of *resourceful and proactive* was displayed through terms like decisive, tenacious, trail blazing, risk taking, and problem solving. *Critical thinking* included concepts such as teachable, experienced, informed, and reflective. *Organization and responsibility* was displayed through terms describing leaders such as planned, detailed, responsible, and disciplined. Lastly *leaders have integrity and values* which was seen in concepts as honesty, respectful, developing trust, humble, and credible.

For the third round of concept maps, data were collected during the final seminar of the program. Results displayed greater variability in the terms used, over double the amount of terms used in either round one or round two. However, the sizes of maps collected in the third round were smaller, with fewer terms and connections reported. This could be a result of the amount of time spent on the construction of the map. As in the first and second rounds, concept map structures varied to include chain, spoke and net structures, with the majority of the participants utilizing the spoke method of concept map construction. Maps focused on a variety of terms but unlike the second round, did not mention specific individuals. Similar to the second round of maps, participants utilized terms from previous seminars, especially those from the previous year. Terms included opinion leaders, consensus building, and “its not personal, just personality.” There was also a greater influence of context involved in the definitions, especially the roles of leadership in the family and in the organization. Unlike the other two rounds, one outlier existed who mentioned the qualities of poor leadership as a part of their map in an effort to supplement the definition of good leadership. This is explained analyzed further using Glaser’s Constant Comparative Method since it influenced the categories of leadership.

The third round of concept maps also indicated richer themes of leadership which were also assessed using the Constant Comparative Method (Glaser, 1965). Results from the constant comparative method indicated a greater number of themes from the concepts in the maps. Ten themes emerged from the third set of concept maps: *focus on the followers and team*, *goals and vision of success*, *leaders operate in different contexts*, *leaders are communicators, leaders are knowledgeable*, *traits and personality*, *leaders are decisive and solve problems*, *organization and discipline*, *leaders have character and integrity*, and *poor qualities of leadership*. *Focus on the followers and team* was displayed within concepts such as collaboration, collective personality, developing people, service above self, and motivating followers. *Goals and vision of success* was based on terms such as vision, innovation, passion, risk taking, big picture, and self-confidence. *Leaders operate in different contexts* was a category that provided different environments in which leaders serve that included community, state, national, family, business, and the WLIANR program. The category, *leaders are communicators* encompassed the largest amount of terms. It included types of communication, dissemination, framing messages, listening, and understanding. The category *leaders are knowledgeable* consisted of terms such as competency, fact-finding, experience, and institutional knowledge. *Traits and personality* was displayed in concepts such as “it’s not personal, its personality”, leadership types, traditional, and positional leaders. The category leaders are *decisive and solve problems* consisted of terms such as good decision making and problem solving skills. *Organization and discipline* included terms such as responsibility, planning, timely, and self-control. Leaders have *character and integrity* focused on morals, doing things right, honesty, trustworthy, and value driven. Finally, the last category *poor qualities of leadership*, as explained earlier encompassed negative attributes of poor leadership. This included bad example, unwillingness to listen, lack of effort and reactionary.

Through the three different stages, definitions of leadership were expanded and showed greater depth and detail. Some categories changed, while others were combined, with some category topics being eliminated altogether because the area was not addressed again. For example, in the second round of maps as opposed the first round, *teamwork* and *communication* were combined into one theme. However, in the third round they were separated again due to the different terms encompassed by each concept. Additionally categories such as qualities of leadership (round two); goals, vision, and commitment; and traits and personality (round three) referred to concepts taught in the leadership program curriculum. These terms included opinion leaders, adaptors and innovators, problem solving, conflict resolution, building consensus, reflection, and the importance of personality.

Conclusions

Analysis of the three rounds of concept maps indicated change and expansion in the definition and conceptualization of leadership. The variety of concepts used in the maps indicated that leadership is thought of not only as a definition, but also something that can be observed in its presence and absence. Participants also specified where they themselves are leaders which indicated the importance of context in leadership (Densten & Gray, 2001) and in the construction of concept maps (Kinchin, Hay and Adams, 2000 & McAleese, 1998). Changes in concept map structures from chain to spoke and spoke to net indicated a greater influence of leadership and its relationships in different situations and interactions. In the analysis of themes, it was shown that program participants will use concepts taught as part of the curriculum in the leadership programs.

Concept map analysis offered by Kinchin, Hay and Adams (2000) allowed the researcher to observe how concepts related to one another and the participant's overall definition of leadership. Observing the entire map gave indication how a participant views leadership, be it association without focus on process or interactions (spoke), sequences or processes of leadership concepts (chain), or the interactions between leadership concepts (net). Changes occurred through the three stages of mapping with most participants relying on the spoke structure which indicated that most participants are observing the association of leadership concepts. To illustrate, in the maps the primary node was leadership with the secondary node being a quality directly related to it. Secondary nodes then led to something else related to it. For example, knowledge was connected business, institutional, company, industry. Research using this method indicates that participants are using terms from the leadership program and that they relate to more general leadership concepts.

Glaser's (1965) constant comparative method also provided a beneficial analysis. Researchers were able to observe how leadership is defined at the class level and how definitions of leadership can change over time. Through finding the major themes of leadership in the maps researchers found an indication of overall effectiveness of different parts of the program.

Applying the method at three different stages of the leadership program also gave indication of changes in leadership definitions. Terms in each set of maps were evolving and were influenced by the recent programming. Researchers also noticed that some definitions overlapped or synthesized with each other in order to create a more broad leadership concept.

Terms used in the definition of leadership developed throughout the three stages of concept mapping. The concept maps from the first round utilized terms that are familiar within discourse on leadership. These included teamwork, goal setting, vision, and communication. In the second round, participants were relying on terms learned within the program curriculum such as adaptors and innovators, critical thinking, reflective, and opinion leaders. By the third round, participants were synthesizing their own terms of leadership alongside those that had been learned in the program. In terms of leadership concepts utilized, definitions become wider and more encompassing, not through the number of terms, but actual terms used. Instead of using simply teamwork, participants utilized terms such as collective personality, providing challenges achievable to the team and service above self. This indicated that teamwork was no longer just a group of individuals working together, but what they as a leader could do to bring about success for the team. Context also changed to include not only business and organizational settings, but the responsibility of being a leader in one's personal and family life. This indicates that though the program is training better leaders for the industry, outcomes of quality leadership are perceived as important and are being utilized in their personal life.

Implications

By the expansion of leadership definitions and the utilization of concept terms, it is indicated that participants will use what is learned in leadership programming and their own experience to refine their definitions of leadership. Throughout the three stages, participants used a greater variety of terms to define leadership. As reported, by the third round, concept maps were smaller in size with few concepts used. However, the third round also displayed the largest amount of concepts used overall. This implicates that leadership is defined individually with each person having constructing their own definition. Additionally, because the maps were smaller, leadership definitions appeared to be more concise and well defined. Some terms, such as critical thinking were present in the second round, but not in the third round of concept maps. This may indicate that participants are using new terms to define leadership, or that a behavior such as critical thinking, becomes a norm rather than about as an individual leadership term. This reconfirms Roberts (2006) in that by participants building on preexisting information, the knowledge base is built upon so one can create deeper conceptualizations and generalizations.

Previous research indicates that analysis of concept maps "not only allowed the instructors to see which concepts were integrated and how they were integrated, they are also a useful tool in the assessment and revision of the course in the future" (Blackwell & Williams, 2007, p. 8). As reflection is a part of experiential learning which provides the framework for agricultural leadership programs, facilitators can implement concept mapping as a reflection tool, but also be able to relate it to the objectives within agricultural leadership programs. Objectives from this leadership program related to reflection can include the analysis of complex issues facing the class member within agriculture and natural resources and the application of interpersonal skills to develop a better understanding of others (WLIANR, 2011).

The use and analysis of concept maps can benefit both the leadership program facilitator and the participant composing the map. On the program level, the practice of concept mapping and the results of this study can influence how leadership is being taught within agricultural leadership programs by giving credit to the role that experience and context has on a participant's definition of leadership. On the participant level, programs using concept maps can enhance understanding of current issues and leadership development processes. Leaders can become stronger and more knowledgeable for their respective communities and state, and the agricultural industry as a whole.

Recommendations

There are multiple opportunities for future research in the utilization of concept maps within agricultural leadership programs. A direction for future research can include alumni members completing concept maps about leadership. This practice would take into account completion of the leadership program, experience, and the duration of time into a conceptualization of leadership. Other opportunities for future research include mapping concepts other than 'leadership' such as current issues or skill development processes, examining concept maps through different methods of analysis, and studying the relationships of the structures and process of concept mapping and other leadership assessments. By allowing participants to use concept maps to analyze current issues such as agricultural or water regulation, connections can be made between concepts and increase understanding of those complex ideas. Lastly, analyzing the types of concept map structure in relation to personality types and other assessments may provide understanding of personality, problem solving preferences, or learning styles. Over the course of the leadership program, participants are given assessments measuring problem solving styles, motivation and self-regulated learning and personality profiles. A study of the relationship between these assessments and concept mapping processes may provide understanding to thought processes and influence the delivery of learning material.

The study of leadership is a "discipline that is learned only through the higher level thinking processes of application and synthesis" (Blackwell & Williams, 2007, p. 8). The purpose of this research study was to describe the outcomes of using concept mapping as a tool of reflection in an agricultural leadership program. Program administrators of leadership development programs find reward in observing the growth of their learners (Blackwell & Williams, 2007) and the practice of concept mapping provides an opportunity to evaluate that growth of participants. It also provides opportunity for reflection and continuance of the learning process for the students of leadership development. Through this reflection, leaders can gain a greater understanding of their environment and acquire knowledge and skills to make better judgments and lead effectively (Densten & Gray, 2001).

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Discussant Remarks: Rick D. Rudd

The Use of Concept Maps to Facilitate Reflection in Agricultural Leadership Programs

I would like to thank the authors for a well-written and thoughtful paper. The use of concept maps is not new but the approach used by the authors to document and describe learning through the use of concept maps is refreshing and thought provoking.

The authors presented a clear and thoughtful review of literature and established a sound conceptual / theoretical base in experiential learning and constructivism. The authors established the use of concept mapping with leadership audiences and as a tool for reflection.

The purpose and objectives are clearly stated and reasonable. The reviewer was particularly impressed with the sharp focus of the study with data collected over time. The methods were clearly described and appropriate for this study.

The researchers were able to document changes in participants over time that indicated growth and learning. Not a small accomplishment! Utilizing this method to document learning and measure program impacts has great implications for similar programs in our discipline.

QUESTIONS

1. How would you change the design of the study?
2. Were you surprised to see these results? Were you surprised to be able to clearly document learning?
3. How can we share this more broadly?

The Magnitude of Teaching All: A Hybrid Coded Qualitative Case Study

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Abstract

The purpose of this qualitative case study was to examine the dynamic of Culturally Responsive Pedagogy (Gay, 2010) among nine secondary agriculture teachers in ethnically diverse schools. By reviewing the diversity of student enrollment in the agriculture programs, the participants were separated by two groups. A hybrid coding system of axial and magnitude allowed the researchers to quantify the comments of each teacher. Results showed a difference in magnitude codes between comments provided by teachers with a diverse student enrollment and teachers with a non-diverse student enrollment. A large difference existed among four of the six characteristics of Culturally Relevant Pedagogy and a medium difference existed in the latter two. Recommendations toward the continued use of SAE visits, the implementation of curriculum modifications and diverse community engagement were directed toward the participants and practicing secondary teachers. Additional research and opportunities for culturally relevant pedagogy among teacher training institutions are also recommended.

Introduction

In the midst of educational reform, the need for secondary teachers who are culturally relevant could be considered greater today, than ever before. Since the turn of the century, US schools are experiencing a decline in student retention (Swanson, 2010) and an increase in substance abuse (National Institute on Drug Abuse, 2012), and disciplinary problems (Robers, Zhang, & Truman, 2010). Banks and Banks (2001) and Spring (2007) posit that as these trends continue to grow, so is the need for teachers who showcase a culturally relevant philosophy.

The need for teachers who can successfully educate students from cultures different than their own is documented throughout educational research. Ladson-Billings (2000) explained how many teacher preparation programs seek to prepare teachers for urban education, but not methods for teaching African American youth. As Latino families continue to extend their careers and homes throughout rural America, concerns grow as schools lack the ability to understand and educate such youth (Wortham & Contreras, 2002). Among all high school youth in the state of Florida, it was discovered that Black and Hispanic youth felt more disconnected with their teacher and the curricula than their Asian and White colleagues (Griffin, 2002).

Research in education attributed to the presence of culturally competent teachers has resulted in an increase of school districts seeking such skilled teachers. In two parallel studies conducted by Doherty, Hilberg, Pinal, and Tharp (2003), student achievement on standardized assessments improved when teachers modified their lessons in order to connect to students' lives. In 1995, Sheets found that students considered remedial learners in a secondary school, received passing grades of 4 or 5 in their AP courses after teachers implemented and practiced culturally relevant instruction. Schools, identified as having multiple professional development trainings that prepared their teachers for diverse cultures showed higher academic achievement and higher academic standards than most schools in the state (Bazron, Osher, & Fleischman, 2005).

Teacher educators would generally agree that effective classroom instruction includes proficiency in content knowledge as well as distinguished skills in pedagogy. Within agricultural education, the evaluation of teaching practices extends in various areas of the teaching discipline. One of the first to study teacher effectiveness, Miller, Kahler, and Rheault (1989), provided a foundation for teaching and research in agricultural education. In 2011, Maxwell, Vincent, and Ball proposed a model to serve as a tool for identifying effect college teaching. In the midst of teaching effectiveness, Roberts and Dyer (2004) showcased a list of strategies in becoming an effective secondary agriculture teacher. However in each of these studies was the absence in evaluating cultural relevance as a method of teacher effectiveness. Buriak, McNurlen, and Harper (1996) proposed a scientific model for identifying the concepts of an effective learner in order to develop effective agriculture educators. Although, scientific models are helpful in generalizing student populations, it does not factor the cultural background and its effect on learning within each student.

The cultural understanding and inclusion continues to grow in popularity among teaching evaluations and state developed teaching standards. Recent education reform in the United States displays the implementation of standards that include the evaluation of and/or the preparation of, teachers who showcase an ability to educate, and relate to, students of diverse cultures (Durden, 2008).

Conceptual/Theoretical Framework

The theoretical framework is derived from Geneva Gay (1993). Gay developed the culturally responsive pedagogy paradigm with socio-cultural minority students in mind. In order for teachers to adopt this paradigm into everyday use, Gay identifies six characteristics (validating, comprehension, multidimensional, empowering, transformative, and emancipatory) that culturally responsive teaching exemplifies.

The first three characteristics (validating, comprehension, and multidimensional) address the teacher authenticating diverse cultures. The first characteristic is validating because culturally responsive teachers incorporate and promote all cultures. Teachers must acknowledge the students' cultural heritage and how the heritage affects the students as a learner. Once this realization has occurred, then the teacher can begin to build "bridges of meaningfulness between home and school experiences" (Gay, 2010, p. 31). This meaningfulness is incorporated into the classroom through instructional strategies and content to meet the needs of all students. The second characteristic of culturally responsive pedagogy is comprehension. Teachers demonstrate this characteristic by striving to develop the "whole child" by using culturally diverse resources and situations to teach the content. The students are held accountable for their learning as well as their peer's learning. The third characteristic of culturally responsive pedagogy is multidimensional. The teacher incorporates all aspect of the classroom to showcase cultures. This can be shown in student-teacher relationships to performance assessments.

The last three characteristics (empowering, transformative, and emancipatory) focus on the teacher developing the students. The fourth characteristic of Gay's paradigm is empowering. The teacher is an enabler of the students' success, however the teacher is aware of the risks involved in learning and provides opportunities for success along the way. The fifth characteristic is transformative. A transformative teacher not only respects and acknowledges other cultures, but he or she uses those cultures for meaningful resources when teaching. Transformative teaching does not negotiate academic success, but instead makes academic success an attainable goal for every student. The teacher recognizing strengths in culturally diverse students and teaches them to be proud of their cultural background rather than ashamed. The sixth and final characteristic of culturally responsive pedagogy is emancipatory. Emancipatory teaching breaks away from mainstream thinking and teaches students to apply new knowledge to problems and experiences. Teaching students this new way of thinking encourages them to find their own voice and take responsibility for their learning (Gay, 2010).

Researchers have developed earlier paradigms to address the need for culturally responsive pedagogy; (Giovanni, 1970; Barbe & Swassing, 1979; Gagne, 1985; Shade, 1989) however, none have been able to incorporate every aspect Gay (2010) has included in the culturally responsive pedagogy paradigm. As researchers learn new aspects of teaching culturally diverse students, paradigms will be revised and recreated to meet the needs of every student (Gay, 2002).

Purpose/Research Objectives

The purpose of this comparable group, qualitative case study was to identify culturally responsive pedagogy, as defined by Gay (2010), and determine if a difference exists among secondary teachers with a diverse student enrollment. The research questions were:

1. Determine the number of responses for each characteristic (comprehension, emancipatory, empowering, multidimensional, transformative, and validating) of culturally responsive pedagogy.
2. Identify responses coded to the characteristics (comprehension, emancipatory, empowering, multidimensional, transformative, and validating) of culturally responsive pedagogy.
3. Determine the perceived magnitude codes for each characteristic (comprehension, emancipatory, empowering, multidimensional, transformative, and validating) of culturally responsive pedagogy.
4. Determine the perceived magnitude codes for each characteristic (comprehension, emancipatory, empowering, multidimensional, transformative, and validating) of culturally responsive pedagogy by teacher classification (diverse and non-diverse).

Methods/Procedures

The researchers applied an intensity sampling design for this comparable group qualitative case study. Intensity sampling involves selecting participants who exhibit different levels of the phenomenon of interest to the researcher (Ary, Jacobs, Razavieh, & Sorensen, 2006). When the case study allows research to associate two various levels within the phenomenon then comparable group research is necessary in qualitative design (Ryan & Bernard, 2000). In this study, the participants selected represent various levels of ethnic diverse enrollment in their secondary agriculture program.

Participant Selection

Nine participants were selected for this study due to two distinct factors: 1) proximity to researcher; and 2) met the developed qualifications. Qualifications of the participants included: secondary agriculture teacher; 4+ years of teaching experience at current school; white male teacher; school is located in a designated rural area, as assigned by the USDA; and a 30% ethnic minority school enrollment. The participants were then divided into two categories: diverse and non-diverse. Qualifications for diverse participants included: the agriculture program had over 30% ethnic minority enrollment. Non-diverse participants taught in an agriculture program with under a 30% ethnic minority enrollment. The 30% threshold is considered a critical mass representation of diversity according to (Kanter, 1977).

Procedures

Gay's (2010) theory of culturally relevant pedagogy guided the research process. An interview protocol was developed that sought to determine the presence of culturally relevant pedagogy, more specifically, the six characteristics. After receiving approval from an Institutional Review Board, ten selected participants were contacted for a face-to-face interview. In order to establish trust and to receive honest responses, the moderating researcher traveled to each participant's school or home to conduct the interview (Denzin & Lincoln, 2005). Each participant participated in two separate interviews. The first interview lasted two to three hours during the participants' academic planning time or after school. The second interview was for clarification in responses as well as additional questions that emerged from the transcription; total time for the second interview was less than one hour. One participant, following their interviews, asked that their responses not be used for publication purposes, therefore, this case study consisted of the nine participants.

Data Analysis

The data was attained from personal interviews. The researchers used triangulation though multiple data points (observation of field notes, reflections of the researchers, and interview transcriptions). Both researchers analyzed the data separately to establish inter-rater reliability. A hybrid coding system was utilized, as defined by Saldana (2009), which included axial coding followed by magnitude coding. The participants' responses were separated by the six characteristics established by Gay (2010) and then magnitude coded. The interview protocol was guided by the six characteristics of culturally relevant pedagogy to ensure equal representation when separating the participants by diverse student enrollment. The confidentiality of the participants was protected throughout the entire process by coding the participants through numbers. Following a magnitude coding technique, codes were identified through the use of central tendency values.

Trustworthiness

Each interview was recorded and then transcribed. The researchers conducted content verification by calling the participants to verify the transcriptions. This assisted the researchers in establishing data confirmability (Denzin & Lincoln, 2005). The data was coded separately in order to raise inter-rater reliability. An outside source was utilized for cross-checking the codes determined by the researchers. In addition, the participants were sent the findings and conclusions for confirmation. The researchers established data credibility through peer debriefing and reference materials. Peer debriefing occurred throughout the entire process by an outside source. The interviews, transcriptions, coding, and the researcher's reflections were maintained for the confirmability and dependability of the results and the feasibility to guide future studies.

Bracketing

In order to establish data confirmability and objectivity, the researchers identified potential biases through several different methods. The researchers utilized reflective journals and peer debriefing to note any personal biases. During the interviews, the moderating researcher also kept a reflective journal during the process to identify any potential biases, while the other researcher maintained a reflective journal during and following each transcription.

Coding

The hybrid coding process served a significant role in addressing each research objective. Saldana (2009) posits that a hybrid coding process assists in the unique needs and disciplinary concerns of a study. In this study, an axial coding process served as the first step in the hybrid coding process. Gay's (2010) six characteristics of culturally relevant pedagogy served as the guide for the axial coding. Once both researchers concluded axial coding, the coded responses were separated by one of the six characteristics of culturally relevant pedagogy and then evaluated by a magnitude coding technique. Miles and Huberman (1994) believed magnitude coding is appropriate for qualitative studies in social science disciplines that support quantitative measures as evidence of outcomes. The magnitude-coding instrument followed the steps provided by Saldana (2009). The magnitude-coding instrument was developed, which consist of each axial coded response placed into the six characteristics of culturally relevant pedagogy. In addition, the instrument included a polar scale with the following anchors: -3 = strongly negative response; -2 = slightly negative response; 1 = negative response; 0 = Neutral; +1 = positive response; +2 slightly positive response; and +3 = Strongly Positive Response. A panel of experts, with experience in instrument design, reviewed the magnitude-coding instrument for face validity. The magnitude-coding instrument was completed by a panel of professionals (n = 12) experienced in multicultural pedagogy and education. Each panel member were provided a definition of each characteristic and then charged with a task of rating the intensity of the coded response as a negative or positive comment. The panel members had no contact with, awareness of, and identity of the responses they were coding and the panel members represented diverse ethnic backgrounds, social categories, and geographical regions. The magnitude coding allowed the researchers to quantify the data by evaluating the intensity score of each code, from each character, of each reviewer. Once received, each intensity score was summated by characteristic and reported in areas of central tendencies. Cohen's d was utilized to explain the difference of intensity scores by teacher classification (diverse and non-diverse).

Results/Findings

The purpose of research objective one was to determine the number of coded responses for each characteristic (comprehension, emancipatory, empowering, multidimensional, transformative, and validating) of culturally responsive pedagogy. The majority of the responses were classified as comprehension (*f* = 69; 25.94%) followed by transformative (*f* = 68; 25.56%), empowering (*f* = 54; 20.30%), validating (*f* = 45; 16.92%), emancipatory (*f* = 20; 7.51%), and multidimensional (*f* = 10; 3.76%). Table 1 provides the number of responses for each characteristic of culturally responsive pedagogy details included in the study.

Table 1
Separation of Axial Coded Responses by Characteristics of Culturally Responsive Pedagogy (*N* = 266)

Characteristic	*f*	%
Comprehension	69	25.94
Emancipatory	20	7.51
Empowering	54	20.30
Multidimensional	10	3.76
Transformative	68	25.56
Validating	45	16.92
Total	266	100.00

Objective two sought to identify responses coded to the characteristics (comprehension, emancipatory, empowering, multidimensional, transformative, and validating) of culturally responsive pedagogy. Each culturally responsive characteristic has a purpose in multicultural education. The purpose of validating is to incorporate and promote diversity, whereas comprehension focuses on developing the "whole child". The multidimensional characteristic encompasses all aspects of the classroom from student-teacher relationships to learning context. The meaning of the empowering characteristic is even though the teacher is aware of the barriers of learning he or she still challenges the students to be successful. Responses from a transformative teacher are recognized as not only respectful towards the students' culture, but also by incorporating the diverse cultures in the classroom. Lastly, emancipatory teachers help the students overcome societal prejudices (Gay, 2010). To showcase the variation of responses, Table 2 provides comments made by participants for each characteristic. The comments are then divided by the identity of the participants: diverse teachers and non-diverse teachers.

Table 2
Descriptive Responses of the Characteristics of Culturally Responsive Pedagogy by Diverse and Non-Diverse Teachers

Characteristic	Quotations from Teachers
Comprehension	
Diverse	"All kids can learn. They don't all know that they can learn. And all kids can be successful."
Non-Diverse	"First thing you learn is patience. They are not going to learn at the same speed as white kids."
Emancipatory	
Diverse	"There comes a time and place to question just about any and everything, but let's be smart when we choose the time to do those things."
Non-Diverse	"We have a few [Black farmers] that don't run

	their own farms, but they are in a management type situation working for other people and they [Black students] can see those out there.”
Empowering	
Diverse	“Trying to put it back onto them [Black students] so they realize that the decisions they make are going to affect their life.”
Non-Diverse	“You have other kids that you’re wasting your breath talking to college and I have never seen the likes of it, but still I will try.”
Multidimensional	
Diverse	“Probably, to me, the best technique is to have a personal relationship with them [minority students] so they feel I notice when they’re involved and I also notice when they’re not involved.”
Non-Diverse	“If I have to, I have forked over money myself and here, you better not ever expect to get it paid back.”
Transformative	
Diverse	“My kids and their parents see me involved in my community so they see the value of what’s going on. Becoming part of the community and by getting involved they step out of their comfort zone.”
Non-Diverse	“Most of your White kids are probably going to go off to college or get a job or something like that. A lot of your Black kids a bigger percentage of them go home, hang out in the hood, draw welfare, sell drugs, whatever because I don’t think anybody ever expects anything different out of them.”
Validating	
Diverse	“Get them [Black students] involved and get their parents involved and become part of the community.”
Non-Diverse	“When we have a teacher work day they’ll [Black parents] schedule conference. The parents that we need to talk to never show. They don’t show up, they don’t care about their kid’s education.”

Table 2 only highlights the 266 comments that were coded using the characteristics of Culturally Relevant Pedagogy (Gay, 2010). Each comment, by characteristic, provided in Table 2 reveal polar sides. For instance, in the multidimensional characteristic, the reader does identify an extension of student/teacher relationship, however the tone of the relationship can be interpreted differently. Therefore, a quantitative method was needed to evaluate how different the comments could be interpreted, hence objectives three and four.

The purpose of research objective three was to determine the perceived magnitude codes for each characteristic (comprehension, emancipatory, empowering, multidimensional, transformative, and validating) of culturally responsive pedagogy. In order to do so, each coded response (n = 266) was placed on a magnitude scale/code, which was then rated by a selected panel of professionals (see Table 3). The characteristic receiving the highest summated mean rating was multidimensional (M = 1.20; SD = 2.57) followed by validating (M = 0.46; SD = 2.52), comprehension (M = 0.78; SD = 1.36), transformative (M = -0.40; SD = 1.65), empowering (M = -0.44; SD = 2.32), and emancipatory (M = -0.70; SD = 2.92).

Table 3
Perceived Magnitude Codes for Culturally Responsive Pedagogy Characteristic Responses

Characteristic	M^a	SD	Range
Comprehension	0.78	1.36	-2.00 – 3.00
Emancipatory	-0.70	2.92	-3.00 – 3.00
Empowering	-0.44	2.32	-3.00 – 3.00
Multidimensional	1.20	2.57	-3.00 – 3.00
Transformative	-0.40	1.65	-3.00 – 3.00
Validating	0.46	2.52	-3.00 – 3.00

[a]Based upon magnitude codes: -3 = strongly negative response; -2 = slightly negative response; 1 = negative response; 0 = Neutral; +1 = positive response; +2 slightly positive response; and +3 = Strongly Positive Response

Research objective four sought to determine the difference in perceived magnitude codes for each characteristic (comprehension, emancipatory, empowering, multidimensional, transformative, and validating) of culturally responsive pedagogy by teacher classification (diverse and non-diverse). Cohen's d was utilized as the method for identifying the effect size difference in means among the two teacher groups. A medium difference was found within the magnitude codes between the diverse and non-diverse teachers in the areas of comprehension (d = 0.31) and emancipatory (d = 0.34). A large effect size was discovered in the magnitude codes of each teacher group in the characteristic areas of validating (d = 1.69), multidimensional (d = 2.10), empowering (d = 0.75), and transformative (d = 0.57). In the characteristic area of validating, the diverse teachers yielded a mean score of 1.92 (SD = 1.96) and the non-diverse teachers reported a mean score of -1.35 (SD = 1.90). The comprehension characteristic revealed a mean score of 1.04 (SD = 1.15) for the diverse teachers and a mean score of 0.63 (SD = 1.46) for the non-diverse teachers. The characteristic area of multidimensional reported a mean score of 2.43 (SD = 1.51) for the diverse teachers and a mean score of -1.67 (SD = 2.31) for the non-diverse teachers. For the characteristic of empowering, diverse teachers had a mean score of 0.18 (SD = 2.31), while non-diverse teachers had a mean score of -1.43 (SD = 1.99). In the characteristic area of transformative, the diverse teachers received a mean score of 0.03 (SD = 1.72) and the non-diverse teachers received a mean score of -0.88 (SD = 1.48). In the area of emancipatory, the diverse teachers reported a mean score of -0.50 (SD = 2.97) and the non-diverse teachers generated a mean score of -1.50 (SD = 3.00).

Table 4

Perceived Magnitude Codes for Culturally Responsive Pedagogy Characteristic Responses by Diverse and Non-Diverse Teachers

Characteristic	*M*	*SD*	Range	Cohen's *d*
Comprehension				Medium
Diverse	1.04	1.15	-2.00 – 3.00	0.31
Non-Diverse	0.63	1.46	-2.00 – 3.00	
Emancipatory				Medium
Diverse	-0.50	2.97	-3.00 – 3.00	0.34
Non-Diverse	-1.50	3.00	-3.00 – 3.00	
Empowering				Large
Diverse	0.18	2.31	-3.00 – 3.00	0.75
Non-Diverse	-1.43	1.99	-3.00 – 3.00	
Multidimensional				Large
Diverse	2.43	1.51	-1.00 – 3.00	2.10
Non-Diverse	-1.67	2.31	1.00 – -3.00	
Transformative				Large
Diverse	0.03	1.72	-3.00 – 3.00	0.57
Non-Diverse	-0.88	1.48	-3.00 – 2.00	
Validating				Large
Diverse	1.92	1.96	-3.00 – 3.00	1.69
Non-Diverse	-1.35	1.90	-3.00 – 3.00	

[a]Based upon magnitude codes: -3 = strongly negative response; -2 = slightly negative response; 1 = negative response; 0 = Neutral; +1 = positive response; +2 slightly positive response; and +3 = Strongly Positive Response

Conclusions/Implications/Recommendations

The purpose of this study is exploratory in nature. To explore the dynamic of Culturally Relevant Pedagogy (CRP) within the discussion of nine secondary agriculture teachers, all teaching in a school where at least 30% of the student's ethnicity were considered a minority. Although teaching in a school where ethnic diversity was present, only half the teachers had a agriculture student enrollment that matched that of the school, however, the researchers identified the presence of Culturally Relevant Pedagogy from each participating teacher. Potential for teachers to discuss CRP is present, but the approach, the method of explaining, and viewpoint is slightly different between the two identified teachers. Gay (2010) believed that all teachers have the opportunity to gain CRP, but identification of own biases must first be addressed. It is recommended that further investigation of the teachers exist and each receive the opportunity to showcase their own bias.

A panel, expert in CRP, instructors of agricultural education, and teachers of multicultural education, closely examined all 266 comments. Without knowing the identity and personal background of each teacher, were able to read the coded comments, by characteristic, and assign a magnitude code, within a range of -3 to +3. As a result, the teachers identified as diverse received a higher mean magnitude code than the non-diverse teachers in each characteristic. This does not reveal that diverse teachers are identified as experts or that they are better proponents of CRP. But it does reveal that the language used to discuss the method of teaching students from diverse backgrounds is different. Frymier and Houser (2000) explained that the tone of conversation and use of vocabulary are important when teaching youth who are culturally different than the instructor. This posits that the comments provided by the diverse teachers could correlate with the ethnically diverse enrollment in their agriculture classes, as opposed to their non-diverse teaching colleagues. A quality communicator coincides with Roberts and Dyer's (2004) characteristics of an effective agriculture educator. In order to help non-diverse teachers understand how reflection, communication, and bias can play a role in the diversity of their student enrollment, it is recommended that each review their identified comments and seek understanding how their discussed philosophy could relate to the shallow enrollment of ethnic diversity. On a larger scale, teacher educators are encouraged to review and address pre-service teachers' bias and understand the impact on enrollment, prior to entering a classroom. By doing so, pre-service teachers can address bias prior to teaching and extend their ability to instruct a variety of learners.

The researchers found the characteristics of validating, multidimensional, empowering, and transformative to have a large effect size. Gay (2010) believed that when a teacher embraces the validating characteristic they have the ability to acknowledge a student's cultural heritage, thus shortening a gap between home and school for the student. Throughout the interview, diverse teachers showcased a better understanding of the validating characteristic. Many of which believed that home visits and community immersed activities helped with shortening the gap between home and school. This implies that Supervised Agricultural Experience (SAE) visits; a function of the effective agriculture teacher (Roberts and Dyer, 2004) serves multiple roles. It is encouraged that teachers who teach students of ethnically diverse backgrounds, use SAE visits and community activities to improve their CRP, more specifically, the validating characteristic.

Multidimensional teachers incorporate cultures in every aspect of their classroom (Gay, 2002). This incorporation of cultures in the classroom extends beyond the scope of famous individuals and holidays (Villegas & Lucas, 2002). In addition, Gay (2010) explained that teachers seek and/or extend a personal relationship with their students in order to gain the multidimensional characteristic. From the results of this study, the diverse teachers' comments revealed a large difference in magnitude coding than the non-diverse teaching participants. The results do not explain that diverse teachers have a better relationship with their students, but it does posit that they may extend more trust to a variety of their students. Riehl (2000) revealed that principals who demonstrated trust toward students who were culturally different than themselves were in schools with more school spirit, high academic performances, and a higher perceived school spirit than administrators lacking trust. The researchers realized that a recommendation to teachers to gain trust in students can be arbitrary, therefore, it is encouraged that students understand how to design CRP lessons that encompass the multidimensional characteristic.

A teacher who exemplifies the empowering characteristic encourages and helps students succeed while realizing the risks that are involved (Gay, 2010). Agriculture teachers already serve as an encourager to their students as it is showcased in the youth organization. Culturally diverse students have to overcome adversity that students from a dominant culture are not aware of. Teachers who help students overcome adversity due to cultural heritage should be recognized.

Gay (2010) described transformative teaching as including cultures as resources. By using existing cultures as a teaching tool, the teacher is increasing the opportunity for every student to succeed in their classroom. Therefore, it is recommended educators capitalize on cultural stakeholders in the community by inviting as guest speakers and recognizing them for their contributions. Teachers should teach and implement civic responsibilities into the curriculum to further close a gap of understanding between student to student and teacher to student. Furthermore, transformative teachers help their students transform as productive citizens, following graduation. Although the findings in this study does not highlight successful transition of ethnically diverse students, it does exemplify that diverse teachers provide a stronger philosophy than non-diverse teachers in their willingness to aid ethnically diverse students in their transformation. It is recommended that research examine the transition of students enrolled in each of the participants' classes.

Need for Additional Research

The researchers recognize this study is limited to the secondary agriculture teachers who participated in the interviews. Future studies are vital to continue to gain an understanding toward the adoption of culturally responsive pedagogy as a key methodology for agricultural education. Therefore, the researchers recommend future investigations toward CRP as a tool of effective teaching, CRP's role in student achievement, best practices of CRP in agricultural education, and methods of teaching CRP among teacher preparatory programs. In addition, it is recommended that a longitudinal comparative study begin that examines the results of student performances between teachers who received training in CRP and teachers who did not. Furthermore, previous research on effective teaching, such as Roberts and Dyer (2004) should be reexamined and modified to include methods of including CRP within its recommendations.

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Discussant Remarks: Rick Rudd

The Magnitude of Teaching All: A Hybrid Coded Qualitative Case Study

I would like to thank the authors for examining a critical area of concern for agricultural education; increasing the diversity not only in our classroom but in our industry. This qualitative study sought to examine differences in teachers who taught in more and less diverse agriculture education programs.

The researchers clearly presented the need for diversity in agriculture and skillfully identified the problem related to cultural understanding and inclusion. The use of the Culturally Responsive pedagogy paradigm (Gay, 1993) is appropriate and frames the study well.

The researchers interviewed nine teachers and coded responses, using a frame from derived from Gay (1993). After the interviews, the researchers quantified the responses and reported counts (magnitudes) for characteristics in culturally responsive pedagogy and compared diverse and non-diverse teachers.

Interview techniques used were appropriate and the interview process was clearly described.

This exploratory study incorporated qualitative and quantitative methodology in a way I am not familiar with. The conclusions seemed to be in line with the conceptual base or the study.

QUESTIONS

1. Please explain the methodology used to quantify the qualitative data.
2. Please explain effect size you found in the qualitative questions.
3. Why did you choose to code magnitude at +/- 3?

Evaluating Change in Undergraduate Attitudes: Capturing Impacts of Faculty Travel Abroad Experiences Shared through RLO Implementation

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Abstract

Reusable learning objects (RLOs) are self-contained, digital learning activities ranging in length from 2 to 15 minutes. These units can either be used individually or linked together to create a larger unit to be delivered in class as part of a lecture, used as a case study or laboratory object, or hosted on either an eLearning platform or independent Web page. For this project, faculty participants each created an RLO that could be used in an undergraduate course to teach students subject-matter knowledge within the Ecuadorian context and integrated them into six undergraduate courses in the College of Agricultural and Life Sciences at the University of Florida over the course between Fall 2011 and Fall 2012. This study investigated whether undergraduate attitudes' about a foreign country would be influenced by exposure to an RLO when that country was used as the context to present subject-matter knowledge. Using a one-group pretest-posttest design for each RLO implementation, the researchers sought to: (a) identify pre-existing undergraduate attitudes regarding Ecuador prior to RLO exposure; (b) identify undergraduate attitudes regarding Ecuador following RLO exposure; and (c) determine if undergraduate attitudes regarding Ecuador were significantly different before and after RLO exposure. Preliminary results of this study suggest that undergraduate attitudes about a foreign country may be influenced by exposure to an RLO when that country is used as the context to present subject-matter knowledge, in this particular case Ecuador.

Introduction/Need for the Study/Importance

The discourse of internationalization continues to resound throughout the academic world – a call for graduates of higher educational institutions to be properly skilled in competencies that will allow them to live and work in a society no longer constrained within a singular custom or culture (NAFSA, 2008; NASULGC, 2007). With an increase to engage in such opportunities, graduates should prepared to interact within this dynamic diversity, displaying awareness of and aptitude for engaging in unfamiliar cultures, major global issues, and currents of change (American Council on Education, 2012; Brustein, 2007). This message has continued to reverberate through academia, found in a recent report from the American Council on Education (2011):

> It is the obligation of colleges and universities to prepare people for a globalized world, including developing the ability to compete economically, to operate effectively in other cultures and settings, to use knowledge to improve their own lives and their communities, and to better comprehend the realities of the contemporary world so that they can better meet their responsibilities as citizens. (p. 14)

The 2011-2015 National Research Agenda for the American Association for Agricultural Education (2011) also echoed that message, specifically stating that agricultural programs:

> must be able to better understand the models, strategies, and tactics needed to best prepare, promote, and retain new professionals who demonstrate the requisite content

> knowledge, technical competence, and cultural awareness, coupled with communication and interpersonal skills. (p. 20)

Furthermore, these professionals must be prepared to understand and relate within the ever-evolving global nature of agricultural enterprise (National Academy of Science, 2009), attempting to address the complex issues now associated with its practice. These points not only reflect a dialogue among university administrators and professional societies, but are also being recognized by students themselves. In a study by the American Council of Education, over 50% of students surveyed reported believing that having knowledge of international issues would be important for their personal careers (Lumkes, Hallett, & Vallade, 2012).

In response, universities have attempted to internationalize the undergraduate curriculum, incorporating strategies such as study abroad opportunities, exchange programs, and globally-focused courses in order to provide students with the intercultural skills necessary to achieve increased undergraduate internationalization. Over the past decade, participation of U.S. undergraduates in study abroad opportunities has more than doubled, but this number represents only a small percentage of the overall American student population (Institute of International Education, 2010). Research attempting to predict undergraduate participation in study abroad activities reveals not only the importance of perceived career benefits (Relyea, Cocchiara, & Studdard, 2008), but also of pre-existing intercultural attitudes (Kim & Goldstein, 2005). One example of an intercultural attitude from current research is ethnocentrism, which has been identified as "one of the central concepts in understanding outgroup attitudes and intergroup relations" (Neuliep & McCroskey, 1997, p. 385). Since it is possible for ethnocentrism to decrease intercultural communication competence while generating misperceptions about culturally different individuals (Gudykunst & Kim, 1997; Kim & Goldstein, 2005; Wiseman, Hammer, & Nishida, 1989), opportunities that assist participants in breaking down attitudinal barriers must be provided in order to elicit the greatest value from the international experiences.

The low number of students opting to include study abroad opportunities in their coursework means the university must rely on faculty members to provide the remaining students with enhanced exposure to international content (Russo & Osborne, 2004). A panel of professionals with extensive international experience concluded that undergraduates appear to greatly benefit when exposed to information presented by professionals who had worked for long periods of time in international settings and who integrated those corresponding cultural perspectives and contexts into their course material (Bruening & Shao, 2005). Within the university, teaching faculty are often best situated to present undergraduates with this information, but in order to do so these faculty must be afforded opportunities to gain international experiences. Unfortunately, even when faculty do have international experiences the question of whether such experiences are able to impact undergraduate intercultural attitudes remains unanswered.

One effort to increase the international experience of teaching faculty, and thus impact undergraduate intercultural attitudes, is present in the Teaching Locally, Engaging Globally (TLEG) project. Funded through a USDA Higher Education Challenge Grant, the TLEG project provided teaching faculty from three southern U.S. land-grant universities with an opportunity to spend 10 – 12 days in Ecuador, Trinidad and Tobago, or Costa Rica observing their subject area within a different culture. This study focuses on outcomes resulting from the Ecuador trip.

Literature Review and Theoretical Framework

One of the project's objectives focused on improving undergraduate attitudes regarding the Ecuadorian culture and global aspects of the respective discipline. Eight TLEG faculty participants collected data, pictures, and videos while in Ecuador in order to create a reusable learning object (RLO) or case studies. RLOs are self-contained, digital learning activities ranging in length from 2 to 15 minutes that can either be used individually to supplement lecture materials or linked together to create a larger unit (Grunwald & Reddy, 2007; Neven & Duval, 2002). RLOs can be utilized in various ways such as delivered in class as part of a lecture, used as a case study or laboratory object, or hosted on either an eLearning platform or independent Web page (Grunwald & Reddy, 2007). For this project, faculty participants each created an RLO that could be used in an undergraduate course to teach students subject-matter knowledge within the Ecuadorian context. RLOs for the TLEG project were integrated into six undergraduate courses in the College of Agricultural and Life Sciences at the University of Florida over the course of the 2011-2012 academic year, and in Fall 2012. The manner that faculty participants chose to integrate the RLO into the classroom varied: several faculty members chose to simply present the RLO content as part of a PowerPoint presentation; another utilized an RLO on nutrition in Ecuador to present case study information to the students for testing critical thinking about previously-learned materials; still another professor used an RLO on precision agriculture concepts to provide insights for completing a lab activity.

As with other teaching tools, students who are exposed to an RLO can be given assessments in order to identify changes in content knowledge or attitude. According to Eagly and Chaiken (1993), attitudes can be seen as the predispositions of individuals to judge objects based on some predetermined evaluative scale. Often this scale tends to be bipolar: good vs. bad, favorable vs. unfavorable (Albarracín, Wang, Li, & Noguchi, 2008). An attitude object can be "a concrete target, a behavior, an abstract entity, a person, or an event" (Albarracín et al., 2008, p. 19), which, in the case of this study is the abstract entity captured by "Ecuadorian culture." Additionally, attitudes have two components: memory and judgment (Albarracín et al., 2008):

> The memory component involves representations of the attitude in permanent memory; the judgment component involves on-line evaluative thoughts generated about an object at a particular place and time. (p. 19)

Based on these components, Albarracín, Glasman, and Wallace (2004) conceptualized the role of memory and on-line information in creating evaluative judgments in their Activation and Comparison Model. According to this model, attitude change depends on three distinct processes: activation of prior attitudes through memory retrieval, activation of information related to the prior attitude, and a comparison of the prior attitude with the related information (Albarracín et al., 2008). According to this model, when faced with information, a person may determine that the information presented is a basis for the pre-existing attitude and thus deem the information as redundant, or, if the information is new, the person may attempt to integrate that information into the current beliefs. Using comparative processes, integration may result in viewing the new information as valid (thus creating a shift in attitude), or as invalid (resulting in dismissal of the information and retention of prior attitude) (Albarracín et al., 2008).

Previous research can be found that has examined the effect of RLO use on attitudes, though it has often focused on the attitudes that students hold towards the RLO as a presentation tool (e.g. Bloomfield, 2008; Chyung, Moll, Marx, Frary, & Callahan, 2010), rather than shifts in attitude toward the content being presented (e.g. Keefe & Wharrad, 2012). Furthermore, when the presented content includes a strong cultural component, there is the potential for the RLO to impact attitudes towards not only the content, but the culture as well. It is understood that students enter an RLO presentation with a set of pre-existing attitudes. However, additional research is needed to better understand how undergraduate exposure to RLOs may impact these student attitudes and beliefs, specifically towards cultural aspects of a student's content area.

Purpose and Objectives

This study investigated whether undergraduate attitudes' about a foreign country would be influenced by exposure to an RLO when that country was used as the context to present subject-matter knowledge. Research objectives for this paper were to: (a) identify pre-existing undergraduate attitudes regarding Ecuador prior to RLO exposure; (b) identify undergraduate attitudes regarding Ecuador following RLO exposure; and (c) determine if undergraduate attitudes regarding Ecuador were significantly different before and after RLO exposure.

Methods

This descriptive study utilized a one-group pretest-posttest design (Ary, Jacobs, Razavieh, & Sorensen, 2006) for each RLO implementation. This design allows researchers to determine differences attributed to the RLO exposure through a comparison of pretest and posttest scores (Ary et al., 2006). The RLOs used in this study were created by six faculty from the departments of: Agricultural and Biological Engineering; Agricultural Education and Communication; Agronomy; Family, Youth, and Community Science; Food Science and Nutrition; and Religion. Faculty were charged with implementing an RLO that they created into at least one of their classes. A census of students in each these classes was conducted. Students were enrolled in these classes in either Fall 2011, Spring 2012, or Fall 2012 (see Table 1).

Table 1
Summary of Each Course RLO Implementation

Department	Semester	Course	Course Level	Student Numbers
Agronomy	Fall 2011	Plants that Feed the World	Lower	12
Religion	Spring 2012	Religion and Environmental Crisis	Lower	22
Agricultural Education & Communication	Fall 2011	Communication Process in Ag and Life Sciences	Upper	38
Family, Youth &	Spring 2012	Methods in Family	Upper	45

Community Sciences		Life Education		
Agricultural & Biological Engineering	Spring 2012	Precision Agriculture	Upper	23
Food Science & Nutrition	Fall 2012	Nutrition and Disease	Upper	60

Activities undertaken in this study were approved by the [university] Institutional Review Board and signed informed consent was obtained from all participants. Instrument construction for data collection began Summer 2011. Using Thurstone's Method of Equal-Appearing Intervals (Trochim, 2004), undergraduate students (from six large survey courses designed to cover a variety of introductory agricultural topics within the College of Agriculture and Life Sciences) were asked to provide researchers with two statements that captured attitudes they believed undergraduate peers may have regarding Ecuador, resulting in 114 unique statements. The statements ranged in ideas from thoughtful ("People in Ecuador have trouble focusing on good education due to their extreme poverty") to uninformed ("I do not know anything about the country."). The cards on which each statement was written were then given to 15 graduate students within the same college to sort into 11 individual piles, arranged from least favorably appearing (score of 1) to most favorable (score of 11) (Trochim, 2004). Scores for each statement were then recorded, the median and inter-quartile range (IQR) identified for each response, and the 114 items sorted in ascending order by median and descending order by IQR (Trochim, 2004).

This process resulted in no statements having a median score of 1 or 11; therefore, the scale was adjusted to represent a 9-point scale (with 1 being least favorable, 9 being most favorable). One statement was then selected for each of the remaining nine median values, using the statement with the smallest IQR so as to capture the statement with the lowest variability across the judges (Trochim, 2004). The pretest instrument was then constructed from these nine statements, with the items randomly arranged according to median score and with a simple Agree/Disagree response option for each statement provided to the right of the statement. The posttest instrument created was an identical duplication of the first instrument, with the exception of two questions at the bottom of the instrument included to probe prior student exposure to the country of Ecuador during their time at the University of Florida. Data collection using the attitudinal instrument began in Fall 2011and continued through Fall 2012. Each student participant was given the opportunity to decline participation in the data collection process, though all experienced exposure to the RLO presentation. No more than nine students opted out of participating in the data collection process in any given course. Hard copies of the pretest and posttest were presented to participating students, with the pretest given before the RLO presentation and the posttest given at the end of the class period. No personal information was collected from students except for individual markers to allow for pretest/posttest matching.

Items from the pretest/posttest were scored using the method outlined by Thurstone (Trochim, 2004). Students were asked to either "Agree" or "Disagree" with the nine statements provided. Students were then given a score that represented the average of the scale values for the "Agreed" items. An average score greater than 4.5 (the mid-point on a 9-point scale) would indicate a more positive set of attitudes, while an average score less than 4.5 would indicate a more negative set of attitudes held by the student. Change in student attitude was examined by comparing the posttest/pretest difference, with a positive difference indicating an increasingly positive impact and a negative difference indicating an increasingly negative impact.

Common limitations of a one-group prettest-posttest design include: history, maturation, and testing effects (Ary et al., 2006). History, the impact of events that happen outside the intervention, and maturation, the changes in subjects over time, have little to no impact on the RLO participants since the pretest, exposure, and posttest all took place within a period of 1-2 hours of each other and all within a single class period. However, one effect that may have impacted internal validity for this study was the exposure of the participants to the pretest. This exposure may have inadvertently sensitized the participants to the information, allowing them to learn from the pretest itself, rather than from the presented RLO (Ary et al., 2006). Therefore, the significance of changes evident from student pretest-posttest differences is cautiously reported.

Descriptive analyses of pretest, posttest, and post-pretest differences were performed for all classes. In order to identify whether significant class-based differences existed, an ANOVA was performed. Post hoc analyses were run using a Scheffe post hoc comparison to identify where resulting significant differences exist between groups. The Scheffe was chosen over alternative post hoc analyses due to its conservative nature under complex conditions of unequal cell sizes (Vogt, 2005). Furthermore, a histogram was utilized to explore post-pre differences and suggested a positive trend for attitude change. To determine whether significant changes in attitude could be claimed within each class setting following RLO exposure, paired *t*-tests were performed on the pretest/posttest pairs for each class.

Findings/Results

Results from the descriptive analyses of student data are provided in Table 2.

Table 2
Summary of Means/Standard Deviations for Each Class and Across Classes

	Class 1 (*n* = 11)	Class 2 (*n* = 35)	Class 3 (*n* = 40)	Class 4 (*n* = 20)	Class 5 (*n* = 20)	Class 6 (*n* = 51)	All (*N* = 177)
Pretest							
M	5.28	5.53	5.35	5.46	5.49	5.22	5.37
SD	0.54	0.87	0.88	0.45	0.65	0.64	0.73
Posttest							
M	5.90	5.94	5.64	5.40	5.85	6.06	5.83
SD	0.46	0.88	0.75	0.42	0.77	1.00	0.84
Post-Pre Difference							
M	0.62	0.41	0.28	-0.06	0.36	0.84	0.46
SD	0.67	0.91	0.85	0.58	0.50	0.99	0.88

Using the same 9-point scale as before (1 being least favorable, 9 being most favorable), results from the basic descriptive analysis reveal that each class began with a slightly positive attitudinal outlook on Ecuador as evidenced by pretest mean scores higher than 4.5(the median for a 9-point scale). The analysis also reveals a mean increase from pretest to posttest for five of the six classes, with Class 4 being the exception (mean difference = -0.06).

Results from the ANOVA revealed no significant difference ($\alpha = .05$) between the six courses in one of the three areas: pretest score $F(5, 171) = .98$, $p = .434$. Therefore, all students in each of the exposed classes are believed to be the similar in attitude toward Ecuador prior to RLO exposure. However, results of the ANOVA revealed significant differences in both the posttest score $F(5, 171) = 2.50$, $p = .033$ and pre/post difference score $F(5, 171) = 4.132$, $p = .001$. In order to identify where the significant differences between class scores existed, a Scheffe post hoc analysis was conducted at $\alpha = .05$. A summary of *p*-values associated with group to group comparisons using the Scheffe post hoc analyses are provided in Table 3.

Table 3
Summary of p-*values from Scheffe Post Hoc Analyses for Each Class*

		Class 2	Class 3	Class 4	Class 5	Class 6
Posttest						
	Class 1	1.000	.972	.754	1.000	.996
	Class 2		.774	.359[a]	1.000	.993
	Class 3			.950	.970	.314[a]
	Class 4				.694	.101[a]
	Class 5					.966
Post-Pre Difference						
	Class 1	.990	.926	.461	.985	.987
	Class 2		.996	.560	1.000	.359[a]
	Class 3			.811	1.000	.087[a]
	Class 4				.765	.007[b]
	Class 5					.470

Note: [a] Refers to p-values that are impacting the *F*-statistic, but are not themselves statistically significant; [a] Refers to p-values that are themselves statistically significant

Results from the post hoc provide greater insight into the dynamics occurring between classes not apparent from the ANOVA analysis. First, when the Scheffe post hoc analysis is run on the posttest data, no significant difference between any two groups actually occurs. This finding suggests that the statistically significant *F*-statistic from the ANOVA is not due to a statistically significant difference between any two classes, but may instead be indicative of a more global effect that is occurring, that may also be compounded by the differences found between Class 2 and Class 4; Class 3 and Class 6; and Class 4 and Class 6 ($p < .40$). Second, when the Scheffe post hoc analysis is run on the post-pre difference scores, only one significant difference between groups actually occurs (Class 4 and Class 6; $p = .007$). However, similar to the posttest results, the *F*-statistic also may be displaying a more global effect, including an influence of differences between Class 2 and Class 6; and Class 3 and Class 6 ($p < .40$).

A histogram of post/pretest score differences was created to visually examine the data's distributional qualities (see Figure 1). The distribution of scores suggests a positive trend in attitude change between the pretest and posttest. While this distribution suggests that attitudes changed for the better following RLO exposure, it is unclear if this was true for each class.

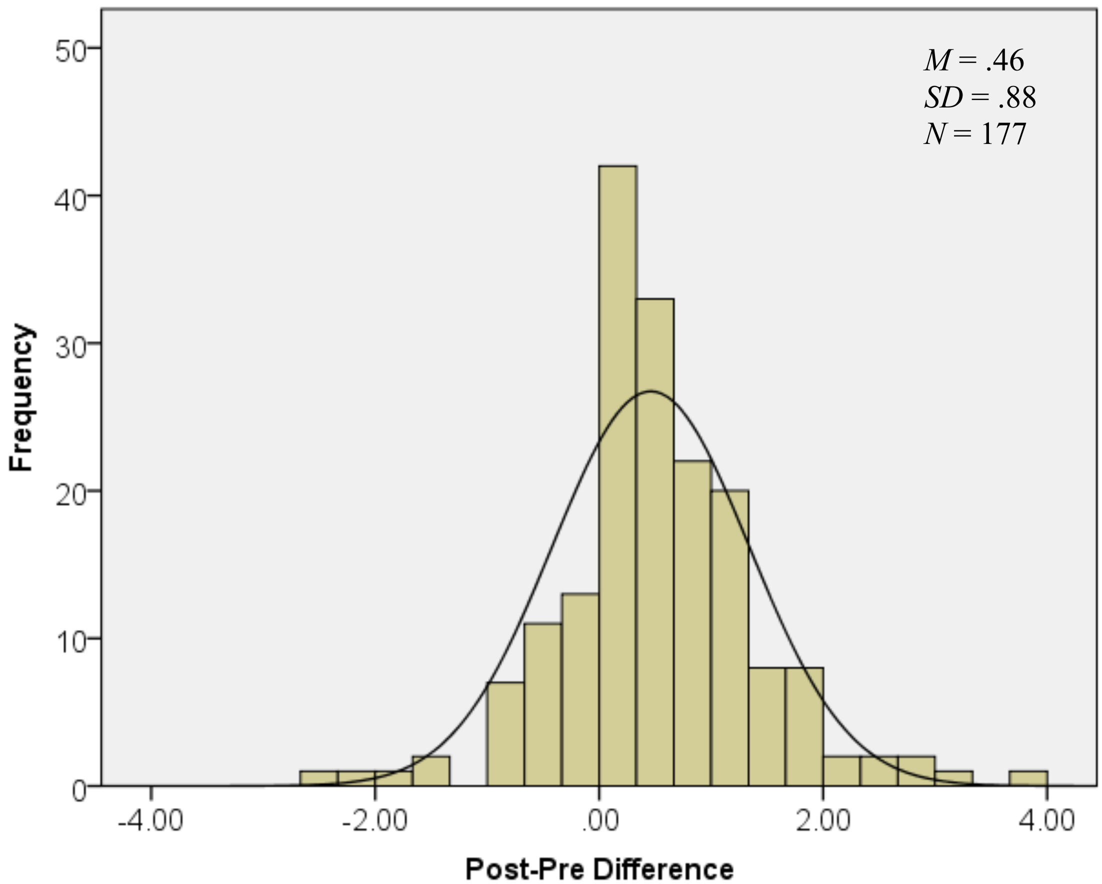

Figure 1: Histogram of post-pre difference frequencies. This histogram represents the frequency distribution of post-pre differences for student attitudes based on Thurstone Scale analysis.

In order to identify whether a statistically significant shift in attitude occurred in all classes, paired *t*-tests were performed on pretest/posttest pairs for each class. Results from this analysis revealed no significant difference at $\alpha = .05$ in the pretest and posttest for:

- Class 1: pre ($M = 5.28$, $SD = 0.54$), post ($M = 5.90$, $SD = 0.46$); $t(9) = .132$, $p = .698$
- Class 4: pre ($M = 5.46$, $SD = 0.45$), post ($M = 5.40$, $SD = 0.42$); $t(18) = .096$, $p = .687$

These results suggest that RLOs utilized in these two classes failed to create a significant change in student attitudes towards Ecuador. However, it is important to point out that Class 1 did have a mean score shift that, while not statistically significant (most likely due to the small class size), still indicates a positive change since the mean scores shifted from $M = 5.28$ (pre) to $M = 5.90$ (post). Furthermore, significant differences (at $\alpha = .05$) in pretest and posttest were found for:

- Class 2: pre ($M = 5.53$, $SD = 0.87$), post ($M = 5.94$, $SD = 0.88$); $t(33) = .456$, $p = .006$
- Class 3: pre ($M = 5.35$, $SD = 0.88$), post ($M = 5.64$, $SD = 0.75$); $t(38) = .466$, $p = .002$
- Class 5: pre ($M = 5.49$, $SD = 0.65$), post ($M = 5.85$, $SD = 0.77$); $t(18) = .764$, $p = .000$
- Class 6: pre ($M = 5.22$, $SD = 0.64$), post ($M = 6.06$, $SD = 1.00$); $t(49) = .335$, $p = .016$

These results suggest that RLOs utilized in these four classes helped to create a significant change in student attitudes towards Ecuador.

Conclusions/Recommendations/Discussion/Implications

The preliminary results of this study suggest that undergraduate attitudes about a foreign country may be influenced by exposure to an RLO when that country is used as the context to present subject-matter knowledge, in this particular case Ecuador. According to the Activation and Comparison Model (Albarracín et al., 2004), attitude change depends on three distinct processes: activation of prior attitudes, activation of information related to the prior attitude, and a comparison of the prior attitude with the presented information (Albarracín et al., 2008). According to this model, when faced with information, a person may either deem the information redundant to pre-existing knowledge, or new. If the information is new, the person will then attempt to integrate the information using comparative processes, resulting in either the new information being seen as valid (thus creating a shift in attitude), or as invalid (resulting in dismissal of the information and retention of prior attitude) (Albarracín et al., 2008).

Results from this study suggest that these students, regardless of the class they were members of, each came into the RLO presentation with pre-existing attitudes about Ecuador. The use of the pretest allowed the students to explicitly consider their attitudes prior to RLO exposure. Results of these pre-existing attitudes hint at a relatively positive attitudinal outlook on Ecuador, with each class displaying a mean pretest score greater than the median score of 4.5.

Following the RLO, the posttest appears to have successfully captured changes that occurred as a result of the comparative process. Results of these altered attitudes suggest increasingly positive attitudes about Ecuador, with five of the six classes exhibiting a positive shift in attitude. Based on the Activation and Comparison Model (Albarracín et al., 2004), this would suggest that students in these five classes found the information in the RLOs to be valid resulting in the recorded shifts. Though hindered by limitations of this study (small non-generalizable population and testing effects), the findings do allude to the possibility of using tools such as the RLO to increase undergraduate attitudes about a foreign country when used as a context for presenting subject-matter knowledge.

It appears that the Thurstone Method of Equal-Appearing Intervals (Trochim, 2004) can be used to develop an instrument that is sensitive enough to track attitudinal changes with respect to RLO use. However, further research will need to be done to examine whether multiple RLO exposure has the potential to increase this effect. More rigorous testing situations, including use of control classes to account for testing effects and random selection of classroom exposures, should be utilized for future research endeavors. These steps would help to alleviate the impact of alternative effects to be captured within the change suggested by the post-pre difference. Additionally, it would be prudent to examine the temporality or permanence that exposure has over time. Finally, it would be educational to examine whether RLOs have the power to negatively influence students' perceptions of a foreign country, and if so, what attributes of the RLO are responsible for mediating such a change.

If future agricultural and life science students are to be prepared to actively engage in the complex issues of the ever-changing global nature of agricultural enterprise (National Academy of Science, 2009), then educators must be able to identify and properly utilize models, strategies and tactics that will properly prepare them (American Association for Agricultural Education, 2011). The potential for attitudinal shifts due to vicarious exposure through RLOs is promising, especially in light of the absence of authentic exposures for many American undergraduate students. However, universities will need to provide additional investment and administrative support for the professional study abroad experiences necessary for such resource development, with RLO development integrated as a formalized expectation of the opportunity.

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Discussant Remarks: Rick Rudd

Evaluating Change in Undergraduate Attitudes: Capturing Impacts of Faculty Travel Abroad Experiences Shared through RLO Implementation

I would like to thank the researchers for their paper on reusable learning objectives and their use as a tool for impacting undergraduate student attitudes about other countries. As the United States continues to grow as a global citizen, it is imperative for undergraduates to be exposed to global thinking and learn about our world community.

The researchers worked with faculty teaching six different undergraduate courses to measure attitude change in undergraduate students through the use of RLO's over time.

The researcher clearly identified the need to internationalize domestic curriculum and review efforts to do so. The researchers also clearly identified research around RLO's and made a compelling case to use RLO's to influence attitude development and change.

The use of Thurstone's Method of Equal Appearing Intervals in collecting written responses and data analysis were appropriate for this study. The researchers are to be commended in the use of this methodology and I would recommend others use this paper as a model to follow.

QUESTIONS

1. How did you work with the faculty from multiple disciplines to develop the RLO's and to bring them into this study?
2. What challenges did you face in your initial review of the written responses?

How will you improve the process next time?

Agricultural Students' Attitudes and Opinions:
Can Reusable Learning Objects Alter Students' Perceptions of an International Setting?

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Abstract

Understanding students' attitudes, opinions, and perceptions is a critical component of the educational process. This understanding becomes even more critical when one considers the need to encourage global awareness as instructors strive to identify ways to positively impact student perceptions related to international settings. The purpose of this study was to measure the impact of reusable learning objects (RLOs) that were created related to the culture of Trinidad and Tobago on undergraduate agricultural students' attitudes about the country. There were three phases to the study: creation of the Thurston scale, administration of the pre-assessment, and administration of the post-assessment. The population of the study consisted of four classes containing a total of 103 students in a College of Agriculture. Findings revealed that viewing the RLOs had an impact on students' attitudes toward the culture of Trinidad and Tobago. Implications exist for the creation and delivery of vicarious learning tools and for the globalization of students.

Introduction

Understanding students' attitudes, opinions, and perceptions is a critical component of the educational process. This understanding becomes even more critical when one considers the need to encourage global awareness as instructors strive to identify ways to positively impact student perceptions related to international settings.

Attitudes can be defined as "a learned predisposition to respond in a consistently favorable or unfavorable manner with respect to a given object" (Fishbein & Ajzen, 1975, p. 6). In accordance with this definition, attitudes can directly impact a student's willingness to learn and be open to new information. One goal of undergraduate education is to create "thoughtful professionals and better informed citizens" (Walter & Reisner, 1992, p. 20) who can participate in educated conversations about agricultural related topics. Hobbs and Chernotsky (2007) stated "[t]o be productive citizens in the 21st century, students need to understand the challenges facing the world today" (p. 2). Regardless of the setting, negative attitudes toward international locations indirectly impact a student's global perspective. Wingenbach et al. (2003) reported that agricultural education students had less than desirable knowledge of global issues and that there was a need to provide opportunities to increase this knowledge.

As shared by Knight (1994), "Curriculum is the backbone of the internationalization process" (p. 6). Colleges of Agriculture strive to provide a global perspective in the classroom. In fact, study abroad and international internships are excellent ways to impact attitude – but these are not always possible or even pursed by agriculture students. In the 2009/2010 academic year, 1.3 % of students from the United States (approximately 3,500) that studied abroad were in the field of agriculture (Institute of International Education, 2011).

Studies have been conducted that have confirmed the benefit of direct exposure to international settings through travel such as study abroad, organized international tours, and international internships. Bruening, Lopez, McCormick, and Dominguez (2002) wrote that students who participated in an extended field trip to Puerto Rico "indicated that the experience was important, valuable and meaningful to them and their professional and personal lives" (p. 73). Stephens and Little (2008) found that student teachers "enhanced their self-confidence, leadership abilities, and global awareness by participating in an international experience" (p. 54). Boyd et al. (2001) reported that participation in an international youth exchange generated interest in global issues and influenced participants to be more culturally sensitive. However, while these activities might be the most impactful methods of exposure to international settings, there are many limitations. Expense and access are very real limitations for undergraduate students enrolled in Colleges of Agriculture. Wingenbach, Chmielewski, Smith, Pina, and Hamilton (2006) reported that students indicated barriers to participation in international experiences as including "personal safety, language and financial barriers, and missing their family" (p. 79) while Irani, Place, and Friedel (2006) confirmed these barriers and noted them as "concern about financial costs and overall time involved" (p. 27).

While interest in participating in international experiences has been documented (Briers, Shinn, & Nguyen, 2010), the reality of actual participation is another matter. Briers et al. reported that greater than 70% of students "felt that participating in a study abroad program would improve their competitiveness in the global marketplace" (p. 17) while at the same time a 2008/2009 report of participation in study abroad at Texas A&M University was only 2.69 % of the approximately 6,200 students in the College of Agriculture (Study Abroad Programs Office, 2009).

One potential way of exposing students to international topics without leaving the classroom is through vicarious learning which has been defined as knowledge acquisition through the observation of behaviors of individuals or forms of media (Bandura, 1977; Schunk, 2004). In the context of training, "[p]reliminary research seems to indicate that vicarious learning has significant advantages over more traditional methods" (Manz & Sims, 1981, p. 112). Schunk (2004) also indicated that vicarious learning may be a more efficient method of learning because the individual is not required to perform all of the behaviors to learn a task.

Boyd, Felton, and Dooley (2004) found that "it is feasible to provide agricultural students with a realistic international experience using an asynchronous simulation" (p. 67); the students were able to learn international agricultural concepts, such as small-farmer decision consequences, via media observations. The advantages of vicarious learning as it relates to international experience also include the convenience of not having to travel and also the potential for substantial cost savings – addressing the limitations shared by previous researchers regarding barriers to student participation in study abroad opportunities. These advantages extend to safety issues and an expanded reach as we consider international experiences for students.

Creating methods to address the need for global awareness is important. Agricultural educators have continuously sought new and better ways to provide education for students in ways that can have a positive impact. Use of the Internet in the broad sense (Molnar & Fields, 2004), the use of audio/video technology (Miller & Honeyman, 1993; Siciliano, Jenks, Dana, & Talbert, 2011), online lessons (Mamo, Kettler, Husmann, & McCallister, 2004), and online course platforms and technologies (Murphrey, Arnold, Foster, & Degenhart, 2012; Strong, Irby, Wynn, & McClure, 2012) are just a few examples of ways that agricultural instructors have sought to improve instruction in the classroom. In fact, Boyd, Felton, and Dooley (2004) reported that an online international simulation was found to increase undergraduate student understanding of international development. Creative ways to expose students to international settings are needed and these methods should be tested for impact on altering student attitudes because attitude ultimately begets action.

Reusable Learning Objects (RLOs) are an emerging method for both online and classroom application that could meet this need. "RLOs are units of content and educational structure divided into reusable objects and modules" (Tate & Hoshek, 2009, p. 51). Reusable Learning Objects are further described as "digital, self-contained, reusable entit[ies] with a clear learning aim that contains at least three internal changing components: content, instructional activities, and context elements" (Laverde, Cifuentes, & Rodriguez, 2007, p. 675). Reusable Learning Objects created by faculty who have visited a foreign country have the potential to provide students an in-classroom experience that would otherwise require international travel to obtain. In addition, RLOs can allow an expanded reach of faculty beyond the faculty who had the opportunity to travel abroad. The creation of RLOs by faculty is being implemented as a means of enhancing classroom experiences in relation to international experience. However, it is not known whether or not this method is an effective tool in altering student attitudes.

Theoretical Framework

The theoretical framework of this study was based on Bandura's (1977) social learning theory. Social learning theory was originally developed as a behavioral modeling theory, but has evolved to also include attitudes and emotional reactions, and is now a model that describes observation, imitation, and modeling as means of learning (see Figure 1); it is also known as social cognitive learning (Bandura, 1977). The social learning theory indicates that the combination of personal, behavioral, and environmental determinates lead to learning.

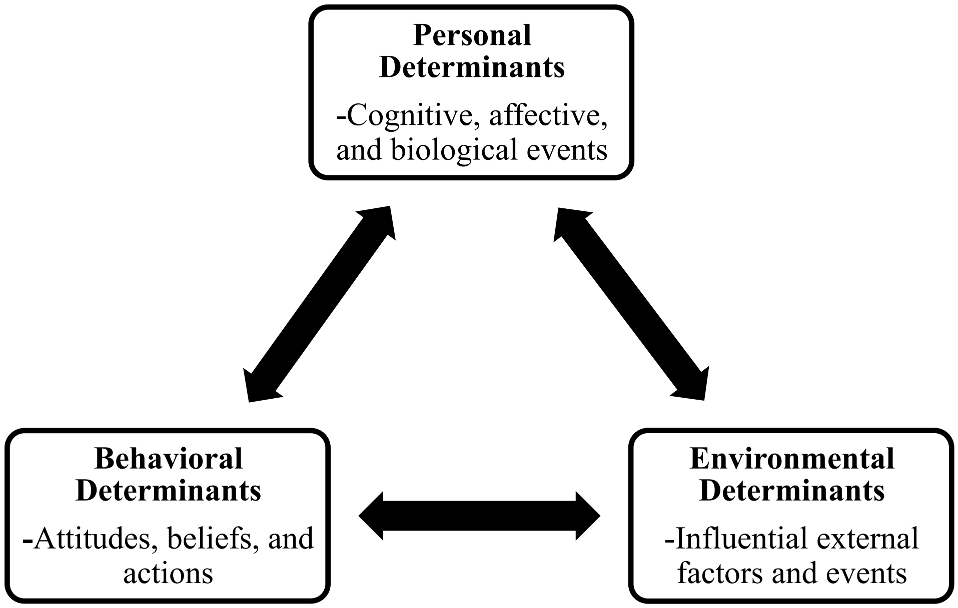

Figure 1. Social learning theory. Adapted from "Social Cognitive Theory of Mass Communication," by A. Bandura, 2001, Mediapsychology, 3, 266. Copyright 2001 by Lawrence Erlbaum Associates, Inc.

Bandura (1977) describes personal determinates as events in an individual's life that have molded their thinking, feeling, and physical traits. These characteristics are indicated to be innate, or internal, to an individual. Behavioral determinants represent the patterns of an individual's actions, attitudes, and beliefs (Bandura, 1977). These determinants are a combination of the values, ethics, and morals that an individual holds and the outward expression of these factors. Environmental determinants are a compilation of external factors that influence the holistic individual (Bandura, 1977).

Study Context

Providing students with an opportunity to gain an understanding of global issues and international settings is critical and the researchers believe that achieving this goal could be accomplished through the use of RLOs to create opportunities for vicarious learning which could in turn impact attitudes and opinions regarding international settings. Each faculty member that participated in the Trinidad and Tobago Faculty Abroad experience with Department of Agricultural Leadership, Education, and Communications at Texas A&M University in 2011 created a reusable learning object (RLO) that addressed a topic in their field of expertise. Each RLO was a digital file that included a learning objective, a lesson, and an assessment. The lesson content and presentation was unique to each RLO; some used video recorded interviews, others used photographs, etc. The RLOs may be accessed at www.globaleducationlab.org. In this study, students experienced one of the created RLOs as a cognitive event in an effort to change their attitudes toward the culture of Trinidad and Tobago. Due to the reciprocal causation nature of Bandura's (1977) social learning theory, if there is an impact on students' attitudes, there will also be an effect on their affective characteristics, beliefs and attitudes, and their willingness to experience other environmental experiences, such as a study abroad or international travel.

Purpose and Objectives

The purpose of this study was to measure the impact of reusable learning objects (RLOs) that were created related to the culture of Trinidad and Tobago on undergraduate agricultural students' attitudes about the country. The following objectives guided the study: (1) create a Thurstone scale to measure student attitude change based on exposure to RLOs focused on the culture of Trinidad and Tobago, (2) identify students' attitudes of the culture of Trinidad and Tobago before and after the use of an RLO during class, and (3) compare pre and post student attitudes and identify changes. Institutional Review Board approval was received for this study.

Methods

Instrument Development

Objective one of the study was to create a Thurstone scale to measure student attitude change regarding the culture of Trinidad and Tobago. The Thurstone scale is designed to measure a participant's "attitude as expressed by the acceptance or rejection of opinions" (Thurstone, 1928, p. 533). Thurstone (1928) also noted that a participant's attitude may change "due to unknown causes or to the presence of some known persuasive factor such as the reading of a discourse on the issue in question" (p. 533). In the case of this study, the persuasive factor is the RLO. In accordance with Trochim and Donnelly (2007), the researchers developed a Thurstone scale by: developing the focus, generating potential scale items, rating the scale items, computing scale score values for each item, selecting the final scale items, and administering the scale.

An instrument should be developed with a well-defined focus for the scale and the description of the focus and what the researcher is measuring should be clear for the respondents (Trochim & Donnelly, 2007). The researchers in this study defined the focus for the scale by creating the following focus command for participants to respond to: Generate statements that describe specific attitudes that people might have about the culture of Trinidad and Tobago.

The researchers generated potential scale items by obtaining a large set of statements (Trochim & Donnelly, 2007). Two classes of approximately 60 students each were given note cards, asked to write one statement per note card, and to generate as many statements as possible in response to the focus command. A total of 320 statements were generated. The researchers sorted the cards into themes so that representative statements could be easily chosen; 17 themes were identified and a total of 32 representative statements were selected.

To rate the scale items, the 32 statements were placed on an instrument with an 11-point scale, with one being least favorable to the concept and 11 being most favorable to the concept (Trochim & Donnelly, 2007). The same two classes of students were asked to indicate how favorable, on a scale of 1-11, each statement was about the culture of Trinidad and Tobago (i.e., "Trinidad and Tobago has beautiful beaches." is a favorable statement and "Trinidad and Tobago is a dangerous place." is not a favorable statement).

The scale score values for each item were computed using SPSS to determine the median and the interquartile range. Two statements were initially chosen from each of the 11 median values.

The two statements within each median value were chosen because they had the smallest interquartile range values and, therefore, the least amount of variability across the responses (Trochim & Donnelly, 2007).

Each statement was then assessed by the researchers to ensure clarity and one from each median value was chosen to represent the final scale (Trochim & Donnelly, 2007). The median value (1-11) became the scale value for the corresponding statement. A final, pre and post instrument was created with the 11 statements; the response options were agree and disagree for each statement. Agree was assigned the scale value (i.e., 1-11), disagree was assigned a value of zero (Trochim & Donnelly, 2007). The same 11 statements were included on both the pre and post assessments.

Study Population and Instrument Administration

The population of the study consisted of four classes containing a total of 103 students. The students were enrolled in a course in a College of Agriculture that was under the instruction of a faculty member that created an RLO on the Trinidad and Tobago Faculty Abroad experience. The students viewed the RLO that was created by their instructor. Data were collected during the 2012 Spring and Summer semesters. Prior to RLO use, students were asked to complete the pre-assessment. The faculty member presented their RLO to the class, and then the students were asked to complete the post-assessment. There were 100 usable instruments collected; three were not included because they were not fully completed.

The instruments were scored by the researchers. To calculate a student's total scale score, the researchers averaged the scale scores of the items that the student agreed with; responses of "disagree," a zero value, were not calculated into the average (Trochim & Donnelly, 2007). This process determined the student's location on the scale; the same was done for the post responses. If a student's response location on the scale increased in value from the pre to the post assessment, their attitude toward the culture of Trinidad and Tobago was considered to have moved in a favorable direction. If a student's response location on the scale decreased in value from the pre to the post assessment, their attitude toward the culture of Trinidad and Tobago was considered to have moved in an unfavorable direction (Trochim & Donnelly, 2007).

Findings

Objective two of the study was to identify students' attitudes of the culture of Trinidad and Tobago before and after an RLO presentation. Descriptive statistics of both the pre and post data were calculated to determine the response frequencies for each survey item (see Table 1). The mean score for each data set (see Table 2) was calculated so that the overall pre (M=6.49, SD=0.63) and post (M=6.97, SD=0.69) RLO attitudes of the students toward the culture of Trinidad and Tobago could be identified.

Table 1
Pre and Post-test Response Frequency for Each of the Eleven Statements (N=*100*)

Item	*n* Pre-test	*n* Post-test
Trinidad and Tobago is a dangerous place.	41	12
Trinidad and Tobago is considered a low income country.	83	68
Hurricanes cause a lot of damage in Trinidad and Tobago.	72	54
The people of Trinidad and Tobago do not speak English.	22	19
The country of Trinidad and Tobago is densely populated.	52	43
The people of Trinidad and Tobago live in small communities.	85	85
The people of Trinidad and Tobago eat a lot of seafood.	79	83
The people of Trinidad and Tobago are skilled in producing crafts.	95	84
The culture of Trinidad and Tobago is friendly.	93	99
Trinidad and Tobago has unique celebrations that attract tourists.	87	85
Trinidad and Tobago has beautiful beaches.	92	97

Note. Items are listed in ascending order of favorableness. Numbers indicate the number of times "Agree" was chosen for each item.

Table 2
Means With Standard Deviations of Students' Attitudes Toward Trinidad and Tobago Pre and Post Reusable Learning Object Presentation

Assessment	*M*	*SD*
Pre-test	6.46	0.63
Post-test	6.97	0.69

Note. N=100.

Objective three of the study was to compare student attitudes toward the culture of the international setting based on the pre and post assessments and identify any changes that may have resulted. The student averages were entered into a paired samples *t-test* to compare the difference between the mean of the students' attitudes toward the culture of Trinidad and Tobago before presentation of the RLO (M=6.49, SD=0.63) and after the RLO presentation (M=6.97, SD=0.69); the difference was found to be significant (t=5.27, df=99, p<0.01). Figure 2 is a graphical depiction of the students' attitudes as measured by the pre and post assessments.

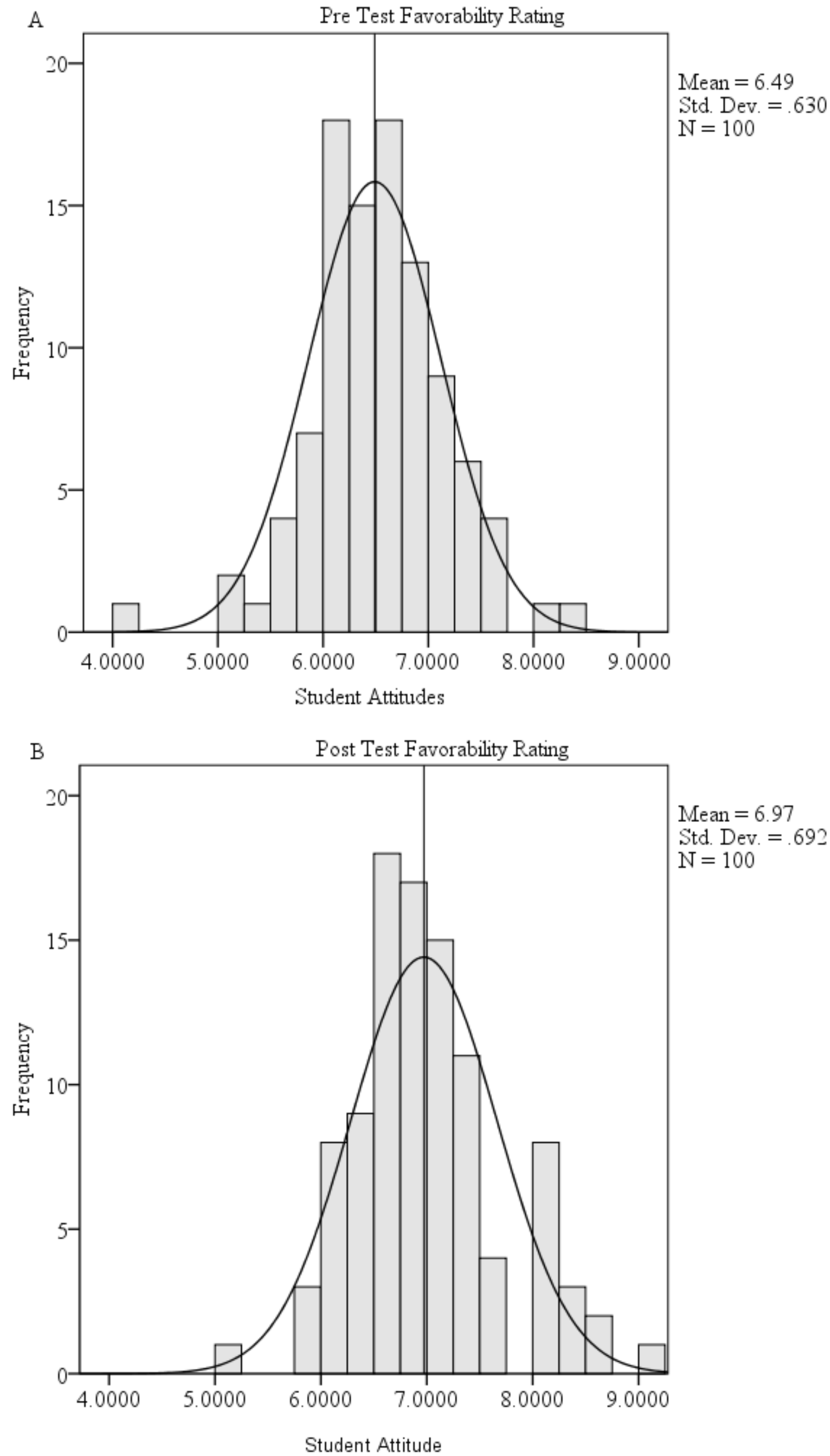

Figure 2. Graphical depiction of the changes in student attitudes toward the culture of Trinidad and Tobago (A) before and (B) after viewing an RLO as part of the course content.

Conclusions and Discussion

Objective one was a methodological objective. The objective was achieved through the creation of an instrument following guidelines articulated by Trochim and Donnelly (2007). It was concluded that the creation of the instrument using the Thurstone scale was an effective method of measuring change in attitude.

Objective two identified students' attitudes of the culture of Trinidad and Tobago before and after an RLO presentation. Based on findings, it was concluded that students' attitudes toward the culture of Trinidad and Tobago were changed as a result of being exposed to the contents of the RLO. It was further concluded that after viewing the contents of the RLO, many students chose to agree with more positive statements and disagree with more negative statements on the post assessment (see Table 1). These findings are consistent with the social learning theory (Bandura, 1977) in that the students personal determinates had an effect on their behavioral determinates (see Figure 1).

Objective three measured the change in students' pre-assessment to post-assessment attitudes of the culture of Trinidad and Tobago. Given the finding that students' attitude score was significantly different between the pretest and the posttest, it was concluded that the RLO impacted students' attitudes. Because the mean moved in a positive direction on the created Thurstone scale (see Table 2), the students' attitudes toward Trinidad and Tobago were found to have become more favorable after viewing the contents of the RLO. In accordance with the social learning theory (Bandura, 1977), students in this study were exposed to a cognitive event in a learning environment and were able to learn vicariously. Similar to the findings of Boyd, Felton, and Dooley (2004) that indicated asynchronous stimulation is a viable means of giving agricultural students an international experience, agricultural students in this study learned cultural lessons through the use of reusable learning objects and, as a result, changed their attitudes toward Trinidad and Tobago.

This study provided evidence that a change in student attitude toward international settings can be accomplished through the use of RLOs in the classroom. It is recognized that limitations to the study do exist. As with any educational activity, characteristics of the RLO such as length, media use, content, and structure along with the way the RLOs is developed and delivered can directly impact the results of that activity. However, this study provides a first-step in documenting impact. Documentation of impact is critical in order to garner support to further the development and promotion of RLO development and use. Additional study is required to document best practices and also factors that determine success and impact. Further research is also needed to determine if the use of RLOs is more or less effective than other teaching methods.

Implications and Recommendations

Technology continues to provide opportunities to enable faculty to impact students with new and creative methods. The conclusion that the use of RLOs in the classroom significantly impacted students' attitudes implies that the use of RLOs in the classroom has potential in regard to impacting students' attitudes toward international settings. This impact could in turn impact a student's decision to participate in activities such as study abroad programs. This impact is in accordance with Bandura's (1977) social learning theory in that the altering of attitudes can lead to changes in environmental determinates; students may become more comfortable with the idea of participating in study abroad programs, international internships, international field trips, and societal participation, as a whole. The documentation of the significant impact of RLO use in the classroom implies that resources spent on the development of these RLOs would be well spent especially given that the process can enabling one faculty member to reach many students. The implications for broader reach are notable.

The intent of this study was not to identify ways to replace international activities such as study abroad, international internships, or international field trips but rather to identify a means to engage students and encourage these students to participant in these additional activities through the altering of attitudes toward international settings. As shared earlier, only a small percentage of students actually participate in international activities that require travel outside of the United States.

Based on the findings and conclusions of this study, it is recommended that faculty members use vicarious learning methods, as described by Bandura (1977) and Schunk (2004), to incorporate context-specific, international concepts into their curriculum. The nature of vicarious learning suggests that learners may not experience many of the usual steps and nuances that a learner may experience while learning in a traditional method (Schunk, 2004). Considering this, it is imperative that the creators of vicarious learning materials take extra care in accurately representing content and context in their RLOs. It is also a recommendation of the researchers that alternate content areas be assessed for vicarious learning tool development and delivery method strategies.

It is recommended that further study be conducted to document the value and impact of RLO use in regard to their effect of attitude toward international settings. In fact, it is recommend that follow-up studies be conducted with students who participated in the original study to see if these students have a higher likelihood of deciding to participate in an international activity that requires travel outside the United States. In addition, further study is recommended that determines if the impact of the RLO is diminished is a faculty member other than the one who created it actually administers it in the classroom. If it can be documented that the impact of RLO use maintains significance regardless of who administers the RLO, the potential for impact is great and the potential for expanded reach is notable.

Perceptions hold the key to reality in regard to student interest and engagement in international program participation. Scholars have noted the importance of engaging undergraduate student in international issues and thus creating “thoughtful professionals and better informed citizens” (Walter & Reisner, 1992, p. 20). This study has documented one method of working toward that goal.

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Discussant Remarks: Rick Rudd

Agricultural Students' Attitudes and Opinions: Can Reusable Learning Objects Alter Students' Perceptions of an International Setting?

I want to thank the authors for conducting this study on the use of Reusable Learning Objectives to influence undergraduate student attitudes and opinions about another country.

As the world continues to "shrink" and we are all called upon to be global citizens, it is imperative that university students be taught in the context of a world curriculum. Utilizing RLO's in the context of other countries is one approach being explored to internationalize curriculum.

The authors clearly defined RLO's. identified the need for internationalization, and described and justified the methodology used in the study. The conceptual frame of social learning theory fit the purpose of the study well.

The use of a Thurstone scale to measure attitude is appropriate for this study. Developing the instrument is a meaningful contribution to future attitude research.

The researchers did show a change in student attitude over the course of the semester utilizing RLO's.

QUESTIONS

1. Where did opinions come into play? How did you measure or document them?
2. Were you surprised that the students already seemed to know a lot about Trinidad – Tobago?
3. Is the effort to use RLO's worth the relatively small change?

Session I: Teaching Strategies

Discussant: Dr. Kirk Swortzel

Climbing the Steps Toward a Successful Cooperating Teacher/Student Teacher Mentoring Relationship
Cameron Jones, Kathleen D. Kelsey, Nicholas R. Brown
Discussant Remarks

Cooperating Teachers' Reflections of the Student Teaching Experience: A Qualitative Study
Dr. Gaea Wimmer, Dr. Todd Brashears, Dr. Scott Burris, Dr. Steve Fraze, Dr. Courtney Meyers
Discussant Remarks

Perceived Importance of the Supervised Agricultural Experience Component of Agricultural Education as Reported by Pre-service Teachers: A Longitudinal Study
Dr. Jon W. Ramsey, Mr. J. Joey Blackburn
Discussant Remarks

The Perceptions of the Quality of Education Received from PhD Graduate Teaching Assistant Instructors through the Eyes of Four Agricultural Education Preservice Teachers
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Climbing the Steps toward a Successful Cooperating Teacher/Student Teacher Mentoring Relationship

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Abstract

Agricultural education cooperating teachers (mentors) are idealized as seasoned professionals, proficient in their craft, and able to transmit tacit knowledge to pre-service teachers (mentees) through demonstration, conversation, and coaching. When the relationship is successful, both parties experience positive outcomes that may last a lifetime. Agricultural educators report that cooperating teachers are one of the most important influences on the development of new teachers. The research reported here used instrumental case study method to identify three steps that underpin successful mentoring relationships between cooperating teachers and student teachers in school-based agricultural education; personality; community and access; trust and communication. Subthemes of personality included compatibility, similar values, mutual interest in growth, successful conflict resolution, and appreciation of differences. Subthemes of community and access included feelings of belonging and having access to cooperating teachers. Subthemes of trust and communication were based on delegating responsibility, providing accurate feedback, and supporting student teachers to assume the role of teacher. Based on the findings, it is recommended that university-based teacher educators increase opportunities for informal mentoring pairs to emerge. Future research could explore the impact of informal pairing on the development of new teachers compared to formal pairings.

Issues Formation

Cooperating teachers (*mentors)* are idealized as seasoned professionals, proficient in their craft, able to transmit tacit knowledge to pre-service teachers (*mentees*) through demonstration, conversation, and coaching. The mentor/mentee relationship exists to transmit knowledge, skills, attitudes, and culture regarding the mentee's career choice. When the relationship is successful, both parties experience growth, learning, and development (Turban & Lee, 2007). Agricultural educators report that cooperating teachers are one of the most important influences on the development of new teachers (Garton & Cano, 1996; Deeds, Flowers, & Arrington, 1991; Harlin, Edwards, & Briers, 2002).

Mentoring is situated in a career context for the purpose of nurturing novice employees and providing pedagogical support. Mentors also support the novice emotionally with interpersonal behaviors that strengthen the mentoring bond and are critical for success in many career fields. The benefits of mentoring may extend over one's lifetime (Bierema, 1996; Iancu-Haddad & Oplatka, 2009; Ragins & Kram, 2007).

Russell and Russell (2011, p. 18) stated, "Promoting successful mentoring relationships is a very important step toward developing student interns into effective practitioners." Roberts and Dyer's (2004) model of cooperating teacher effectiveness included five foundations that effective cooperating teachers used during the student teaching experience: instruction, advising, professionalism, cooperating teacher/student teacher relationship, and personal characteristics. These characteristics can be traced back to Kram's (1985) idea of career and psychological functions that mentors provide mentees.

There are two types of pairing mentors and mentees: formal and informal. Formal pairings are generally arranged by organizational agents using various characteristics of both the mentor and mentee, while informal pairings emerge from both parties interacting together informally and choosing to create and participate in a mentoring relationship (Lee, Dougherty, & Turban, 2000). Many factors play into successful formal and informal mentoring relationships including personal characteristics (Turban & Lee, 2007). Personality traits deeply influence mentoring relationships and have been found to be linked to informal pairings. Informal pairings are often more productive than assigned pairing because social attraction and common interests drive people to affiliate with each other; however, this line of inquiry is underrepresented in the literature and served as a focusing theme for the research reported here (Chao, Walz, & Gardner, 1992; Ragins & Cotton, 1999).

Focusing the Case

The purpose of the case study was to understand the mentoring relationship between cooperating teachers and pre-service teachers in school-based agricultural education using the fall 2011 cohort as the bounded case. We described 1) the relationship between pre-service teachers and their cooperating teachers from an emic perspective, and 2) the influence the mentoring relationship had on pre-service teachers' overall experience while in the field.

Methodology

Research Design: A qualitative, instrumental case study was used to describe how three pre-service teachers' experienced a mentoring relationship with their cooperating teachers and its influence on their field experience. Instrumental case study focuses on a specific issue within a case to gain a deeper understanding of how the issue impacts participants (Stake, 1995).

Research Participants: Participants were pre-service agricultural education teachers from the fall 2011 cohort. The participants (n = 3) were purposively chosen for variety of parings and included a male cooperating teacher (Mr. Ray) with a male pre-service teacher (Kyle); a male cooperating teacher (Mr. Alton) with a female pre-service teacher (Macy); and a female cooperating teacher (Mrs. Pierce) with a female pre-service teacher (Amanda). Note that only the pre-service teachers were interviewed for this study, not the cooperating teachers. The study was approved by the university Institutional Review Board (AG-12-4) and adhered to the federal guidelines for the ethical and responsible conduct of human subjects' research.

Data Sources and Collection Strategies: The primary data source was verbatim transcripts resulting from recordings of three semi-structured, face-to-face interviews that lasted 30 minutes with the three pre-service teachers. I added additional notes to the transcripts to capture the meaning derived from body language expressed during the interviews. I then coded the data using a software program (ATLAS.ti®) following a deductive, constant comparative stance to analysis (Creswell, 2007; Corbin & Straus, 2007). I triangulated the data with participants' weekly reflective journals created during the field experience. The journals were a required course assignment. The journalist logged daily activities along with commentary about their field experiences.

Quality Criteria: Tracy (2010) outlined several practices for enhancing quality in qualitative research studies. To enhance the truth-value of the findings and subsequent interpretations, I inserted participants' quotations in context, giving the reader a better understanding of participants' experiences. An extensive audit trail was retained throughout the study to document my observations, thoughts, and justification for actions taken during the data collection, coding, and reporting phases of the study. This led to "the thick description and concrete detail to allow the cases to show rather than tell" (Tracy, 2010, p. 840). As a member of a qualitative research club, I participated in weekly peer-debriefing sessions with fellow agricultural education graduate students and my co-authors, both qualitative research experts, over a 10-week period. My peers gave substantive feedback about research quality and actions.

In order for the reader to understand the case holistically, Creswell (2007) stressed the significance of giving rich, thick descriptions to demonstrate personalization of participants' experiences. The extensive descriptions should assist the reader in putting the cases in context to determine transferability of findings to similar situations. While qualitative case studies are not generalizable, the findings could be transferred to scenarios similar to this one "through the process of naturalistic generalizations, [where] readers make choices based on their own intuitive understanding of the scene" (Tracy, 2010, p. 845).

Ethics: Research that includes multiple voices and varied viewpoints (multivocal) demands researchers to bracket their experiences. "Qualitative researchers do not put words in members' mouths; rather attend to viewpoints that diverge with those of the majority or with the author" (Tracy, 2010, p. 844). While I came to this case with my biases and previous experiences as a member of the cohort under study, I listened closely to participants' stories to capture their experiences from their perspective, bracketing out my own (Moustakas, 1994).

"Situational ethics ask that we constantly reflect on our methods and the data worth exposing" in terms of risk versus reward to the participants and the reading audience (Tracy, 2010, p. 847). Along with situational ethics, I practiced relational ethics by emphasizing reciprocity between researcher and participants, including my responsibility to not coerce participants to get the story (Tracy, 2010). As part of retaining an ethical stance, I helped participants understand the purpose of the study and remained transparent with my intentions (eventual publication of findings). Each participant agreed to allow me to share their mentoring experiences. Finally, I practiced sound exiting ethics by allowing participants to act as co-researchers through member reflection and encouraged them to edit the manuscript prior to publication (Tracy, 2010).

Researcher Reflexivity: I maintained a reflexive journal to identify and bracket out bias (Moustakas, 1994) during the conduct of the study. A short synopsis of my background is warranted for transparency (Creswell, 2007). I completed a Bachelors of Science in Agricultural Education at the university in December 2011. As an undergraduate, I volunteered at many competitive and non-competitive FFA activities, as well as taught micro-lessons in several different high school classrooms. My pre-service teaching experience was completed at a small, one-teacher program in a rural setting with a male cooperating teacher fall 2011. I graduated high school from a suburban city near the capital city and was a member of a large agricultural education program. My high school agricultural education program had three male teachers. My research agenda has just begun, and I am focusing on the role of women in agricultural education from the lens of feminist and critical theory that questions the severe disparity between the number of women training to become secondary agricultural education teachers (over 50% of recent cohorts) and those actually placed and retained in the field (7%) in this state.

Description of the Mentoring Pairs

The agricultural education pre-service teacher program capstone experience consisted of a 12 week field experience preceded by four weeks of instruction (160 hours) and practice teaching on campus. Pre-service teachers were then placed in the field at a cooperating site. Sites were chosen based on the mentoring potential of cooperating teacher (number of years taught, program success, curricular diversity, and involvement in FFA events), and faculty in the department matched cooperating sites and teachers with pre-service teachers (formal pairing).

Pair 1, Mr. Ray and Kyle: Male Cooperating Teacher/Male Pre-Service Teacher

West Village High School agricultural education program serves 70 students; the total enrollment is 377 students (National Center for Education Statistics, 2012). A single teacher, Mr. Ray, taught at rural West Village for over 20 years, and has mentored many pre-service teachers. Mr. Ray welcomed another pre-service teacher, Kyle, for a semester-long student teaching experience fall 2011.

Kyle came from a relatively large rural school with two male agricultural education instructors. As a farmer's son, Kyle considered himself proficient in the subject areas of cattle, forestry, and crop production. During high school, he took all of the courses offered in the agricultural program and was active in FFA, SAE, and classroom activities.

Kyle was offered three placement sites by the university coordinator, Dr. Dyson. He was advised that West Village would be a good fit for his goals, which included learning more about training Career Development Event (CDE) teams and expanding his knowledge in unfamiliar agricultural courses. Dr. Dyson spoke highly of Mr. Ray and outlined his expectations and areas of expertise. Kyle agreed that West Village would be a good cooperating site and initiated a relationship with Mr. Ray and the West Village community the summer before his field experience.

When Kyle began his field experience, he was comfortable with his relationship with Mr. Ray. During our interview, Kyle reflected on his overall experience at West Village and spoke a great deal about the practical experiences that emerged from his time in the field. Although he acquired theoretical knowledge at the university, he lacked practical knowledge that comes from working in the teaching profession. Lessons of administrative paperwork, classroom management, and dealing with parents were learned during his field experience. Those experiences were carefully facilitated and supervised by Mr. Ray.

Kyle's overall pre-service teaching experience was positive. His weekly reports reflected his reluctance to leave starting three weeks before his last day. "I cannot believe my experience is coming to an end. I am really going to miss working with Mr. Ray and interacting with all of my students." Mr. Ray was mentioned six times throughout the twelve weekly reports, always in affectionate and positive terms.

Pair 2, Mr. Alton and Macy: Male Cooperating Teacher/Female Pre-Service Teacher

Mr. Alton was a certified florist who taught floral design and was in charge of the rabbit and poultry projects at an inner city magnet agricultural education program in Fredrickson. He also worked with the agri-science fair participants. He was a non-traditional instructor, never having participated in FFA or 4-H as a youth. Unlike many of the programs in his state, Fredrickson was focused on educating students about agriculture through classroom and lab situations. Fredrickson faculty knew that a majority of their students were enrolled for science credit (vs. a passion for agriculture), and emphasized their role as educators before advising FFA events or supervising Supervised Agricultural Experience (SAE) projects. Fredrickson and Mr. Alton welcomed their first out-of-state student teacher, Macy in the fall of 2011.

It was no surprise when Macy was placed in a non-traditional agricultural education program. With no youth experience with 4-H or FFA, she was drawn to agriculture because of her passion to teach in an urban setting. Because of Macy's background and future goals, she sought placement out-of-state in an urban program to work with non-traditional students. Because her placement was unique and finalized late, Macy did not contact Mr. Alton until her required visit two weeks into the four-week block experience.

After a week of observing, she assumed control of six courses including professional communications, scientific research and design, three floriculture courses, and freshmen-level principles of agriculture class. In addition to classroom instruction, Macy worked closely with students involved in fundraising by selling flower arrangements. During these after school activities, Macy learned many informal lessons about teaching agriculture through Mr. Afton's mentorship. Macy enjoyed freedom in the classroom and while advising students.

The overall pre-service teaching experience for Macy was extremely positive. Her weekly journals documented her excitement during the student teaching experience and her appreciation of the Fredrickson facility. She remained busy and engaged throughout her 12-week stay, as reflected in her weekly journals. Macy mentioned Mr. Afton five times in her journals, always in a positive and grateful manner.

Pair 3, Mrs. Pierce and Amanda: Female Cooperating Teacher/Female Pre-Service Teacher

June is a small, agriculture-based community. June High School had 244 students enrolled in 2012 with 37 of those students enrolled in agricultural education (National Center for Education Statistics, 2012). Mrs. Pierce, the sole teacher, has led the program for seven years and has hosted two pre-service teachers. She is regarded as able to balance career and personal roles, making this an ideal placement for Amanda, a soon-to-be mother seeking a career in agricultural education. The June FFA program participated in speech contests and a few members showed lambs at livestock shows; however, the focus of the program was on community involvement.

Amanda grew up in a suburban neighborhood and attended a large high school. She was active in her high school FFA program for four years. Her home program had two teachers, a male and a female, and the program served 100 students. Along with showing livestock, Amanda was active as an FFA officer who participated in numerous CDE and public speaking contests. She considered her two agriculture teachers as second parents and the agriculture building her second home. Because of her family commitments, she was placed close to her home in an urban area. Amanda did not seek contact with Mrs. Pierce until her day-long visit to June during the four-week block experience.

Amanda's pre-service teaching experience predominately took place in the classroom and lab setting. By the third week, she had taken over all classes. She expressed how well-behaved students were, serving as a key component to her positive experience. Mrs. Pierce gave her guidelines about what she taught, and asked Amanda to complete all units and objectives during her experience. Amanda was given freedom to develop unique lessons and units to achieve the goals, and was able to choose the order of instruction.

As Amanda reflected on her experience, she focused on the similarities between Mrs. Pierce and herself. Both were married with growing families and were passionate about teaching agriculture at the secondary level. Because of this connection, much of the experience revolved around how Amanda could balance the expectations of teaching agriculture and home life. Because neither of the women were talkative, Amanda made sure to ask questions when she felt unsure of her role in particular situations. Amanda was also goal directed, which helped Mrs. Pierce better facilitate her experience. Although Amanda's experience was positive, she did not mention Mrs. Pierce in her weekly reports.

Findings and Assertions

I identified three major themes to describe the mentoring relationships between the pairs: *personality; community and access; trust and communication*. Each theme is discussed and supported with the use of participant's words to add textual richness. A metaphor of a staircase is woven throughout the findings and conclusions to illustrate the case (see Figure 1).

Elaborate descriptions are used to elucidate themes and illustrate the particulars of the case, leading to assertions (claims) regarding the nature of the mentoring relationship between pre-service teachers and their cooperating teachers (Stake, 1995). After each pair is described within the theme's context, I offer assertions that tie the pairs together through the use of thematic analysis. Creswell (2007) recommended that the assertions for a case study be presented as a summary of what I understood about the case, and whether initial conclusions have been changed or conceptually challenged.

Personality

Personality was the first level on the staircase. It was the simplest level to achieve and was the basis for the other steps to build a strong and stable mentoring relationship. Personality was defined as "the relatively stable dispositions (traits) of individuals that contribute to consistency in their thoughts, behavior, and emotions" (Turban & Lee, 2007, p. 24) and is described in the context of the experiences between the pairs.

Kyle and Mr. Ray - Kyle reported that he and Mr. Ray had complementing personalities. After years of teaching, Mr. Ray was well adjusted to the challenges of teaching agricultural education at the secondary level. Mr. Ray's veteran experience coupled with his disposition towards an "easy going and laid back" (2; 133:135) personality made for a relaxed atmosphere at West Village. Kyle described himself as a more excitable and energetic teacher. His tendency to be easily stressed when a situation was not organized posed many situations where Mr. Ray would step in and advise Kyle on a better way of handling a situation. "The things that Mr. Ray was really good at may not be the things that I am really good at, but there were a few things that he learned from me" (1; 328:330). Because of their complementing differences in personality, they were able to deepen respect for each other.

Macy and Mr. Alton - Macy and Mr. Alton also had complementing personalities. Macy was more driven than Mr. Alton and pushed students to do their best. She described herself as serious and focused on making sure students performed. On the opposite end of the spectrum, Macy described Mr. Alton as having a "mellow" (2; 134) personality. He remained laid back in his interactions with students. Macy noted their differences in personalities while traveling out-of-state with students for competitions. "It was definitely an adjustment because you are spending so much time with someone, but then you really learn how to adapt and rely on one another" (3; 129:131). Because Mr. Alton was normally the sole chaperone, he sometimes struggled with supervising female students. This need allowed Macy to bring a new dimension for students who were traveling with Mr. Alton. "Even if we didn't always see eye to eye, he had a lot of perspective to bring to the table and it was an excellent opportunity to gain more insight" (3; 355:357). Macy was able to hone her supervising skills and find a balance between the passive personality of Mr. Alton and her own demanding personality.

Amanda and Mrs. Pierce - Amanda described Mrs. Pierce and herself as having similar personalities. Both were unexcitable and flexible, neither engaging in extraneous talk. Amanda expressed that both women would "only speak if there was something to be said… so our conversations were always relevant or meaningful" (3; 200:204). Not only did their similar personalities show through their communication styles, but also how they worked through critiques on lesson plans. There was no structured time to review Amanda's teaching. Instead, Mrs. Pierce filled out evaluation forms to inform Amanda about her strengths and weaknesses in the lesson. Amanda felt this was most effective because "if we had talked about it, she would have just restated what she had written and I think I would have been put on the defense trying to rationalize why I did what I did" (3; 194:196). Understanding their similar personality and engagement style strengthened the mentoring relationship and positively affected Amanda's pre-service teaching experience.

Theme conclusion.

When pre-service teachers thought their personalities were similar to their cooperating teachers, their satisfaction with student teaching increased (Kitchel & Torres, 2007). Although two of the three pre-service teachers described their personalities as divergent from their cooperating teachers, it was clear they shared similar values in regard to the teaching and learning process. None of the students reported discomfort with personality differences.

It is important that whether the student teacher and cooperating teacher have similar or different personalities, they understand how they can find common ground. In instances where personalities were different, both Kyle and Macy recognized how they could learn, adapt, and grow from the relationship. The key point with personalities lies in whether the student teacher and cooperating teacher recognize those differences and adjust to enhance the experience. Conflicts occur when neither party accepts or recognize them, and may turn the personality differences into a hindrance within the mentoring relationship (Turban & Lee, 2007).

All three pre-service teachers were able to identify strengths and weaknesses in personality and adapt accordingly to benefit from their experiences. After the pre-service teachers successfully reached the first level of the staircase, they were ready to experience the second level: community and access.

Community and Access

After compatibility and understanding of personalities had been established between the pairs, the next step toward a successful pre-service teaching experience was developing a sense of *community and access*. We formed emic definitions for community and access based on codes that emerged from the data. Community was expressed as a feeling of acceptance and emersion in the cooperating site and greater community. Access was defined as availability of the cooperating teacher, including access to resources and opportunities.

Kyle and Mr. Ray - Kyle prioritized gaining acceptance with Mr. Ray and acclimating to the community. He recognized the importance of working with a seasoned professional who was highly respected in the agricultural education profession. "I wanted to get an idea about where I would live and learn Mr. Ray's expectations of me, the community, and discuss how Mr. Ray wanted me to teach" (1; 73:79). Kyle was the only participant who sought to blend into the community. He felt it was an easy transition and that it increased his success as a pre-service teacher.

Kyle received full access to Mr. Ray's resources and time for debriefing. Because of the openness of their relationship, Kyle was able to prepare all assignments for the university without difficulty. Mr. Ray was keen on making sure the assignments were completed in a timely fashion and were high quality. "Mr. Ray was there to help me with both my resource file for the university and building lessons for the classroom" (1; 62:67). Kyle believed Mr. Ray prioritized him and did not feel like a burden when he needed resources such as Mr. Ray's time or curriculum and books.

Macy and Mr. Alton - While Macy did not explicitly mention a feeling of belonging in Fredrickson, she did express feeling part of the school-based community. In her weekly report, she talked about "helping other teachers finish tasks." By week four, she ended her weekly report with this statement: "I am becoming really comfortable at Fredrickson. I feel like a real teacher and am more grateful every day for being at this facility" (2; 40:45). She viewed the other teachers as mentors, "It was nice being mentored by people who have been in the agriculture industry for so long" (2; 335:339).

Macy relied on Mr. Alton for resources to create units in the floriculture class. Beyond curriculum, she had structured meetings three times a week to debrief on the week's activities and plan for the future. Macy's consistent access to Mr. Alton created a strong mentoring relationship. Macy felt that Mr. Alton prioritized her and knew he was available to listen and give advice that would help her navigate better the pre-service teaching experience.

Amanda and Mrs. Pierce - Many of Amanda's community experiences were conveyed through her weekly reports. Because the classroom was modeled after community needs vs. CDE events, the students were motivated to be involved in the town's affairs. Although Amanda attended all events in the community, she did not feel a part of the community of June. This could be attributed to her commute from another city and she was not completely engaged in June, unlike the other two participants who lived in their communities. However, she was able to assimilate into the school community. She assumed all teacher duties including lunch duty, monitoring and supervising homeroom, and advising period, giving her visibility with other teachers and administrators at June High School.

Access was established from the beginning between Amanda and Mrs. Pierce because both women were transparent with their thoughts and feelings throughout the experience. Amanda believed Mrs. Pierce prioritized her throughout her pre-service teaching experience. When she talked about their relationship, Amanda said, “She made sure that I was always around for learning in new and unique experiences” (3; 137:138). Because of the prioritized access to Mrs. Pierce, Amanda felt very comfortable as a new educator.

Theme conclusion.

“The student teaching center and the supervising teacher are the most important ingredients in the student teaching experience” (Norris, Larke, & Briers, 1990, p. 58). All three pairs experienced varying degrees of feeling a part of their communities. The perceived feeling of community was expressed both within the school and townships. Belonging to the school and community helped build pre-service teachers’ credibility, as well as their self-confidence as new educators.

In order to climb the stairs to a successful mentoring experience, the pairs experienced feelings of belonging to the school and community, and had open access to their cooperating teachers. Researchers generally agree that the cooperating teachers should support pre-service teachers through constructive feedback and emotional support (Maynard, 1996). All three pairs reported being a priority to their cooperating teachers. “Cooperating teachers must be conscious of the moves they make and the access they provide (or deny) student teachers to the work of teaching and teachers” (Cuenca, 2011, p. 126). If student teachers do not believe they can approach their cooperating teachers, they will not progress to the next level: trust and communication.

Trust and Communication

In the previous theme, I established that access and a sense of community were critical for a successful mentoring experience. The first theme of personality established that while personalities may differ, each party can learn from the other to grow a successful mentoring relationship. My final theme, trust and communication, will tie the foundational steps of personality, access and community to the final step for achieving a fruitful pre-service teaching experience.

Three psychosocial functions assist in career development between colleagues; they are (a) counseling, (b) acceptance, and (c) friendship (Hall, 1986). These functions surfaced as the steps toward communication and trust within each pair. Communication encompassed counseling functions and occurred when the cooperating teacher provided, “a helpful and confidential forum for exploring personal and professional dilemmas” (p. 162). Trust was expressed through actions, feelings, and reflections on the relationship between the pairs. Trust was modeled from friendship and acceptance. The pairs in this study experienced friendship through “mutual caring and intimacy that extends beyond the requirements of daily work tasks” and is “sharing experience outside the immediate work setting" (p. 162). The acceptance function was shown through, "providing ongoing support, respect, and admiration, which strengthens self-confidence and self-image" (p. 162).

Kyle and Mr. Ray - Kyle trusted Mr. Ray and felt it was reciprocated. Their trust was built on the daily operations both inside and outside the classroom. Kyle felt Mr. Ray perceived him as an equal and believed he had a "position right beside" (1; 205) Mr. Ray instead of being regarded as a teacher-in-training. This bond empowered Kyle and allowed him to make more decisions without fear of making mistakes or disrupting the established program. "I felt like I was actually responsible for creating a lesson, teaching it, and the kids learned from it, instead of taking something that had been changed so many times that it wasn't my lesson anymore" (1; 171:174).

Kyle was the only student teacher to initiate contact with his cooperating teacher in the summer. This pre-communication strengthened their relationship and created a solid foundation for their relationship. During the student teaching experience communication between Kyle and Mr. Ray was informal. Nevertheless, Mr. Ray made it a priority to talk with Kyle after classroom lessons to discuss his strengths and weaknesses within the lesson. When miscommunication occurred, Kyle described Mr. Ray as, "a gentleman who would try and communicate when issues arise instead of just getting mad and screaming about them" (1; 234-237). Kyle felt connected with his cooperating teacher and believed he would continue their relationship because of the positive student teaching experience.

Macy and Mr. Afton - After Mr. Afton established expectations, she was given "a lot of leeway" (2; 54) on how to carry out tasks. When she struggled, he would step in to facilitate and guide her. "If I wanted to do something, he would leave me to it" (2; 55:57). The Fredrickson faculty treated pre-service teachers as equals and desired excellence in the classroom. Faculty allowed pre-service teachers to choose the courses they taught. This built trust and was pivotal to allowing Macy to test her strengths and weaknesses in a secure environment.

Macy believed communication was a priority, "We made it a big point if it was late at night or early in the morning to keep students out of the room so we could discuss and reflect on the day without interruptions" (2; 212:219). The 12-week externship also assisted in developing trust among the pairs. Macy was able to vent frustrations about her experience, as well as excitement during her successes with her mentor. "He really took me under his wing and we developed a strong relationship where I could vent to him if I was upset of frustrated about something" (2; 194:196). The mentoring relationship between Macy and Mr. Afton was built on trust, which made her overall student teaching experience a success.

Amanda and Mrs. Pierce – As a mother, Mrs. Pierce was able to mentor Amanda on an entirely different dimension. Amanda said Mrs. Pierce "was a female and understood what it was like to be pregnant. She knew the difficulties it included" (3; 41-44). Throughout our interview, Amanda expressed her need to discover how to balance her career with her new family obligations. Mrs. Pierce met this desire through a reciprocal relationship that encompassed both professional and personal information. "We talked about married life, what our lives have been like during pregnancy, what our goals were for our families, and our student teaching experiences: what hers was like and what mine was becoming" (3; 53:55).

Amanda and Mrs. Pierce had a distinct communication style; both were selective in what they talked about. Although their relationship did not start until later in the semester, they had a strong bond because they appreciated similarities between their communication styles. Most of their communication took place in the classroom and in the school vehicle on the way to students' homes or to livestock shows. Amanda's perception of their relationship in terms of communication was reflected through her response about her overall experience, "She knew how to relate to me. She was open, able to communicate her thoughts, and I didn't have to prove myself" (3; 41:44).

Theme conclusion.

"Cooperating teachers are often the most influential in the development of novice teachers, as they have the most contact and communication with the student teachers" (Kasperbauer & Roberts, 2007, p. 32). Because of the transition of authority and proximity between the university supervisors and the cooperating teacher, the cooperating teacher must be willing and ready to engage with the student teacher. Transfer of knowledge will happen when cooperating teachers allow access to themselves for pre-service teachers and voluntarily give feedback and coaching. Communication is pertinent to both the career and psychosocial functions that contribute to successful mentoring relationships (Turban & Lee, 2007).

Communication leads to trust, and trust is essential for a positive experience, regardless of context. Each pair exhibited mutual trust leading to a positive student teaching experience. "Cooperating teachers who generally support their student teachers by maintaining harmony, giving praise, and being cooperative and those who delegate responsibility, allow freedom for experimentation and are facilitators, positively influence their student teacher's success" (Stahlhut & Hawkes, 1987, p. 12). Each cooperating teacher displayed most of these characteristics and, therefore, built trust that allowed the student teacher to grow as a teacher. Because student teaching is a time to apply theory, it is important that the cooperating teacher build an environment based on trust through letting go and gently facilitating the experiences and situations that occur. Without communication and trust, a successful student teaching experience is unlikely. Figure 1 depicts the steps necessary for climbing toward a successful mentoring relationship in the context of agricultural education pre-service teaching externships.

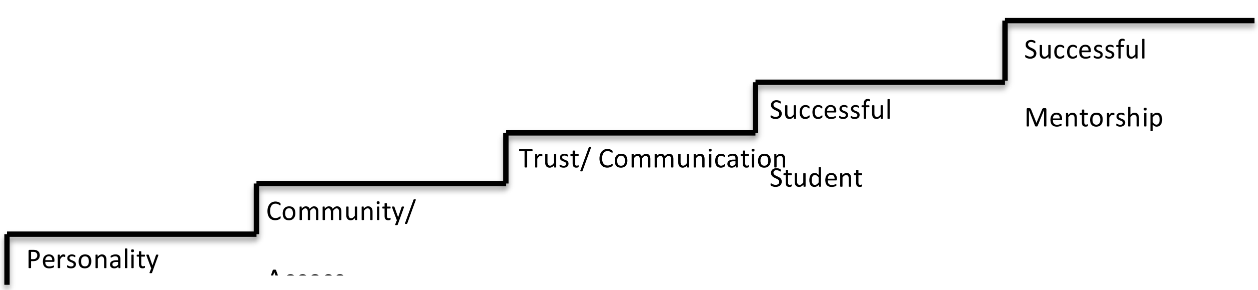

Figure 1. Drawing of the metaphorical stair steps representing each theme.

Recommendations for Practice

Three steps (personality, community/access, trust/communication) were identified to lay the foundation for a successful mentoring relationship between cooperating teachers and pre-service teachers. These steps closely mirror the outcomes of informal mentoring pairs. As such, we recommend that university-based teacher educators allow space for informal pairing. "When efforts are made to ensure that criteria for matching are aligned with key objectives of the program, both career advancement objectives and personal learning objectives can be met" (Kram & Ragins, 2007, p. 659). Informal mentoring relationships are driven by similarity and attraction (personality) and involve high levels of commitment. In addition, formal mentoring relationships can invoke feelings of awkwardness, anxiety, tentativeness, and possible skepticism for both parties. In contrast, informal mentoring relationships invoke excitement, infatuation, and positive anticipation among participants (Blake-Beard, O'Neill, & McGowan, 2007). While the three pairs in this case study were successful under the formal pairing model applied, enhanced outcomes maybe realized when mentors and mentees are allowed to pick each other and is worth further examination.

For informal matching to take place, university-based teacher educators must facilitate multiple opportunities for pre-service teachers and the pool of cooperating teachers to interact. Collegiate FFA meetings, competitive FFA and CDE events, and district meetings provide opportunities for pre-service teachers and cooperating teachers to meet. University faculty can also facilitate social mixers to encourage informal interactions. Pre-service teachers could be charged with seeking out possible cooperating teachers during the course of their program and presenting a list of possible mentors during placement meetings with faculty.

Regardless of whether informal or formal mentoring programs are utilized, it is vital that university-based teacher educators create a culture that encourages cooperating teachers and pre-service teachers to invest energy and time to develop their relationships, not only as employee/employer but also as friend and mentor (Kram & Ragins, 2007). This could be accomplished in a workshop setting that establishes expectations and standards for teaching and learning interactions. In addition, pre-service teachers should be encouraged to explore new techniques during the field experience, allowing cooperating teachers the opportunity to coach and mentor pre-service teachers through both failures and successes. The pre-service teaching program plays a vital role in "determining the nature, learning process, and effectiveness of developmental relationships" (Kram & Ragins, 2007, p. 677).

Future directions for research could focus on gaining a deeper understanding of the complex relationship between cooperating teachers and pre-service teachers in both formal and informal mentoring pairs. This case study was situated in the context of formal pairings, where pre-service teachers rarely meet potential cooperating teachers prior to official placement. Several authors have explored informal pairing in other settings; however, it is underrepresented in the agricultural education literature (Blake-Beard, O'Neill, & McGowan, 2007; Chao, Walz & Gardner, 1992; Kram, 1985).

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Discussant Remarks: Dr. Kirk A. Swortzel
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Climbing the Steps toward a Successful Cooperating Teacher/Student Teacher Mentoring Relationship

The purpose of this paper was to present a case study to understand the mentoring relationship between cooperating teachers and pre-service teachers in a school-based agricultural education setting. Specifically, the authors described the relationship between pre-service teachers and their cooperating teachers from an emic perspective and described the influence the mentoring relationship had on pre-service teachers' overall experience while in the field.

I applaud the efforts of the researchers with the quality of study they conducted. The researchers did an outstanding job identifying the issue to be addressed in this study as well as describing the methods and procedures used in this qualitative research study. This paper is a good model to follow for others who wish to pursue and utilize a case study approach to qualitative research.

I found it particularly helpful to read the description of the mentoring pairs. It helped me understand the backgrounds of all of the individuals involved in the case study and it particularly helped create a mental picture for me as I imagined the setting these pre-service teachers were placed in.

The researchers did an outstanding job in identifying and describing the themes for these mentoring relationships. As I read the results of this study, I concur with the researchers on the themes they identified in this study. I appreciate the thoroughness of each description and the connection of the themes with the relevant literature in the field to show.

As the researchers made their recommendations, they recommended that informal pairings for mentorships be allowed. I would like to know if informal pairing for student teachers if the norm at this university or is this something relatively new? Does everyone get to "pick' their cooperating teaching or does the university supervisor provide some guidance and recommendations in this process?

While this paper only addressed the view of the student teacher, I wonder what the views of the cooperating teacher would have been? Would they provided similar insights as the student teachers did? Would this be an area of inquiry worth investigating?

Again, I commend the researchers on an excellent study and thank them for adding such an interesting study to the agricultural education knowledge base.

Cooperating Teachers' Reflections of the Student Teaching Experience: A Qualitative Study

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Abstract

Cooperating teachers play a vital role in the development of future generations of agricultural education teachers by allowing student teachers to practice teaching in their programs. The importance of the cooperating teacher-student teacher relationship is well-recognized and does impact the student teacher in a variety of manners. The purpose of this study was to explore the application of a leadership model targeted to better meet the developmental needs of the student teacher and the conceptualization of the cooperating teacher role from the perspective of the cooperating teacher. Seven cooperating teachers were purposively selected and interviewed to gain understanding of the student teaching experience from the cooperating teacher. Participants were able to recognize and help support the developmental needs of the student teacher. They utilized the questionnaires and feedback provided by the university as validation for behaviors they were already performing. Cooperating teachers view their role in the preparation of future teachers as the window in which to show what teaching is really like and promote the profession to the student teachers. Additional research should be conducted to continue to improve the student teaching experience for all parties involved.

Introduction/Need for Study

The nation continually struggles to put enough qualified teachers in all classrooms each year. This will continue to be a problem as the total number of elementary and secondary teachers is projected to increase an additional 18% by the year 2017 to an estimated 4.2 million teachers (Hussar, 2008). Each year, agricultural education struggles to fill teacher vacancies with highly qualified teachers. This situation is present even though more than enough qualified agricultural educators graduate from college preparation programs each year (Kantrovich, 2007; 2010).

Methods aimed at recruiting more students to major in agricultural education are important, but does not solve the problem of student attrition from the field at the completion of their degree program. Programs designed to improve a key feature of most agricultural education teacher preparation programs might help increase the number of graduates accepting teaching positions (Kasperbauer & Roberts, 2007a). This key component of most programs is the student teaching experience.

Cooperating teachers are vital in the training and preparation of future teachers. The role filled by the cooperating teacher has been described as a supervisor (Kahn, 2001). Boudreau (1999) identified words to describe how cooperating teachers supervise student teachers, "help, guide, advise, encourage…offer opportunities, allow him/her" (p. 456). The type of supervision provided by the cooperating teacher will vary depending on the individual. The relationship between cooperating teachers and student teachers is an important component of the student teaching experience (Harlin, Edwards, & Briers, 2002; Kasperbauer and Roberts, 2007b; Young & Edwards, 2005; Young and Edwards, 2006;).

Although the process used by cooperating teachers has been termed 'supervision' (Kahn, 2001), the leadership style exhibited by the cooperating teacher can impact the way the supervision is provided. The study of leadership styles focuses on leaders' behaviors and actions when working with followers (Northouse, 2010). Situational leadership is a category of leadership theory in which the leader must vary their leadership to best meet the developmental needs of their followers (Northouse, 2010). The Situational Leadership® II model (Blanchard, Zigarmi, & Zigarmi, 1985) requires the leader to examine the developmental level of their follower(s) and adjust their leadership style to best meet their needs. This can be applied to the cooperating teacher-student teacher relationship due to the leader-follower approach of the student teaching experience. The leadership style of the cooperating teacher may have an impact on the student teacher's development during the semester.

Research focusing on improving the student teaching experience, in an effort to increase the percentage of new teachers who choose to enter the profession immediately after graduation, is an area of interest. Roberts et al. (2009) stated, "it is imperative to conduct research in an effort to better understand the student teaching phenomenon and decision to teach" (p. 137). Studying the impact of the cooperating teacher's use of the Situational Leadership® II Model and how cooperating teachers interpret their role when working with student teachers are areas that warrant further investigation.

Literature Review/Theoretical Framework

Cooperating teachers serve a vital role in the preparation of future teachers. Roberts (2006) stated, "cooperating teachers exert a tremendous influence on the quality of the learning experience" (p. 1). Kasperbauer & Roberts (2007a) contend "cooperating teachers are often the most influential [person] in the development of novice teachers, as they have the most contact and communication with the student teachers" (p. 9).

The role of the cooperating teacher when supervising student teachers has been qualitatively researched (Boudreau ,1999; Kahn, 2001). After analysis of written documents from 36 cooperating teachers, Boudreau (1999) identified five categories of tasks conducted by a cooperating teacher: "integrating the student teacher into the school system, establishing a relationship with the student teacher, offering professional self-development opportunities, organizing a practicum, exchanging ideas and feedback" (p. 456).

Kahn (2001) used qualitative methodologies to study the role of the cooperating teacher and the types of preparation and support needed for a successful experience. In relation to the role of the cooperating teacher "they… freely shared the qualities they believe they possess as cooperating teachers, including flexibility, ability to establish a good working rapport, and positive communication skills" (p. 51).

The perceptions student teachers hold in connection to the characteristics of effective cooperating teachers was researched by Roberts and Dyer (2004) and Roberts (2006) to develop a model of cooperating teacher effectiveness. In 2006, Roberts replicated the Roberts and Dyer (2004) study and developed a working model of cooperating teacher effectiveness consisting of four categories: "Teaching/Instruction, Professionalism, Student Teacher/Cooperating Teacher Relationship, and Personal Characteristics" (Roberts, 2006, p. 8).

The relationship between cooperating teachers and student teachers is well recognized as essential and leads to a better experience (Harlin et al., 2002; Kasperbauer and Roberts, 2007b; Young & Edwards, 2005; Young and Edwards, 2006). Cooperating teachers place a high level of importance on the on the relationship they have with student teachers (Edwards & Briers, 2001; Young & Edwards, 2005). Student teachers also recognize the importance of the teacher-student teacher relationship for a successful experience (Harlin et al., 2002; Kasperbauer and Roberts, 2007b; Young & Edwards, 2006).

The benefits of successful experience are also shared by the cooperating teacher. Tannehill (1989) interviewed three cooperating teachers who had served in that role for over 50 student teachers. The cooperating teachers spoke about their role in terms of being a role model and supporter of the student teacher's development. They understand the importance of "matching expectations to capabilities" (p. 248) and identifying problems before they occur. Serving as a cooperating teacher was described as a way to reinvigorate what is already occurring and reinforce their passion for the career.

The Situational Leadership II Model (Blanchard et al., 1985) was used as the theoretical framework for this study. The model consists of two parts; one for the leaders and one for the follower. The first part focuses on the leader and the two types of behavior they could exhibit when working with followers. Four fundamental leadership styles are identified from the combination of the two leadership behaviors: supportive (relationship) and directive (task) (Northouse, 2010). The four leadership styles are: Directive, Coaching, Supporting, and Delegating.

Leaders who utilize the Directing leadership style "provide specific instructions and closely supervise task accomplishment (Blanchard et al., 1985, p. 30). The Coaching style is characterized by a leader who "continues to direct and closely supervise task accomplishment, but also explains decisions, solicits suggestions, and supports progress" (Blanchard et al., p. 30). The third leadership style in the model, Supporting, in described as when "the leader facilitates and supports subordinates' efforts toward task accomplishment and shares responsibility for decision-making with them" (p. 30). The fourth leadership style is the Delegating style. "The leader turns over responsibility for decision making and problem solving to subordinates" in this final style (p. 30).

Ralph (1994) utilized Hersey and Blanchard's original Situational Leadership Model when developing the supervisory approach, Contextual Supervision. "In the Contextual Supervision model, individuals in a supervisory role match their supervisory styles to the contextual variables characterizing supervisee's situations" (Ralph, 1994, p. 354). He states the supervisor is the experienced educator (cooperating teacher, university supervisor, etc.) and the supervisee is "any professional or preprofessional educator who, in a relationship with a supervisor, intendeds to learn or improve a specific skill or task" (p. 354). Ralph (1994) describes the level of competence and confidence exhibited by the supervisee will influence how the supervisor goes about supervising their experience and growth. The unique situational characteristics must be taken into consideration by the supervisor in order to help the supervisee develop and grow.

The contextual approach to supervision used by cooperating teacher's has been investigated in the agricultural education profession by Thobega and Miller (2007). They investigated the use of five types of supervision: clinical, contextual, differentiated, conceptual, and developmental supervision cooperating teachers may utilize when working with student teachers. Of the five types of supervision, Thobega and Miller (2007) found cooperating teachers most often used contextual, clinical, and conceptual models of supervision. They determined the cooperating teachers may get used to a routine and that routine would extend into their supervisory practices when working with a student teacher.

Purpose and Objective

The student teaching semester is a well-recognized tool in preparing future agricultural education teachers. There is a need to continually improve the student teaching experience to benefit all parties involved. The *National Research Agenda: American Association for Agricultural Education's Research Priority Areas for 2011-2015* (Doerfert, 2011) recognized this need in Priority Area 3 "we must be able to better understand the models, strategies, and tactics needed to best prepare, promote, and retain new professionals" (p. 20). Cooperating teachers are essential in the preparation of future generations of agricultural education teachers. The purpose of this study was to qualitatively investigate the student teaching experience from the cooperating teachers' point of view. Specifically, to explore the application of a leadership model targeted to better meet the developmental needs of the student teacher and the conceptualization of the cooperating teacher role from the cooperating teachers' perspective.

The research objectives were:

1. Describe how cooperating teachers applied components of the Situational Leadership® II model when working with their student teacher.
2. Examine how cooperating teachers conceptualize their role when working with student teachers.

Methodology

This study was designed using qualitative methodologies to explore the research objectives. Qualitative research involves the use of thick descriptions to help describe a phenomenon in more detail than possible with quantitative methodologies (Gall, Gall, & Borg, 2007). The population for this study was current agricultural education teachers who were serving as cooperating teachers at a southwestern university during the spring 2012 semester. As a component of their duties as cooperating teacher they were asked to assess their student teacher at four points during the semester on an instrument to gauge the competence and commitment of the student teacher toward agricultural education as a profession. After the first three administrations the cooperating teachers were provided feedback to help them adjust their leadership style when working with their student teacher's development. This was in connection to the application of the Situational Leadership II Model (Blanchard et al., 1985).

Prior to data collection, approval for the use of human subjects was obtained from the university's Institutional Review Board. Participants were selected using purposive sampling. This type of sampling is used to "select cases that are likely to be 'information rich' with respect to the purposes of the study" (Gall, Gall & Borg, 2007, p. 178). All cooperating teachers were sent an email asking for permission to be contacted to participate in the interviews. All of the cooperating teachers, except one agreed to participate ($N = 7$). In accordance with IRB protocols there were no further contacts with the cooperating teacher who elected not to participate.

The seven participants were interviewed via telephone using semi-structured interview protocols. Semi-structured interviews allow for flexibility to develop additional questions out of the interviews (Erlandson, Harris, Skipper, & Allen, 1993). Demographic questions before asked before beginning each interview. The average number of years teaching of the cooperating teachers in the sample was 18.14 ($SD = 11.82$). The range for teaching experience was from nine years to forty-three years. The cooperating teachers had worked with an average of 5.29 ($SD = 4.07$) student teachers during their years teaching agriculture. The range of student teachers worked with prior to this particular student teacher was from two to ten.

Qualitative research questions addressed how the cooperating teachers utilized the Situational Leadership® II model when working with their student teachers and their personal beliefs about their role in training future teachers. The questions were developed by the researcher and peer-reviewed by a panel of experts familiar with the purpose of this study including an agricultural education professor, a professor familiar with qualitative methodologies, and an agricultural education doctoral student. All interviews were conducted over the phone and audio-recorded. Each interview lasted approximately 30 minutes. They took place over a period of two weeks at the end of May 2012.

Interviews were audio recorded and then transcribed verbatim into Word documents. Pseudonyms were assigned to each participant in order to protect their identity. Transcripts were analyzed using NVivo using the constant comparative method in which "each stage provides guidance for the next throughout the inquiry" (Lincoln & Guba, 1985, p. 340). Trustworthiness of the study was accomplished by assuring credibility, transferability, dependability, and confirmability (Lincoln and Guba, 1985). Efforts to establish credibility were done by triangulating data, peer debriefing, and member checks. Confirmability was established through the use of an audit trail and knowledge of potential researcher bias. The use of thick descriptions and purposive sampling contributed to the transferability while an audit trail and assigning pseudonyms for each participant addressed the dependability.

Findings

RO1: Describe how cooperating teachers applied components of the Situational Leadership® II model when working with their student teacher.

Expectations for Student Teachers

In order to help the student teachers develop, it is important to understand what is expected of them by their cooperating teacher. There were several key expectations that revolved around professionalism and being open-minded. Danny said, "I want them to be prompt, and responsible, on-time and treat the kids with respect and teach class like it is supposed to be taught." Billie responded, "Lots of things from professionalism, being here on time, following school policy…" Glen said, "I want them to have good communication skills, not only with the students, but with our parents group, with our administrators and with our students and community." Franklin said, "Being open-minded to different ideas and also somebody who is not afraid to give their opinion if they think it is necessary."

Other expectations focused on teaching and getting involved in the program. Glen said, "I want them to teach the whole period. I want them to have the kids involved the whole period. I don't want to waste any class time or lab time." Franklin said, "I expect them to be able to come in and have an idea of what is expected in the classroom, how to teach, ability to get along with students, have a correct attitude and attitude and willingness to learn."

Several spoke to the need for the student teacher to jump in and get involved as he or she enters the student teaching site. Henry said, "Get involved with the kids and get to know them pretty quickly and then start taking on responsibilities as they feel comfortable."

Alan agreed that the student teachers need to immerse themselves quickly, while also recognizing that they do not know everything yet. He added:

> I don't expect them to know everything. I like for them to ask questions. I also don't want to be one of those to look over their shoulder at all times. I think a lot of times you learn by doing. I want them to hit the ground running and just jump in and go to work.

Finally, cooperating teachers said they understand the student teaching semester is a learning experience and want their student teacher(s) to be open to the development process. Billie said, "I think it is important for them to learn and grow as a teacher."

Areas for Development

Teachers were able to identify areas in which their student teacher needed extra assistance in order to develop. Although no two were the exact same, the cooperating teachers were all able to identify at least one competency they focused on helping their student teacher improve.

Classroom management and lesson planning were areas for growth identified by several of the cooperating teachers. Danny said, "I would say he needed to be able to elaborate on his lesson plans. You get it across, but you still have to fill up the whole time span of your class."

Glen said one area he helped his student teacher develop was dealing with non-traditional agriculture education students. He said, "I think that between myself and my teaching partner that we probably, hopefully, helped him… deal with some of those students that are non-traditional ag students that don't want to be in the class to start with."

Several cooperating teachers mentioned student teachers needed more livestock showing knowledge and ability. Alan said, "I would say probably more the [livestock] show end of it. A lot of kids are like that and not even every ag teacher knows what is going on in the stock shows half the time."

Being the authority figure in the classroom was also an area for development. Eddie said:

> Getting those kids' attention and being the center of the attention for the class and trying to make sure the kids knew that she was the one in charge and they had to pay attention to her… At times she was a little timid to start with, but as the experience went on she really gained a lot of experience with that and did very good and by the end she was great.

Working with the student teachers to become more comfortable in the shop was also mentioned. Billie said, "Well I think probably where she was lacking the most, probably where she felt the least comfortable, was probably in the shop setting. We spent some time out there."

Guidance Depends on Student Teacher

The amount of guidance and support cooperating teachers give to their student teachers was highly influenced by the individual student teacher. Danny said, "Everyone is different. I think you need to sit in and observe them and give them feedback before you just turn them loose."

In terms of the amount of guidance a cooperating teacher should provide, Billie said:

> I think it really just depends on that person. For instance, I didn't give a lot of directives to [student] because she was so motivated and she knew what she needed to do and she did a good job. And she was creative. She was excited about what she was doing. Now some of the other….one of the other young ladies I had, I had to sit her down and tell her, "Look, you know, you can't do this, but you need to be doing this." So I think it really depends on the individual.

Franklin said his role as the cooperating teacher should adjust for each student teacher: "Saying that you are going to do it the same way every single time, I think, is not as beneficial to the student teacher. Guide them, not tell them what to do."

Henry also used a flexible approach to determine the amount of guidance needed. He said:

> I don't want to be controlling so kind of a give and take figuring out what's best for that person and the kind of person that they are. If it is somebody that doesn't need a lot of leadership and guidance, somebody that is pretty self-motivated that can just get in there and handle things, then that is what I let them do – just handle it. Though I guess it is situational.

Assessment of Readiness

Cooperating teachers overall said they felt their student teacher was well prepared for the student teaching experience. They measured their readiness in a variety of ways including lesson planning and eagerness to be involved with the program. Alan said, "Her lessons were well prepared… she had a good rapport with the students. She was one that didn't sit around and wait for things to get done, she just got things done." Glen said, "He came in ready to start and looking forward to finding out which classes he was going to start out with. I feel like he was always very well prepared for the classes that he taught and he had good classroom management skills.

The cooperating teachers shared they are happy with the preparation of the student teachers by [university]. Glen said: "I think [university], and I shared this with the professors when they were up here. I think you are doing a great job on getting the student teachers ready for their student teaching experience." Billie said, "As far as [university] providing student teachers, [they] are doing a good job." Alan commented, "I have always had pretty good experience with [university's] student teachers so that is a good thing."

Appreciated Feedback from University

In order to apply the Situational Leadership® II Model, cooperating teachers were asked to complete four questionnaires over the course of the experience and were sent feedback after the first three. Glen said, "I didn't think they were confusing because I rated [student] very high on all of them, not just because of him, but because I thought he was doing an exceptional job." Eddie said: "I thought they were very easy to fill out, very straight forward, I didn't see any problems. The information you were asking was the very basic of what you need from a cooperating teacher."

Overall, the cooperating teachers were not confused by the questionnaires and understood the purpose for them. Billie said: "No, they weren't confusing. I could follow what you were trying to find out. Is this person really going to be committed going into the field of teaching?" Franklin said, "I thought it was fine, it was helpful, I was asked some pertinent information.

Several mentioned the questionnaires seemed repetitive and expressed slight concern with how certain questions were phrased. Henry said: "Some of them were…maybe didn't seem relevant or they were sort of repetitive. Kind of hard to answer given the situation, I am not sure if it was the way it was worded or what."

In terms of the feedback they received after completing the first three questionnaires, cooperating teachers said they found the information useful overall. Billie said: "I think those were helpful as well. And like I say, you know, [student] is pretty self-motivated and….I could see where if you had a student teacher who was struggling, those definitely would have really been a benefit."

Some liked the feedback forms because it reinforced and validated what they were already doing. Danny said, "I did like the feedback because really, truly that was some of the same stuff that we was doing." Eddie said, "It [feedback form] was something that as I looked at them they were things I kind of realized that that's what I needed to do anyway. So no, I thought they were appropriate and helped. No doubt about it.

Preferred Leadership Style

Cooperating teachers said they fell into the supporting leadership category for the majority of the time they worked with their student teacher, with a few also mentioning the coaching category as a close second.

Billie said, "Probably supporting mostly, I would think" and then elaborated on her decision:

> She [the student teacher] had her own ideas and she would ask me what I thought and most of the time they were great…some of the times when I evaluated her I would say, "You know maybe next time you could do this, this and this." And she was like, "Oh, okay that is a good idea. I think I will." and she would make notes of that. I think a lot of the lessons that she taught she will probably use later.

A few of the cooperating teachers were not sure which leadership style they displayed the majority of the time. Franklin said: "I would probably say mine would be the coaching or supporting. I am not a very good delegator. I think that either coaching or supporting would be where I would be." Glen responded, "I don't delegate to a student teacher…I want their input, and I want to see how they think on things."

RO2: Examine how cooperating teachers conceptualize their role when working with student teachers.

Expose Them to the Realities

Cooperating teachers expressed that their role when working with student teachers involves exposing the student teachers to the reality of the job responsibilities. Many different responsibilities are involved in being a successful agriculture teacher. Danny said, "They need to get across what teaching is really like…A cooperating teacher should be there to guide them and help them understand the everyday stuff." Glen said, "Help them see how to deal with administrators, parents, other teachers, and other organizations within the school."

Providing the experiential piece of the college preparation process is an important part of the process. Henry said, "I think there are only so many things that you can teach in the college classroom… I don't know that I learned enough through any of my classes in college that really helped prepare me for that teaching experience."

Cooperating teachers are also focused on the high school students in their program and making sure they are receiving a good education while allowing the student teacher to practice their teaching methods. Glen said, "One of our primary focuses is to teach the students, teach the class, then utilize all of our extracurricular activities to expand on those and help develop the students' skills but still primarily remembering that we need to teach."

Curriculum is also an important topic area that cooperating teachers want student teachers to become familiar with. Eddie said, "We went through some curriculum… I always try to include my student teachers, 'this is what we are doing in the future, this is why we offer these classes when we offer them.'"

The need for student teachers to be flexible was expressed by the cooperating teachers. Eddie said, "Just trying to teach her…that sometimes you just kind of got to roll with it and do the best you can with what's been given you that day." Franklin said, "One thing that I always try to do is to try to develop that flexibility in student teachers …to [help them] understand that you do have to be flexible and give and take in all that to work."

Advance the Profession

Many of the reasons why cooperating teachers agreed to serve in their role are their philosophical beliefs in bettering the profession. Billie said, "I think it is important for us as educators to help those that are trying to get in the field as well." Franklin said, "It is a chance for me to reach out to somebody who is going to be out there working with the kids in this area or in the country." Glen spoke about the need to keep the profession strong, "I would do anything that I could do to help our profession… I tell all these student teachers it is the best career in the world if you like what you are doing."

Others spoke about the importance of the student teaching semester in their decision to become an agriculture teacher. Eddie said, "I know how important it was, what it meant to me when I was student teaching to have a cooperating teacher who was really good." Henry said, "I think when I was an undergrad student and was on the teaching block it was, that is probably where the biggest impact came from me, was during my student teaching."

Cooperating teachers said they want to teach the student teachers what the job entails and what it will look like when they enter the profession. Franklin said, "Having a student teacher is another way to take it a step further to hopefully teach somebody what goes on, what the programs are like." Glen said, "Well, I think that they need to understand teaching ag is…you have to have a lot of commitment to it... I want to give them a broad idea of everything that this is going to encompass."

The cooperating teachers expressed a desire to help the student teacher become a successful teacher, but allowing them to make mistakes and learn from them. Alan said, "I actually think that cooperating teachers should be there to try to help mold that teacher, but at the same time not keep them from learning things on their own as well." Franklin said, "I think as a supervising teacher you have to be open minded and be willing to let them take hold and make some mistakes because mistakes that I have made in the past that I learned the best from."

Student Teacher's Intent to Teach Can Affect Relationship

All of the cooperating teachers had visited with their student teacher in reference to their intent to teach agriculture after graduation. Several of the student teachers came into the student teaching experiences with very high intentions of seeking a teaching position after graduation. Glen said, "[Student] told me that he wanted to teach and… all the way through it became a stronger drive in him." Billie said, "I really don't know that [student] has probably ever thought about another career."

Other cooperating teachers noticed a change in intention over the course of the semester. Henry said, "I knew going in that she considered teaching as an option, but didn't know if she wanted to teach, which is fine because that is kind of the way I was going into teaching too." Eddie had a similar situation with his student teacher, "Initially she never even thought about doing the ag teaching deal, but about halfway through she was pretty set that if she could get an ag teaching job she would definitely love to do that too."

One student teacher did not plan to teach after graduation. Danny said: "I don't think he really wanted to. I think a lot of that is because he has his family business back in [hometown]. And he was going to go work with his dad."

The majority of the cooperating teachers said they would change the way they interacted and worked with a student teacher who expressed they did not intend to teach after graduation. Eddie said:

> I know I would do what I need to do in terms of completing my duties as a cooperating teacher, but if it comes to a point there is just no way this student teacher would want to be a teacher, I might back off a little bit it terms of really trying to teach them the ins and outs and small parts. And I know I shouldn't do that, but at the same time there is a lot to do as an ag teacher and if you are just wasting your breath I would rather not do that, if I know they are not ever going to teach.

The cooperating teachers would work to encourage the student teacher to consider teaching and get them excited to become an agricultural education teacher. Billie said, "I think I would try to figure out why they didn't want to teach." Alan said, "I think more it would probably prompt me to try to urge them to teach, push them in that direction."

Conclusions/Implications/Recommendations

Cooperating teachers were able to discuss their feelings toward the use of a leadership model when working with student teachers during the spring 2012 semester. They also described their role when working with student teachers. One of the participants in this study agrees that the role of the cooperating teacher is essential, "I think that role is pretty important, and I actually am really glad you are doing this kind of research."

The type and amount of guidance provided to student teachers by the cooperating teachers varied depending on the student teacher. The realization that every student teacher is different and must be guided differently, depending on their competence and commitment level, was a reassuring theme expressed by the cooperating teachers. Cooperating teachers in Tannehill's (1989) study also expressed an understanding that expectations should be matched to capabilities.

Cooperating teachers articulated specific expectations of their student teachers. The expectations focused on professionalism, being open-minded to the student teaching experience, getting involved in the program, and open to the development process. Student teachers should be professional, but also eager to soak up all the experiences and knowledge they can from their cooperating teacher. The expectations are similar to that of a full-time agricultural education teacher (Roberts, Dooley, Harlin, & Murphey, 2006), but should be examined further for other specific expectations of student teachers.

The preferred leadership style exhibited by the cooperating teacher was not well-established or known by the individuals interviewed. The majority of cooperating teachers in Wimmer, Brashears, and Burris's (2012) study reported to prefer the supporting leadership style which ties to the estimation of these cooperating teachers indicating they may be a supporter when working with their student teacher. The preferred leadership style of the cooperating teacher could be an unconscious influencer on how they work with their student teacher and the type of supervision used by the cooperating teacher. More should be done to educate cooperating teachers on making conscious leadership decisions when they are working with their student teachers. Also, more research should be conducted to correlate leadership style with supervisory style used.

Further research using the contextual supervisory model (Ralph, 1994) should be conducted. The model focuses on matching the supervisory style with the readiness level of the student teacher on a particular task (Stephens & Waters, 2009) which is connected to the Situational Leadership® II Model (Blanchard et al., 1985).

The questionnaires cooperating teachers were asked to complete over the course of the semester were not confusing or time-consuming, but they did mention their repetitive nature. Cooperating teachers also mentioned they appreciated the feedback, but recognized they were already performing the items stated in the feedback email. Asking and providing information throughout the semester was welcomed by the cooperating teachers. This is similar to Kahn's (2001) finding in which the cooperating teachers wanted more communication from the university in connection to working with student teachers.

Cooperating teachers expressed an understanding of the importance of the student teaching experience in getting future teachers excited and prepared to enter the classroom. The lessons student teachers learn in a real classroom are an essential component of the student teaching experience (Harlin et al., 2002). Cooperating teachers want to know if their student teacher wants to teach or not and use that information to structure the experience. If a student teacher states they are not planning to teach, cooperating teachers shared they would still do their job, but they may alter their efforts.

"The role of the cooperating teacher appears to be the most neglected aspect of the student teaching experience" (Tannehill, 1989, p. 252). More research should be conducted to better understand the best methods to train and support cooperating teachers during the student teaching experience. The university teacher education program should have more knowledge of the unique needs of the cooperating teacher and how best to assist them (Tannehill). Training efforts should be made by teacher educators in an effort to better equip cooperating teachers with the knowledge and skills needed to more effectively work with student teachers. Previous researchers have also recommended training cooperating teachers in supervision through special workshops or courses (Deeds, 1993; Deeds & Barrick, 1986; Norris, Larke, & Briers, 1990; Young & Edwards, 2006).

Teacher educators need to seek out cooperating teachers who will promote the profession and work to convince an undecided student teacher to choose to teach after graduation. "Given the importance of the student teaching experience, it is critical that interns be placed with cooperating teachers that will provide them with the best experience available" (Roberts & Dyer, 2004, p. 11). The attitudes and behaviors of cooperating teachers can be affected and influenced by feedback and coaching from the university teacher education faculty (Bojarsky, 1985).

Building and maintaining a strong connection between the university faculty and the cooperating teacher will help student teachers have the best experience possible. An open dialog should exist between the university and cooperating teachers in an effort to identify and improve areas of the teacher education program. Naturalistic inquiry would allow for observational studies "focused on cooperating teacher behaviors during student teacher supervision" (Thobega & Miller, 2007, p. 72) to better understand the relationship between the student teacher and cooperating teacher.

Roberts (2006) recommended using the model of cooperating teacher effectiveness "with cooperating teachers to enhance understanding of the dimensions that student teachers find important in cooperating teachers" (p.11). The model includes several characteristics which are of particular interest in the Student Teacher/Cooperating Teacher Relationship category: anticipates needs of student teacher, provides clear expectations, provides constructive feedback/evaluation, assists student teacher when needed, praises student teacher when appropriate, gives student teacher control. These are related to the dynamics of the Situational Leadership® II Model (Blanchard et al., 1985) and should be emphasized in training workshops.

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Cooperating Teachers' Reflections of the Student Teaching Experience: A Qualitative Study

The purpose of this study was to qualitatively investigate the student teaching experience from the cooperating teachers' point of view. Moreover, the researchers sought explore the application of a leadership model to identify the developmental needs of the student teacher and to conceptualize the cooperating teacher's role in the student teaching experience.

The researchers did an outstanding job describing the problem and need for their study. Appropriate literature was used to provide the conceptual and theoretical foundation for the study. The Situational Leadership II Model by Blanchard, et al. was appropriate to use at the theoretical framework for this study. For those who may be unfamiliar with this model, I wish the researchers would have included a figure within the paper to show and describe the model.

Appropriate research methodologies and analytical techniques were used in the study. As I read the research paper, it would have helped me to know what questions were asked of the cooperating teachers and how those questions were related to the components of the theoretical model utilized in the study. I can see the answers as it relates to the objectives of the study, but I could not really determine what interview questions were asked to solicit the answers.

While the results and the conclusions were interesting to read, I was hoping that the conclusions and recommendations would have tied back more into the Situational Leadership II Model as indicated by research objective number one. I guess I was looking for the key words of the model as I was reading the conclusions. Also, as the researchers seek to answer research objective two, was any thought given to developing a figure see how the cooperating teachers conceptualized their role when working with student teachers?

As I know this is only one part of a larger study completed by the researchers, I look forward to seeing the complete picture of this study as it relates to the application of the Situational Leadership II Model to the student teaching experience in agricultural education. I wish the researchers the best and look forward to more of their presentations on this study at future conferences.

Perceived Importance of the Supervised Agricultural Experience Component of Agricultural Education as Reported by Pre-service Teachers: A Longitudinal Study

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Abstract

The purpose of this longitudinal cohort study was to assess pre-service teachers' perceptions of Supervised Agricultural Experience (SAE) importance as well as perceived barriers to conducting SAE. A census of the junior level agricultural education course at Oklahoma State University was conducted to gauge perceptions at the beginning (n = 35) and end (n = 33) of the course. This study was framed around Ajzen's Theory of Planned Behavior. These pre-service teachers perceived SAE to be an important component of the total agricultural education model and that SAE was important at the secondary school they attended. The item "[t]here are new SAE categories, such as research that I am not familiar with conducting" was perceived to be the greatest barrier both at the beginning and end of the course by the pre-service teachers. It is recommended that pre-service agriculture teachers be exposed to all types of SAE. This would allow pre-service teachers to perceive they have more control over this particular barrier of SAE implementation. In addition, this cohort of pre-service teachers should be surveyed over time to determine whether their perceived barriers of SAE implementation changed as they progress in the teacher preparation program. In-service agriculture teachers also should be surveyed to determine if perceived barriers differ with professional experience.

Introduction and Conceptual Framework

School-based agricultural education programs are founded on the delivery of classroom and laboratory instruction, supervised agricultural experiences (SAE) and youth development through the National FFA Organization (Phipps, Osborne, Dyer & Ball, 2008). The implementation of this comprehensive approach requires agricultural education teachers to facilitate multiple duties and responsibilities that align with each component of the program; one of these responsibilities includes facilitating students' SAE programs.

The scope of work required of an agricultural education instructor includes implementation of SAE as an important element of the job (Wilson & Moore, 2007). The SAE component of the agricultural education program is often operationalized as the "hands-on" element of the agricultural education experience. SAE as well as other youth development opportunities provide a gateway for experiential, inquiry-based learning to occur (Parr & Edwards, 2004). SAE projects can help fill the cognitive gap between agricultural content learned in the classroom and how the knowledge is applied in real-life situations (Phipps et al., 2008). This contextual learning opportunity provides agricultural education tremendous 'credibility' with those who are responsible for making important decisions regarding program availability at the local level (Cheek, Arrington, Carter, & Randell, 1994; Gentry-Smith & Myers, 2012; Kalme & Dyer, 2000).

Other benefits of SAE are reported in the literature. SAEs have been linked positively with student achievement (Arrington & Cheek, 1990; Cheek, et al., 1994) and SAE has been shown to increase enrollment in agricultural education (Retallick & Martin, 2008; Talbert & Balschweid, 2004; Thompson & Schumacher, 1998; White & Pals, 2004). In addition, several studies indicated that agriculture teachers believe SAE helps students to develop desirable work habits, attitudes, and skills (Berkey & Sutphin, 1984; Ramsey & Edwards, 2012; Stewart & Birkenholz, 1991). Despite the importance to the total program and the benefits reported in the literature, experts in agricultural education disagree on many indicators of what constitutes "high quality" SAE (Jenkins & Kitchel, 2009).

Unfortunately, instead of an increase in SAE participation among agricultural education students the opposite is being reported in agricultural education programs. Baggett-Harlin and Weeks (2000) reported Oklahoma students were "being passed through agricultural education programs without having SAEs or record books or being involved in FFA" (p. 171). Young and Edwards (2006) reported Oklahoma cooperating teachers and student teachers ranked SAE as the lowest of five core areas representing the student teaching experience. Blackburn and Ramsey (2011) conducted a study of pre-service agricultural education students enrolled in an Introduction to Agricultural Education course and found they were unfamiliar with the different categories of SAE programs. The diminished implementation of the SAE component of the agricultural education program could narrow the programs potential as a gateway for student inquiry and experiential learning. Jenkins and Kitchel (2009) conducted a Delphi study to identify quality indicators of SAE and found that the expert panel was only able to reach agreement on six items. The agricultural education profession appears to disagree on the definition of quality SAE (Jenkins & Kitchel, 2009). Teacher educators, through course work, students' early field experience and student teaching should reinforce the importance of SAE to pre-service teachers and provide strategies that will allow future teachers to manage barriers they may encounter and highlight the experiential learning opportunities afforded through the SAE component of agricultural education.

Conceptually, this study is supported by Ajzen's (1991) work describing the role of beliefs in human behavior. In particular, the construct of *belief salience* i.e., "a relation between a person's salient beliefs about the behavior and his or her attitude toward that behavior" (p. 192) exists and therefore informs an individual's perceptions. Accordingly, it was posited that pre-service teachers perceptions are valid reflections of their attitudes regarding importance and implementation of selected elements of SAE.

The intent to perform a behavior is influenced by motivational factors and indicates how much effort an individual will exert to perform the behavior (see Figure 1). Therefore, "the stronger the intention to engage in a behavior, the more likely should be its performance" (Ajzen, 1991, p. 181). Intention to perform a behavior is influenced by the individual's attitude toward the behavior, the subjective norm surrounding the behavior, and perceived behavior control (Ajzen, 1991).

Behavioral beliefs indicate how favorable or unfavorable a behavior is perceived to be and influence an individual's attitude towards the behavior. Behaviors that are perceived to be favorable tend to aid in the development of a positive attitude toward the behavior. Intention to perform a behavior is also impacted by "perceived social pressure to perform or not perform the behavior" (Ajzen, 1991, p. 188). Perceived subjective norms are influenced by individual's normative beliefs, or how likely that "referent individuals or groups approve or disapprove of performing a given behavior" (Ajzen, 1991, p. 195). The final factor affecting intention is the individual's perception of the ease or difficulty of behavior performance, referred to as perceived behavioral control. Ajzen (1991) describes an individual's beliefs of the "presence or absence of requisite resources and opportunities" as control beliefs (p. 196). Control beliefs, therefore, influence perceived behavior control. Also present in the model is actual behavior control. Actual behavioral control refers to skills, abilities, and other prerequisites possessed by the individual needed to perform the given behavior (Ajzen, 1991, 2002).

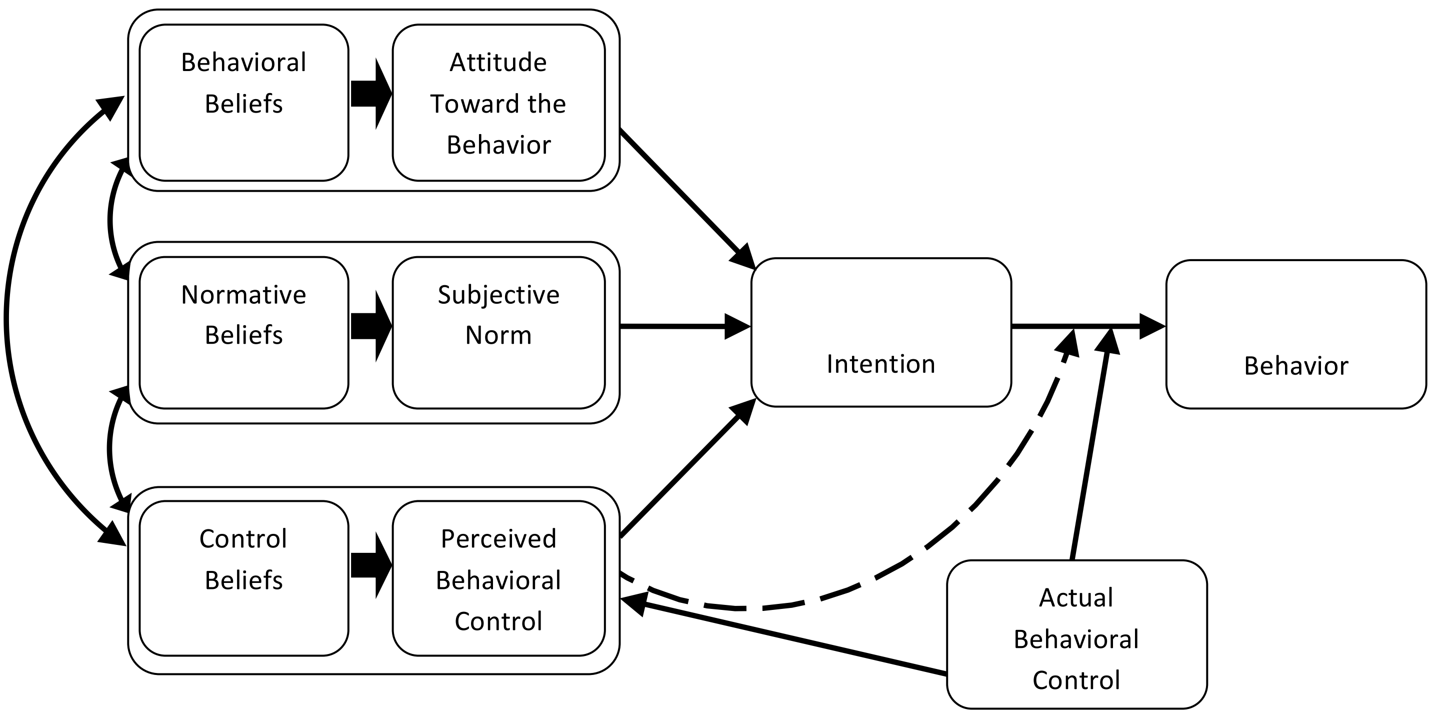

Figure 1. The Theory of Planned Behavior. Adapted from "The Theory of Planned Behavior," by I. Ajzen, 1991, *Organizational Behavior and Human Decision Processes, 50*(2), p. 182. Copyright 2006 by Icek Ajzen.

Previous research has indicated that agriculture teachers had a positive attitude towards implementing quality SAEs (White, 2008; Wilson & Moore, 2007). This positive attitude, coupled with efforts at the state and national levels to promote SAE (Wilson & Moore, 2007) indicate a positive subjective norm toward the behavior of implementing SAE. However, agriculture teachers "need help improving the quality of the SAE component of their program" (Wilson & Moore, 2007, p. 89). Perhaps teachers perceive the behavior of implementing SAE is out of their control. Time, lack of summer contract, student numbers, poor administrative/ community support, limited resources, and lack of knowledge in newer types of SAE have been reported as barriers to SAE implementation (Wilson & Moore, 2007; White; 2008; Blackburn &

Ramsey, 2012). Perhaps the preparation of pre-service teachers could influence the students' perceptions of SAE implementation (Blackburn & Ramsey, 2012).

This study will aid researchers and teacher educators in understanding better "Research Priority Area 5: Efficient and Effective Agricultural Education Programs" (Doerfert, 2011, p. 24). Specifically, key outcome one: "Highly effective educational programs will meet the academic, career, and developmental needs of diverse learners in all settings and at all levels" (p. 24) is addressed by this research study. Even though the importance of SAE and its benefits to students and programs have been reported in the literature (Dyer & Williams, 1997), the profession appears to be at a crossroads in its view of what indicates quality SAE (Jenkins & Kitchel, 2009). Despite the lack of agreement of quality, the tradition and philosophy of SAE is an important component of the total agricultural education program. SAE serves as a link between classroom knowledge and practical application of knowledge (Phipps et al., 2008), therefore, it is vital to identify pre-service agriculture teachers perceptions of barriers to implementing quality SAEs. Based on the review of the literature, the principle research question that guided this study was "What items do pre-service agriculture teachers at Oklahoma State University perceive as being beyond their control regarding the implementation of the SAE component of agricultural education?"

Purpose of the Study

The multifold purpose of this longitudinal cohort study was to 1) determine the level of importance pre-service agricultural education teachers enrolled in a junior level agricultural education course at Oklahoma State University placed on SAE by, 2) identify factors that may impact SAE implementation in the total agricultural education program, and 3) determine if pre-service teachers' perceptions of SAE importance and factors affecting SAE implementation changed during enrollment in a junior level agricultural education course. The following research objectives guided the study:

1. Describe the personal characteristics of pre-service agricultural education teachers enrolled in a junior level agricultural education course at Oklahoma State University.
2. Determine pre-service agricultural education teachers' perceived level of importance for SAE.
3. Identify factors that pre-service agricultural education teachers perceived impacted their ability to implement SAE in the school-based agricultural education program.
4. Describe changes in pre-service teacher's perceptions of the importance of SAE, as measured at the beginning and end of the spring semester of 2012.
5. Describe changes in pre-service teachers' perceptions of factors affecting SAE implementation, as measured at the beginning and end of the spring semester of 2012.

Methods

This longitudinal cohort study was descriptive in nature. Gay, Mills, and Airasian (2009) defined a study as longitudinal if data are collected at least twice to determine changes over time. Specifically, a cohort study involves selecting a specific population and collecting data at different points in time (Gay et al., 2009). This study focused on a census of pre-service teachers enrolled in a junior level agricultural education course at Oklahoma State University during the spring semester of 2012. This course is the second course pre-service teachers complete during their junior year. The focus of this course is planning a community program, specifically regarding SAE project management and FFA chapter advisement. Data were collected at two points during the semester, the initial data collection occurred on the first day of the course. All (n = 35) students completed the instrument resulting in a 100 % response rate. The second data collection occurred on the last day of the course. Thirty-three of the 35 students completed the instruments yielding a response rate of 94 %.

A modified version of the instrument utilized by Wilson & Moore (2007) was employed in this study. Face and content validity were evaluated by a panel of experts representing Oklahoma State University agricultural education faculty and graduate students and Oklahoma agricultural education state staff. A pilot study was conducted to determine the reliability of the instrument: As determined by the importance of implementing SAE a reliability estimate of α = .84 was reported. As a result of the pilot study, minor adjustments to the instrument were made for clarity. The final version of the instrument contained a section to determine students' personal characteristics, two items to assess perceived importance of SAE, and 21 items to gauge students' perceptions of factors that could impede SAE implementation. Items were arranged on a five point Likert-type scale with *5* indicating *Strongly Agree*, *4* indicating *Agree*, *3* indicating *Neutral*, *2* indicating *Disagree*, and *1* indicating *Strongly Disagree*.

Data associated with personal characteristics were nominal in nature and were analyzed using frequencies and percentages. Measures of central tendency were employed to analyze the data associated with perceived importance of SAE and barriers to implementation. Ordinal response scales are utilized to categorize responses with a rank order, however, the "intervals between values cannot be presumed equal" (Jamieson, 2004, p. 1217). Gay et al. (2006) stated that when choosing a measure of central tendency to analyze data, the mean is only "appropriate when the data represent either an interval or ratio scale" (p. 308). Similarly, Miller (1998) described the use of mean scores to describe nominal and ordinal data as "nonsensical" (p. 2). The data of this study represent nominal and ordinal data, therefore, the measures of central tendency reported include the minimum score, maximum score, mode, and median.

Findings

Research Objective 1: Personal Characteristics

Table 1 describes the personal characteristics of pre-service teachers (n = 33) enrolled in a junior level agricultural education course at Oklahoma State University. Nineteen (57.6%) of these students were female and 14 (42.4%) were male. A majority (n = 30) of the students had participated in four or more years of secondary agricultural education. More than 87% (n = 29) of these students were born in 1990 or 1991. Most (n = 24) students identified they had received some level of proficiency award as a secondary agriculture student, with a majority of recipients (n = 11) identifying the local level as the highest level. Most of the students (n = 25) had an SAE project in high school with a majority (n = 23) classifying their project as entrepreneurship.

Table 1

Personal Characteristics of Junior Agricultural Education Students at Oklahoma State University (n = 33)

Variable	*f*	%
Years Enrolled in Secondary Agricultural Education		
None	1	3.0
1 year	1	3.0
2 years	1	3.0
3 years	0	0
4 or more years	30	90.9
Level of Proficiency Award Participation While in High School		
None	3	9.1
Local Level	11	33.3
State Level	8	24.2
National Level	5	15.2
Classification of High School Attended		
Urban	0	0
Rural	33	100
Types of SAE While Enrolled in Secondary Agricultural Education		
Entrepreneurship	23	69.7
Placement	2	6.1
Research	0	0
Other	0	0
Did not have and SAE in High School	2	6.1
Gender		
Male	14	42.4
Female	19	57.6
Highest FFA Degree Earned		
None	2	6.1

Discovery	0	0
Greenhand	0	0
Chapter	2	6.1
State	9	27.3
American	20	60.6
Year Born		
1988	1	3.0
1989	2	6.1
1990	17	51.5
1991	12	36.4
1992	1	3.0

Research Objective 2: Perceived Importance of SAE

Research objective 2 sought to determine how important the pre-service teachers perceived SAE to be to agricultural education students. In addition, students were asked to rate how important they perceived SAE to be at the high school they attended. The students perceived SAE to be important to all agricultural education students, with 10 representing both the median and mode of the data. The students also perceived SAE to be important at the high school they attended, with 8 being the mode for the item. Six was the median score for this item. Table 2 presents the students' perceptions at the beginning of the course.

Table 2

Students' Perceptions of the Importance of SAE at the Beginning of the Course (n = 35)

Item	*Minimum*	*Maximum*	*Median*	*Mode*
Importance of SAE to all agricultural education students	7	10	10	10
Importance of SAE in your high school Ag program	1	10	6	8

Note. 1 = Not Important … 10 = Important

Table 3 presents the student's perceived SAE importance at the end of the course. At the end of the course, the students perceived SAE to be important to all agricultural education students with 10 representing the median and mode of the data. The students also perceived the importance of SAE in their high school programs to be important with 8 as the median and 10 the mode of the data.

Table 3

Students' Perceptions of the Importance of SAE at the End of the Course (n = 33)

Item	*Minimum*	*Maximum*	*Median*	*Mode*
Importance of SAE to all agricultural education students	6	10	10	10
How important was SAE in your high school Ag program	1	10	8	10

Note. 1 = Not Important … 10 = Important

Research Objective 3: Factors Perceived to Affect SAE Implementation

At the beginning of the semester, pre-service teachers enrolled in a junior level agricultural education course at Oklahoma State University perceived "[t]here are new SAE categories, such as research that I am not familiar with conducting" as a factor that could affect SAE implementation (see Table 4). This was the only item with a median and mode of *Agree*. The item "SAEs are not required by the state" had a median and mode score of 3, indicating a *Neutral* view of the item as a factor that would affect SAE implementation. The remaining items had medians and modes indicating *Disagree* or *Strongly Disagree*.

Table 4

Pre-service Students' Perceptions of Factors Affecting the Implementation of Supervised Agricultural Experience Program at Beginning of the Course (*n* = 35)

Item	*Min.*	*Max.*	*Median*	*Mode*
There are new SAE categories, such as research that I am not familiar with conducting.	1	5	4	4
SAEs are not required by the state.	1	4	3	3
I do not know how to teach recordkeeping.	1	5	2	2
I will not have time to help each student develop individualized SAE objectives and project plans.	1	5	2	2
Increased opportunities in FFA will leave me less time for	1	5	2	2

SAE.				
I may not encourage students to conduct SAE because they lack resources at home such as a garden area, pasture, barn and/or equipment.	1	3	2	2
It will be harder to garner support for SAE that FFA in my community.	1	4	2	2
I will get more recognition for my chapter by participating in FFA activities than supervising SAE projects.	1	5	3	2
SAE projects are seen by students as homework.	1	4	2	2
I lack the knowledge to offer individualized instruction for my students in all content areas in which SAEs may exist.	1	4	2	2
I may not be able to help students identify SAE opportunities.	1	3	2	2
Parents believe SAEs are an unrealistic expectation of their child.	1	4	2	2
SAEs will not be in my teaching contract	1	4	2	2
SAE recordkeeping is too complicated.	1	4	2	2
I may not encourage students to conduct SAE because I will lack the time to visit their SAE projects.	1	3	1	1
I may not encourage students to conduct SAE because of the lack of recognition by administrators.	1	4	2	1
I do not know how to supervise SAE projects.	1	4	2	1
Nobody really cares if I conduct SAE or not.	1	4	1	1
The concept of SAE is outdated.	1	4	1	1
I may not encourage students to conduct SAEs because I may lack release time to supervise projects.	1	3	1	1
I may not encourage students to conduct SAEs because I may lack school facilities to house projects.	1	3	2	1,2*

Note. 1 = Strongly Disagree; 2 = Disagree; 3 = Neutral; 4 = Agree; 5 = Strongly Agree.

* bimodal

At the end of the semester, the item "[t]here are new SAE categories, such as research that I am not familiar with conducting" was the only item with a mode that fell in the limits of *Agree* (see Table 5). The median score for this item was three, indicating *Neutral*. The item "SAEs are not required by the state" was bimodal indicating the same number of students indicated *Strongly Disagree* and *Neutral*. The remaining items were not perceived as factors that would affect SAE implementation.

Table 5

Pre-service Students' Perceptions of Factors Affecting the Implementation of Supervised Agricultural Experience Program at the End of the Course (*n* = 33)

Item	*Min.*	*Max.*	*Median*	*Mode*
There are new SAE categories, such as research that I am not familiar with conducting.	1	5	3	4
I may not encourage students to conduct SAEs because I may lack school facilities to house projects.	1	4	2	2
I do not know how to teach recordkeeping.	1	4	2	2
Increased opportunities in FFA will leave me less time for SAE.	1	4	2	2
I may not encourage students to conduct SAE because they lack resources at home such as a garden area, pasture, barn and/or equipment.	1	4	2	2
It will be harder to garner support for SAE that FFA in my community.	1	5	2	2
SAE recordkeeping is too complicated.	1	5	2	2
I may not encourage students to conduct SAE because of the lack of recognition by administrators.	1	3	2	2
I will not have time to help each student develop individualized SAE objectives and project plans.	1	2	2	2
I will get more recognition for my chapter by participating in FFA activities than supervising SAE projects.	1	5	3	2
I lack the knowledge to offer individualized instruction for my students in all content areas in which SAEs may exist.	1	4	2	2

I may not be able to help students identify SAE opportunities.	1	3	2	2
Parents believe SAEs are an unrealistic expectation of their child.	1	4	2	2
SAE projects are seen by students as homework.	1	4	2	2
I may not encourage students to conduct SAE because I will lack the time to visit their SAE projects.	1	2	1	1
Nobody really cares if I conduct SAE or not.	1	3	1	1
I do not know how to supervise SAE projects.	1	3	1	1
I may not encourage students to conduct SAEs because I may lack release time to supervise projects.	1	3	1	1
The concept of SAE is outdated.	1	4	2	1
SAEs are not required by the state.	1	5	2	1,3*
SAEs will not be in my teaching contract	1	5	2	1,2*

Note. 1 = Strongly Disagree; 2 = Disagree; 3 = Neutral; 4 = Agree; 5 = Strongly Agree.

* bimodal

Conclusions and Implications

Most students enrolled in this junior level course were female and attended a rural high school. The majority were involved in four years of high school agricultural education, had an SAE classified as entrepreneurship, and had earned their state or American FFA Degree. Fifty eight percent were female, a 31% increase as compared to a similar population reported by Kelsey (2006) who found that females completing at least two pre-service teacher preparation courses were outnumbered by their male peers at Oklahoma State University.

The pre-service teachers were in the middle of the pre-service program at Oklahoma State University. Most of the students had completed three days of early field-based teaching at a local high school and had completed 45 contact hours of early field experience. The pre-service students perceived SAE to be important to all agricultural education students at the beginning and end of the course, consistent with the findings of Blackburn and Ramsey (2012). These students also perceived their own high school SAE program to be important, both at the beginning and end of the course. These findings indicated the students had a positive attitude toward SAE, indicating a positive subjective norm (Ajzen, 1991), consistent with prior research (Wilson & Moore, 2007; White, 2008; Blackburn and Ramsey, 2012). A positive subjective norm and positive attitude towards a behavior are prerequisites for conducting a behavior (Ajzen, 1991).

Per the Theory of Planned Behavior (Ajzen, 1991), the final prerequisite to SAE implementation is perceived behavioral control, or perceptions of barriers. Other researchers have indicated several barriers perceived by in-service teachers (Wilson & Moore, 2007; White, 2008). Jenkins and Kitchel (2009) reported disagreement existed in the agricultural education profession on what constituted a quality SAE program. Their Delphi study found that only six items reached consensus and were deemed quality indicators of SAE. One of the items identified by the panel of experts was the "need for a diversity of SAE types to be promoted" (Jenkins & Kitchel, 2009, p. 40).

Results from this current study support the findings of Blackburn and Ramsey (2012) that pre-service teachers at Oklahoma State University perceive a lack of knowledge of newer types of SAE, specifically research SAE, as a barrier to implementation. Even though the literature is unclear about what constitutes a quality SAE program, evidence exists that suggests supporting a diversity of SAE projects is an indicator of quality (Jenkins & Kitchel, 2009). Could this single barrier reduce the likelihood that pre-service teachers implement SAE? Perhaps only the newer SAE types will be affected by this barrier. Could the fact that most of the students had an entrepreneurship SAE in high school contribute to this perception? Even with the course curriculum and required early field experiences, it is possible that these students just did not know enough to perceive additional barriers to SAE implementation.

Recommendations for Future Research

Although in-service teachers are having problems with implementing SAE in Oklahoma and across the nation (Bagget-Harlin & Weeks, 2000, Young & Edwards, 2006, Wilson & Moore, 2007, White, 2008), Oklahoma State University appears to be instilling a positive philosophy of SAE in pre-service agriculture teachers. Future research should assess barriers to SAE implementation among in-service agriculture teachers at various career stages. Do early career teachers perceive barriers similar to pre-service teachers, or because of their experiences, do they perceive many barriers? How do the barrier perceptions of early career teachers differ from mid to late career agriculture teachers? Do more experienced teachers perceive more items within their behavioral control or have they determined what types of SAE they excel in implementing and, therefore focus their efforts mostly on those types of experiences?

This cohort of pre-service teachers should be surveyed once they enter the agricultural education profession to determine if and how their perceptions of barriers to SAE implementation change. In addition, most of the pre-service teachers in this study indicated they had an entrepreneurial SAE in high school. Research on secondary SAE projects in Oklahoma should be conducted to determine if that is the norm and if students who complete other types of SAE projects choose different career paths. Perhaps in-service teachers in Oklahoma perceive barriers that prevent them from expanding the diversity of the SAE component at their local school. Diversity of SAEs is one of only six quality indicators of SAE (Jenkins & Kitchel, 2009), therefore, it is important for researchers in Oklahoma to determine the types of SAE being implemented.

Recommendations for Practice

It is encouraging that the pre-service teachers entered the course perceiving SAE to be important and continue to value it at the end. However, these students reported they were not comfortable implementing research-oriented SAE projects. The course's instructor should recognize this and implement strategies to reduce students' lack of self-efficacy for this aspect of SAEs. Currently, pre-service teachers are required to complete 45 contact hours of early field experience to be admitted to the professional education unit at Oklahoma State University. The instructor of the course studied should identify opportunities for pre-service teachers to earn hours while learning about SAE implementation. Further, teachers in Oklahoma who implement research SAEs at a high level should be identified and utilized as guest speakers in this course. Because the Oklahoma FFA Agriscience Fair is held usually during the same semester as the course, the course instructor should encourage students to attend this event to view examples of research SAE. Students should be exposed to a variety of SAE types "early and often" throughout their pre-service preparation. Oklahoma State University has a unique opportunity of offering one credit-hour outreach courses, so perhaps a course on SAE should be developed and taught through that venue.

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Dicussant Remarks: Dr. Kirk A. Swortzel
Mississippi State University

Perceived Importance of the Supervised Agricultural Experience Component of Agricultural Education as Reported by Pre-service Teachers: A Longitudinal Study

The researchers address an important topic that has lingered for years within agricultural education. In fact, the issue of supervised agricultural experience programs has probably been, and continues, to be a thorn in the side of having a quality agricultural education program. It is essential to make sure that teachers we produce in pre-service programs have a strong foundation and understanding of the importance of students having an SAE.

The primary purpose of this study was determine if pre-service teachers' perceptions of SAE importance and factors affecting SAE implementation changed during enrollment in a junior level agricultural education course. The researchers provided a sound conceptual and theoretical framework to conduct this study and utilized appropriate research methodologies.

The results and conclusions of this study were pleasant to read. For the most part, I was pleased to see that pre-service teachers held supervised agricultural experience programs in high regard. There were still those that had no idea about the importance of SAE in high school programs, but I suspect that will always be the case.

There is still a lot of research to be conducted in this area and the researchers do an outstanding job of identifying topics for future research on the subject. The researchers also do an outstanding job of identifying ways we in teacher education need to work with future teachers on how to work with high school students in developing quality SAEs in the future.

Recently within the profession, the renewal of SAEs has emerged once again as a serious topic we need to address within teacher education. This study helps bring this topic to the forefront. If we are to have a quality, complete agricultural education program at the secondary level, SAE needs to be a part of it.

I commend the researchers for an enlightening study and wish them well on future studies.

The Perceptions of the Quality of Education Received from PhD Graduate Teaching Assistant Instructors through the Eyes of Four Agricultural Education Preservice Teachers

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Abstract

University faculty members have been challenged with increased teaching and research responsibilities. As a result, universities have employed graduate teaching assistants (GTAs) to serve undergraduate students. This study used a qualitative approach in order to explore the perceptions of the quality of education received from PhD GTAs. Four in–depth interviews were conducted with preservice agricultural teachers and domain analysis was conducted to identify the preservice teachers feelings regarding the quality of education received from PhD GTAs. Three domains were delineated from the findings and revealed that the four participants felt that PhD GTAs served a vital role in their education and provided a quality education. The findings from this study should be used to improve instructional capabilities of PhD GTAs in order for preservice agricultural teachers to continue to receive a high quality education.

Introduction

In 2011, the United States Department of Education reported that 2.4 million graduate students were currently working on a degree within the United States, while the number of professors in the United States exceeded 1.7 million (Bureau of Labor Statistics, 2011). While completing graduate degree programs, graduate students are commonly employed as graduate teaching assistants (GTAs) and commonly used in large universities to help the university operate smoothly and serve undergraduate students (Austin, 2002), since university faculty members teaching and research responsibilities have increased (Shannon, Twale, & Moore, 1998). GTAs are accepted as an integral part of the higher education system in North America through their research and teaching roles (Park, 2004).

GTAs, with teaching roles, are expected to be experts in their field and to provide undergraduates with an excellent and effective education, through the utilization of appropriate pedagogical strategies (Luft, Kurdziel, Roehrig, & Turner, 2004). According to the National Research Council (2009), the teaching methods and styles that an instructor integrates into the classroom are often based on how that instructor was taught. As university budgets are constrained, GTAs are likely to face increased workloads (Bettinger & Long, 2004; Luft et al., 2004; National Research Council, 1996a; Park, 2004). However, faculty and higher education institutions have acknowledged that expertise in teaching takes time to develop (Luft, et al, 2004). In turn, GTAs need proper training and support in order to perfect their teaching abilities (Luft et al., 2004; Shoulders, Stripling, & Estepp, 2012).

Literature Review

Parents, employers, and legislators are interested in the quality of teaching provided at universities and colleges across the United States. This includes the teaching methods used by individuals who provide instruction in the collegiate classroom (Austin, 2002). Since GTAs are a major part of the university system in the United States (Park, 2004), it is critical to examine the quality of education provided by GTAs.

Bettinger and Long (2004) found that when a graduate student serves as the lead instructor of a course, students will often take fewer credits within the particular content area. This experience will reduce the likelihood of the student choosing that content area as a major. Shoulders, Stripling, and Estepp (2012) found that undergraduate students that had bad prior experiences with GTA's, are hesitant to take additional courses taught by GTA's. However, if the GTA had prior teaching experience and established credibility at the beginning of the course, undergraduate students could be influenced to change their opinion of the course and GTA instructor.

Furthermore, Schuckman (1990) found that GTAs in introductory courses received higher teaching evaluations than professors that taught the same course. A study conducted by Prieto and Altmajer (1994) found that GTAs self–efficacy increased as the GTAs prior teaching experience increased or when the GTA attended training to help prepare them for their teaching responsibilities. However, Luft et al. (2004) reported that the majority of GTAs that attended university led trainings did not feel that the trainings were effective. The GTAs reported that the trainings were too generalized and needed to be more focused in order to effectively prepare them for their teaching responsibilities (Luft et al., 2004). GTAs often have very little to no training or prior teaching experience upon entering the college classroom (Lumsden, 1993). Causing GTA's to be placed under an extreme amount of stress and being unprepared to be an effective classroom instructor (Bettinger & Long, 2004). Moreover, Roberts and Dyer (2004) conducted a study to delineate the effective characteristics of an agriculture teacher. Sixteen characteristics were identified through the study. Please consult Roberts and Dyer (2004) for a complete listing of the characteristics of an effective agriculture teacher.

Shoulders et al. (2012) found that undergraduate preservice agricultural education students' perception of GTAs can change over time when the preservice teacher recognizes that the GTA has had more recent experiences that will relate to their future than professors. However, additional perceptions from undergraduate students regarding the quality of education received from PhD student lead instructors are lacking from the literature. Shoulders et al. (2012) argued that a need exists to better understand the relationship between a GTA, who has teaching experience, and preservice agricultural education teachers.

Theoretical Perspective/Epistemological Perspective

This study utilized constructivism as the theoretical perspective. Constructivism posits that people individually create their own knowledge based on personal experiences (Crotty, 1998); furthermore, social interactions can influence an individual's construction of reality and knowledge (Flick, 2006). Crotty stated, "constructivism describes the individual human subject engaging with objects (inanimate or animate) in the world and making sense of them" (p. 79). Constructivism takes into consideration each person's unique experience and views their experience and knowledge formation as valid (Crotty, 1998). This study sought to describe preservice agricultural education students perceptions of education received from PhD GTA lead

instructors. The theoretical perspective of constructivism allowed the researchers to obtain, focus on, and analyze the individual experiences that shaped the participants view of education received from PhD GTA student instructors.
Additionally, the epistemology for this study was constructionism. Crotty (1998) asserted that the epistemology provides a theory of knowledge, which is part of the theoretical perspective, and the methodology of the study. The epistemology of constructionism was used due its assertion that humans construct their own reality through interactions with the external environment (Crotty, 2008).

Theoretical Framework

Bandura's (1986) social cognitive theory served as the theoretical framework for this study. The social cognitive theory asserted that learning happens through observation, imitation, and modeling (Ormrod, 2008). According to Bandura, interactions between the individuals' internal cognitive processes and external factors combine to produce learning. The model of triadic reciprocality was used due to its emphasis on the interaction between behavior, personal factors, and the environment (Bandura, 1986). Bandura (1989a) described the determinants of the triadic reciprocality model (Figure 1) as interacting determinants that exert influence on one another, but do not always exert an equal amount of influence on each factor.

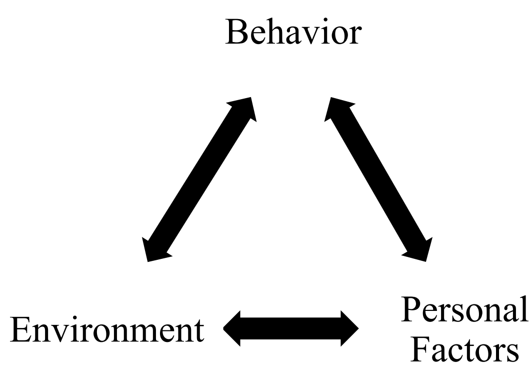

Figure 1. Triadic Reciprocality (Bandura, 1986, p. 24)

Purpose

The purpose of this study was to describe preservice agricultural education students perceptions of education received from lead PhD GTAs to gain further understanding related to the qualities of the instructor of a course. The National Research Agenda calls for research to "deepen our understanding of effective teaching and learning process in all agriculture education environments" (Doerfert, 2011, p 9). The research question addressed in this paper was;

> How do preservice agricultural education students perceive their experiences in classes where their lead instructors are PhD students?

Subjectivity

According to Glense (1999), the subjectivity statement within a qualitative research study allows the researchers to share their personal experiences and beliefs that may influence the research study. Subjectivity statements have been provided by both of the researchers and will be presented in first person.

Researcher A

The research question investigated in this study is a question that I have much experience with. I have been a doctoral student TA for 3 classes and the doctoral lead instructor for 3 classes. I have often wondered how the students feel about having a course taught by someone other than a professor. I am connected to the topic of finding out the perceptions of undergraduate students regarding the quality of education received from a GTA. I hope and want to find that the undergraduate students feel that they are receiving a high quality of education from their GTA. My feelings towards this could potentially influence the way I interrupt and code the data. However, if the findings do not support what I hope they do, I would like to grow from this experience and alter my teaching in order to provide a higher quality of education to the students.

The participants for the study are not my own students so hopefully they will be inclined to give honest answers to the questions. I do not know the participants and am not expecting certain answers from them. I do not feel that my relationship or lack of relationship with the participants will affect how the participants answer the questions.

Researcher B

Growing up in a rural community, I have experienced a variety of instructional techniques both in high school and during my collegiate coursework. As an undergraduate student, I found that having a GTA as an instructor was a normal occurrence. These experiences varied in relation to the effectiveness of the PhD student as an instructor. This could be attributed to a variety of reasons such as, the area in which they are earning their PhD, the instructional training they received, or even their interest in teaching an undergraduate course.

The most memorable experience that I have working with a PhD student was during my public speaking course. My PhD GTA instructor was expected to graduate at the end of the summer term. She was extremely engaging and would enter the classroom every day with a smile on her face, excited to present new information to us. In addition, when we were required to present a speech to the class, she always provided positive comments. She would note areas for improvement on your grading rubric instead of announcing them in front of the entire class. This experience may seem normal to some individuals, but I found that most of the PhD GTAs that I had as instructors were not courteous to students and were not as in-tuned with their instructional needs.

As a current PhD GTA instructor for an undergraduate course, I find myself attempting to immolate my public speaking course instructor. Each day I enter the classroom excited to present new information and to provide a positive environment for my students to learn and grow professionally. I can only hope that I have a positive impact on my students' career paths. Additionally, I find that this research will benefit my instructional abilities and assist me in becoming a better instructor both as a PhD GTA and as a professor.

Methods

Participants/Sampling

This study consisted of four undergraduate students studying agricultural education at the University of Florida within the College of Agricultural and Life Sciences. Participants were recruited for this study by email. An email was sent to the College of Agricultural and Life Sciences administrative secretary, who forwarded the email to the undergraduate students on the college's list serve. The four students in this study were purposively selected based on their enrollment in the agricultural education teacher preparation program. A purposive sample was collected to examine the specific objectives of the study. Specifically, typical sampling was utilized to seek the average participant (Merriam, 1998).

The participants included one male and three female students. Three of the participants were in their senior year and planned to conduct their student teaching experience in the spring of 2012. The fourth student was in their junior year and had three more semesters to complete in their program. Three of the four participants had GTAs both inside the Department of Agricultural Education and Communication as well as in their general education courses. One participant only had experiences with GTAs within the Department of Agricultural Education and Communication. The educational training that all four of the participants have received plays a role in constructing their perceptions of GTAs.

Data Collection

This study used individual interviews to determine the perceptions that preservice teachers, within the Department of Agricultural Education and Communication at the University of Florida, have regarding the quality of education provided by GTAs that were lead instructors of a course. Semi–structured interviews were developed and used for this study. According to Koro-Ljungberg, Yendol-Hoppey, Smith and Hayes (2009) when using a constructivist methodology, one of the proper data collection methods is the use of individual interviews. Dooley (2007) purported that "most qualitative researchers are guided by a set of basic questions and issues to explore but deviations may occur in order to capture nuances and emerging trends not previously determined" (p.36).

Participants were asked a variety of questions related to the experiences they had with PhD students as instructors. Additionally, participants were asked questions about qualities that aided GTAs in being successful or unsuccessful as an instructor. Questions were also used to compare the quality of instruction provided by a professor that taught a course. The interviews lasted between 30 and 45 minutes and were audio recorded on a digital voice recorder. The data files were transcribed verbatim using an audio program called Express Scribe. Pseudonyms were used to protect the identity of the participants. There were two researchers for this study and each researcher was responsible for conducting interviews with two participants with identical semi-structured questions.

Data Analysis

Domain analysis was used to analyze the collected data. The domain analysis method breaks data sets into small units of cultural knowledge or key topics called domains (Spradley, 1980). The domain analysis method examines the transcripts for common words or phrases that exist within each interview. The four steps of a domain analysis include:

1. Select a single semantic relationship
2. Prepare a domain analysis worksheet
3. Select a sample of field–note entries
4. Search for possible cover terms and included terms that fit the semantic relationship (Spradley, 1980)

However, the researchers deviated from Spradley's (1980) process of domain analysis. Overarching themes were established, and then broken down into domains which consisted of the cover term. Included terms were pulled from the data set and matched with the appropriate cover term (domain). The last step that the researchers completed was to identify the semantic relationship between the cover term (domain) and the included terms. The entire domain analysis procedure was completed and consisted of one domain analysis worksheet for each domain.

Each interview transcription was reviewed three times in order to gain contextual understanding of the data. With each reading a separate theme was examined and key words and phrases were determined. The key words assisted the researcher in establishing the cover terms that were extracted. The researcher delineated broad and narrow terms that described the domains that were established. Spradley (1980) reported that researchers can omit or adapt steps based on the individual research program.

Trustworthiness

In order to ensure the trustworthiness of the findings, attention was given to the credibility, transferability, dependability, and confirmability of the research. Credibility was achieved through the use of triangulation, peer debriefing, and member checking (Lincoln & Guba, 1985). Triangulation was attained through the use of multiple interviews and multiple researchers. Member checking was verbally done throughout the interview process to ensure the appropriate meaning of the respondent's statement was recorded. Additionally, peer debriefing was utilized throughout the research process and allowed the researchers to remove themselves from the research and gain a fresh perspective from a qualitative researcher that was not directly involved in this research study (Erlandson, Harris, Skipper, & Allen, 1993). Transferability was addressed through the use of thick description within the data (Dooley, 2007). The context, findings, and thick description should be reviewed by readers in order to determine if the findings, from this study, could transfer to their situation and context (Lincoln & Guba, 1985). In order to trace data to the original source, a methodological journal was used to document the researchers' methodological decisions in order to prove dependability and confirmability (Dooley, 2007).

Limitations

The researchers' note that due to short interview times and only agricultural education students participating in the study, the conclusions and results could be swayed. The findings from this study could be influenced by the participant's coursework and interest in the education field. In addition, the participants primarily experienced GTAs in small classroom setting within agricultural education classrooms.

Furthermore, the researchers found that the questions included in the interview guide did not provide as much detail, as initially perceived, about undergraduate students' perceptions of the qualities of PhD GTA lead instructors. The lack of participant review of the transcripts could also be a limitation of the study. These limitations provide a need for further investigation on the topic both in a qualitative and quantitative manner.

Findings

To assist in providing anonymity, the participants' names have been changed. The findings were broken down into overarching domains and then into sub–domains. The findings will be described one domain/sub–domain at a time. The following three domains were delineated from the transcripts:

1. The relationship between GTAs student and undergraduate
2. Qualities of GTA student instructors
3. Qualities of a Professor

Relationship between GTAs and Undergraduates

When examining the undergraduate students' responses, the researchers determined that a relationship existed between a PhD GTA lead instructors and undergraduates. It was found that GTAs can both benefit and hinder a student's success. Sub–domains were used to describe the students' responses.

Personable.

Two participants focused on the importance of building positive relationships with their GTAs. They strongly felt that the GTA needed to be personable with their students. Sara said, "We were trying to… get to know her more on the personal side which makes it easier for her to help us…" She wanted a GTA that was willing to talk to her about classroom activities as well as life outside of the classroom. She felt that being personable showed how much the GTA cared about her and it enhanced their relationship. Jenny said, "… they [GTAs] are always willing to sit down and talk to me and it doesn't even have to so with school or something it could be something outside of school". Jenny wants the GTA to be personable and willing to take the time and talk with her.

Understanding/lack of understanding.

One participant felt that the GTAs better understood their individual situations. Jenny said, "… I feel like they [GTAs] are more willing just to sit down because they understand what you are going through a little better than your professors do". She felt that GTAs understood her situation because, typically, GTAs had recently graduated with their undergraduate degrees and were current students. Thus, understanding from a GTA demonstrated how they cared for their students and were willing to take the time to listen and help their students succeed in the course. This participant felt more comfortable asking for guidance when they knew that the GTAs would understand their current situation.

However, it was also found that GTAs sometimes have a lack of understanding regarding undergraduate knowledge. Jason states, "They were saying she was too easy… Ahhh …with her testing and the way that she taught. They said it was more of a middle school/high school base than a collegiate level style of learning." The students' prior knowledge was not always recognized and integrated into the course content/learning activities. The failure to recognize undergraduate knowledge gave the impression that the GTA had low expectations for their students.

Relatable or unrelatable.

Another domain that was evident was the GTAs ability to relate to their students. The participants felt that the GTAs are better able to relate to the undergraduate students than their professors. Sara said, "So I think with the TA you get more, you like connect and they put it down on your level and make it connect with the real world…" It was clear that Sara felt more comfortable with a GTA and counted on them to help her understand the material and make it relevant to her and her future career. Since Sara could relate to the GTA she was much more comfortable working and talking with them. Additionally, Sara felt that she could talk to the GTA due to the relationship they had built. Jenny also felt that GTAs related well with their students. Jenny stated, "They understand what you are talking about and they know what you are going through". The personal connection established between the participants and their GTAs helped foster a positive learning environment.

However, one participant reported that GTAs take their role extremely serious and at times do not provide for the instructional needs of the students. Jessica echoed this by stating, "If that TA umm took time to just kinda chill out I guess and kind of umm not be so serious and not almost put a face on. Umm for me I would learn better from that TA."

Outgoing.

The willingness of the GTAs to go the extra mile helped foster a positive relationship between the GTAs and the students. Jenny said, "I feel like they're [GTAs] more willing at times to spend the extra minute…" The extra effort that the GTAs put into the course came off as a positive aspect and made for a better learning environment. Therefore, Jenny expected GTAs that go above and beyond their job requirements. Jenny stated, "…I know that they [GTAs] are willing to help…" The awareness of the GTA being willing to help, stems from the relationships that the PhD GTA lead instructors formed with the students.

Qualities of a GTA

Collegiate experience/real world experience/teaching experience.

The participants found that GTAs have a broad knowledge base due to their personal course requirements. They felt that since GTAs were currently learning themselves, that there was a higher interest level in sharing information with others. In addition, the participants felt that GTAs have more relevant experiences that would influence undergraduate students learning. The participants felt strongly about the importance of their GTAs having several years' of experience teaching agricultural education in the public school system. Sara said, "…they [GTAs] should be able to know what they are teaching about and have at least a couple years of experience just so they can give us real world scenarios they've encountered." Jessica stated, "A lot of times when I will be there teaching I have done something she [GTAs] has done in her classroom, umm she is able to relate how to make it more effective." The GTA's public school teaching experience helped to show the participants that a PhD GTA lead instructor had valuable knowledge to share.

Additionally, the GTA was capable of understanding what their students were currently experiencing and what they may experience in the future. Sara stated, "Umm being knowledgeable and having that real world experience [teaching] so it's like this going to happen just wait, you'll see it will happen". Sara expressed the importance of having a GTA with high school teaching experience. She felt that the experience her GTA had enhanced her teaching at the University level. It validated what the GTA said and the teaching methods that they were advocating. It is evident in the following quote that Sara also valued the teaching experience of her GTA. Sara stated,

> …In the agricultural education department I feel like having the experience of being a teacher and relaying that to us in the classroom and letting us know well this is what I did in this type of situation definitely makes me understand more of what I am going to be doing in the near future…

The domain of teaching experience came up often in a positive way. The participants felt that GTAs should have to have prior teaching experience if they are in the field of education. If the GTAs are in a field outside of education, they should attend university workshops that prepare GTAs to teach and utilize various teaching methods.

Age proximity.

The participants felt very comfortable with their GTAs and one reason was due to age proximity between the GTA and preservice teacher. Jenny said, "PhD students can relate to students better because not only often are they younger than a lot of professors, but they are still a student…" The participants felt more comfortable working with and talking to GTAs since they were typically closer to their age than professors. Age proximity helped the student be relaxed around the GTAs and focus on the course material without feeling uncomfortable. Furthermore, GTAs were found to be more helpful and approachable. Jason stated, "I feel like he [GTAs] is more on a level with the students more than a professor."

Workload.

The participants felt that the GTAs had a large work load, but were still willing to help them succeed. This made participants feel more comfortable about asking the GTAs for assistance. Jenny said, “PhD students have tons on their plate, but I feel like they're more willing at times to spend the extra minute…” The participants acknowledge the time commitments that GTAs have and felt that they were still willing to help. That made the participants feel at ease with their GTAs and they did not feel as if they were disturbing their GTAs when they had questions or concerns.

Intimidation or lack of intimidation

The participants felt comfortable engaging in conversation with their GTAs. Jenny stated, “I feel like they [GTAs] are often much more approachable than a professor because there are professors that are kind of intimidating and you don't want to bother them”. The approachability of the GTAs allowed the participants to feel confident and comfortable going to their GTAs and asking for guidance. Participants did not feel intimidated by their GTAs and were willing to communicate with them.

Additionally, one of the four participants felt that it was beneficial to take a class taught by a GTA because they were typically less intimidating, easier graders, and had lower expectations than a professor. Jason stated, “the average of the class prior to her teaching [taught by professor] was the average C and everyone in the class received A's and B's that semester”. The thought of receiving a higher grade encouraged the participant to become more engaged in the course.

Finally, one of the participants felt that GTAs were less intimidating than professors because of the amount of time the GTAs have put towards developing and implementing the course. Jessica perceived that GTAs often perform a large amount of the legwork in preparing a course. The involvement of GTAs in the course allowed this participant to perceive GTAs as unintimidating, approachable, and interested in student needs. Jessica said,

> I think that a lot a times you see a PhD Student doing the bulk work. Umm the leg work I guess you could say. I guess I always be more personal with the TA. Umm you know if I have a dumb question. I feel like my TA will be like ok that is a common question you know that is cool.

Qualities of a Professor

Over all the participants were very avid about the fact that professors seem too busy to spend time talking with undergraduate students. The participants felt that a professor was busy because of their increased workload. In turn, this workload would cause them to miss class, which one participant noted as an additional negative aspect of having a professor as the lead instructor. However, one participant noted that they enjoyed having professors and that their teaching has been beneficial. Finally, it was noted by one participant that a professor has little to learn and this can cause for them to seem distanced from the material that they are teaching. Jason said,

> … with a professor they have a lot on their plate. Ahh they could possibly teach multiple different lectures and classes. And with umm TA's from our standpoint as an undergrad,

> they have their classes as well but they are also only teach a minimal amount of lecturing and lessons and so I would say that they have less responsibilities than a professor … , I believe that a professor has already hit their point [in regards to learning] of what they are going to be teaching

Jessica stated,

> Our professors are very busy people and they do very very important things. … it's like when they are its like they won't be there because they are out of town for something … Umm so that has sometimes been a hindrance because you want your professor you like your professor, you love the way that they teach.

While this does seem to show a tendency that participants have less enjoyment from professor lead courses, it can be seen in the quotations that students do respect their professors and appreciate their involvement in the educational process.

Implications/Discussion

Based on the domains established through the interviews, the participants were interested in having GTAs as instructors of courses. This study concurred with the importance of GTAs having prior teaching experience (Prieto & Altmajer, 1994). However, the student participants in this study identified that it was critical for the GTAs to have prior teaching experience and that it made the GTAs more knowledgeable and credible.

Training to help GTAs become effective teachers is something that the participants in this study suggested for GTAs that did not have prior teaching experience (Shoulders et al., 2012). According to Luft et al. (2004), GTAs often feel that university led trainings are not effective. In order to extend university led training sessions and to further develop the teaching skills of GTAs, the participants indicated that GTAs should enroll in a teaching methods course, which could be a viable option for many GTAs. This could assist GTAs outside of education in having a better understanding of how students learn and how they are engaged in coursework. Additionally, a teaching methods course would serve as a refresher course for GTAs that had previous teaching experience. Furthermore, professors overseeing courses should provide more guidance for GTAs, which could aid in increasing the teaching effectiveness of the GTAs, and provide continuity between semesters.

Additionally, the experience that GTAs possess, are of large benefit to students. The participants of this study found that the experience that the GTAs have is relevant to them. However, depending on the field the GTA is in, it is not always possible for them to enter the university setting with prior teaching experience at the secondary level. It is important to distinguish that the undergraduate students from this study recognized additional forms of teaching experience that included the current and previous coursework included in a GTAs degree program and teaching workshops or trainings that are available through the university or outside agencies. In order to assist preservice agricultural educators in gaining knowledge and skills from their classroom interactions with GTAs, it is important for faculty members to encourage GTAs to share their prior experiences with their students when it aligns with the curriculum.

This study differed from Lumsden's (1993) study and found that the majority of GTAs, described in this study, had prior teaching experience at the secondary level. According to the National Research Council (2009), one's teaching style is influenced by how the individual has been taught in the past. Due to the GTAs prior pedagogical training and their teaching experience at the secondary level, the preservice teachers should be positively influenced by the GTAs instructional capabilities.

The importance of positive relationships between the GTAs and their students was a major contributing factor on an undergraduate's perceived educational value of a PhD GTA instructed course. The willingness of a GTA to talk with undergraduate students and take time out of their schedules was a major reason the participants thought highly of the education they received. They suggested that workshops where the GTAs learned how to build relationships with students would be beneficial. The participants preferred GTAs who were closer to their age and were willing to talk with them about class content and assignments, as well as life outside of the classroom. Through the GTAs effort to build positive relationships with students, it was evident that GTAs were effective at communicating with others, and counseling or advising students (Roberts & Dyer, 2004). The participants in this study felt that they received a quality education from GTAs. However, it is critical for a GTA to have prior teaching experience in the classroom or through workshops, and a focus on building positive relationships with their students.

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Discussant Remarks: Dr. Kirk A. Swortzel
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The Perceptions of the Quality of Education Received from PhD Graduate Teaching Assistant Instructors through the Eyes of Four Agricultural Education Preservice Teachers

The purpose of this study was to describe preservice agricultural education students perceptions of education received from lead PhD GTAs to gain further understanding related to the qualities of the instructor of a course. In my years within the profession, I do not recall where such a study of this type has completed. I applaud these young researchers for taking on such unique and challenging study.

I applaud the efforts of the researchers with the quality of study they conducted. The researchers did an outstanding job identifying the issue to be addressed in this study as well as describing the methods and procedures used in this qualitative research study. Appropriate conceptual and theoretical frameworks were utilized in this study.

The findings in this study were interesting to read. The perceptions shared by the preservice teachers within the program appeared to be honest and straightforward.

I would have liked the researchers to identify some areas for additional research or practice based on their study. I think that as we complete research studies, we should always be thinking about areas that we can research further or ways we can improve what we are doing in the profession.

Again, I commend these young researchers for an interesting study and with them well as they prepare to enter the profession with us.