RESEARCH CONFERENCE PROCEEDINGS

North Central Region

American Association for Agricultural Education

Research Session Coordination
The Ohio State University

Research Conference Coordination
University of Purdue

Conference Host
University of Purdue
West Layfette, IN

Friday, October 7, 2016

Review Process for the North Central Research Conference

The AAAE North Central members express their sincere gratitude to NC AAAE colleagues who served as reviewers for research abstracts submitted for the 2016 North Central Research Conference. A total of 38 research manuscripts were submitted. The AAAE Protocol Guidelines for Conference Paper Selection were used in the paper review and selection process. Twenty-four abstracts were selected for presentation at the 2016 North Central Conference.

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Susie Whittington
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2016 North Central Research Conference
Friday, October 7, 2016
8:00 A.M. to 9:30 A.M. - Research Session I

Concurrent Session A

Theme: Extension
Discussant: Dr. Donna Westfall-Rudd, Virginia Tech University
Facilitator: Dr. Jeanea Lambeth, Pittsburg State University

Concurrent Session B

Theme: Science (STEM) in Agriculture
Discussant: Dr. Robert Martin, Iowa State University
Facilitator: Dr. Erica Odera, Penn State University

Concurrent Session C

Theme: Leadership, Management, and Training
Discussant: Dr. Erica Theiman, University of Illinois
Facilitator: Kaila Thorn, Penn State University

Friday, October 7, 2016
10:00 A.M. to 11:30 A.M. - Research Session II

Concurrent Session D

Theme: Preservice Ag Ed
Discussant: Dr. Steve Harbstreit, Kansas State University
Facilitator: Buddy McKendree, Kansas State University

Concurrent Session E

Theme: Ag Comm, Literacy
Discussant: Dr. Annie Specht, The Ohio State University
Facilitator: Siti Abdul Latir, The Ohio State University

Concurrent Session F

Theme: FFA, SAE, Ag Mech
Discussant: Dr. Tom Paulsen, Morningside College
Facilitator: Aaron Giorgi, The Ohio State University

Science Integration: The Role of the Agriculture Teacher

Aaron J. McKim, Michigan State University
Jonathan J. Velez, Oregon State University
Tyson J. Sorensen, Utah State University

Introduction

The agriculture, food, and natural resources education (i.e. AFNRE) discipline has continuously adapted to align with social and educational values (McKim, Balschweid, Velez, & Lambert, 2016). Current ideologies, within society and education, support science, technology, engineering, and mathematics (i.e. STEM) education (Augustine, 2005; Sanders, 2009). In alignment with current trends, many AFNRE teachers are attempting to integrate science within their curriculum. Integrating science within AFNRE accomplishes two important aims: (a) offers students a contextualized method for learning science (National Research Council, 2010) and (b) provides students with the foundational science knowledge of agriculture. Within AFNRE, researchers have sought to examine the efficacy of science integration, with mixed results (Haynes, Robinson, Edwards, & Key, 2012; Ricketts, Duncan, & Peake, 2006; Theriot & Kotrlik, 2009). However, we assert these explorations into the efficacy of science integration should come in combination with understanding the why, how, and level in which AFNRE teachers are integrating science within their curriculum. Within this study, we focused on the role of the AFNRE teacher in science integration.

Theoretical Foundation and Research Objectives

The theoretical foundation for this study was the theory of planned behavior (Ajzen, 1985, 2011). This theory posits three predictors to behavioral intentions: (a) attitude, (b) subjective norms, and (c) perceived behavioral control (Ajzen, 1985). Within the theory, each predictor is estimated to be positively associated with greater intentions to perform the behavior of interest (Ajzen, 1985). For example, an individual with higher subjective norms (i.e. perceive those around them [e.g. administration, fellow teachers] support science integration) will be more likely to integrate science.

In addition to established predictors, current research highlights the importance of teacher knowledge in integrating external content (Darling-Hammond & Bransford, 2005; Hamilton & Swortzel, 2007; Scales, Terry, & Torres, 2009; Wilson, Kirby, & Flowers, 2001); therefore, we added a self-reported measure of science knowledge as a fourth potential predictor of science integration. Using the theoretical foundation described above, three research objectives emerged: (a) describe the attitudes, subjective norms, perceived behavioral control, and knowledge of science among AFNRE teachers, (b) describe the science integration intentions of AFNRE teachers, and (c) describe a model of science integration.

Methods

We utilized survey methodology to complete this research. Within the survey, responses were collected for attitude (i.e. four item construct), subjective norms (i.e. three item construct),

perceived behavioral control (i.e. four item construct), knowledge (i.e. three item construct), and integration intention (i.e. eleven item construct) constructs. The attitude construct was adapted from previous research (Davis, Ajzen, Saunders, & Williams, 2002) and included response options from 1 *(strongly disagree)* to 6 *(strongly agree)*. Subjective norms and perceived behavioral control were also measured from 1 *(strongly disagree)* to 6 *(strongly agree)* and adapted from previous research (Cheon, Lee, Crooks, & Song, 2012). Knowledge, the additional predictor, was measured via a researcher-developed instrument in which respondents reported their knowledge on domains of the Next Generation Science Standards (i.e. Next Generation Science Standards Lead States, 2013). The knowledge construct was scaled from 1 *(not knowledgeable)* to 4 *(very knowledgeable)*, a method utilized in past research (Diamond, Maerten-Rivera, Rohrer, & Lee, 2013). Intention to integrate science was also measured using a researcher developed construct. For courses teachers had taught, were teaching, or planned to teach, respondents indicated their intended science integration percentage. Face and content validity were established prior to the instrument being used for data collection.

The aim of this research was to infer findings to all AFNRE teachers during the 2015-2016 school year. Using sample size requirements of structural equation modeling (i.e. the statistical analysis used to accomplish research objective three), we identified a need for 160 respondents (Kline, 2005). Given the response rate limitations of national samples, we requested a sample of 950 teachers from the National FFA organization. This large sample request assured a 20% response rate would still yield 160 respondents.

Data were collected using Dillman's (2007) tailored design method in November and December of 2015. Due to frame error, the list of potential respondents was reduced to 828. A total of 212 useable responses were received for a 25.60% response rate ($n = 212$). Late responders ($n = 44$) were compared to on-time respondents ($n = 168$) in the variables of interest with no statistical differences (i.e. p-values > .05) between groups; therefore, non-response bias was not considered an issue in this study (Lindner, Murphy, & Briers, 2001; Miller & Smith, 1983).

Assumptions of structural equation modeling (i.e. multivariate normality, absence of outliers, linearity, absence of multicollinearity, and complete data) were evaluated. Attitude was found to be skewed left (Kline, 2005); therefore, a robust structural equation modeling procedure (i.e. asymptotically distribution free; Bentler & Yuan, 1999) was utilized. Additionally, intentions to integrate science contained statistical outliers. These outliers were replaced by the value of the most extreme response, not identified as an outlier (Guttman & Smith, 1969; Moyer & Geissler, 1991).

Research objectives one and two were accomplished using means and standard deviations. Research objective three was accomplished using structural equation modeling. Readers are encouraged to review detailed accounts of structural equation modeling (e.g. Bowen & Guo, 2012; Ullman, 2013) for a description of this procedure.

Findings

Research objective one sought the attitude, subjective norms, perceived behavioral control, and self-reported knowledge of respondents (see Table 1). On average, respondents had favorable attitudes (*M* = 5.46; *SD* = 0.67), subjective norms, (*M* = 5.34; *SD* = 0.70), and perceived behavioral control (*M* = 4.87; *SD* = 0.75) toward science integration. With regard to knowledge, respondents identified themselves between "somewhat knowledgeable" and "knowledgeable" (*M* = 2.60; *SD* = 0.60).

Table 1

Attitude, Subjective Norms, Perceived Behavioral Control, and Knowledge of Science

	Minimum	Maximum	*M*	*SD*
Attitude	1.00	6.00	5.46	0.67
Subjective Norms	1.00	6.00	5.34	0.70
Perceived Behavioral Control	1.00	6.00	4.87	0.75
Knowledge	1.00	4.00	2.60	0.60

Note. Items measuring attitude, subjective norms, and perceived behavioral control toward science integration were scaled from 1 (*strongly disagree*) to 6 (*strongly agree*). Items measuring knowledge of science were scaled from 1 (*not knowledgeable*) to 4 (*very knowledgeable*).

Research objective two focused on the science integration intentions of respondents. In total, respondents indicated just under 40% of their curriculum would include science content (*M* = 39.91; *SD* = 14.93). The level of science integration ranged from under 20% of FFA curriculum including science (*M* = 17.00; *SD* = 18.25) to over 50% of Plant Science curriculum (*M* = 57.18; *SD* = 20.14).

Table 2

Intentions to Integrate Science

	f	Minimum	Maximum	*M*	*SD*
Plant Systems	176	0.00	100.00	57.18	20.14
Animal Systems	182	10.00	100.00	55.65	18.96
Biotechnology Systems	86	15.00	100.00	55.12	20.92
Environmental Service Systems	101	10.00	100.00	52.26	19.38
Natural Resource Systems	139	5.00	100.00	51.89	20.90
Food Products and Processing Systems	95	10.00	100.00	48.35	19.15
General Agriculture	192	0.00	100.00	42.46	18.39
Power, Structure, and Technology Systems	143	0.00	100.00	29.01	17.72

SAE: Supervised Agricultural Experience	188	0.00	100.00	25.34	18.39
Agribusiness Systems	128	0.00	100.00	18.03	17.55
FFA	167	0.00	100.00	17.00	18.25
Total	212	4.00	81.67	39.91	14.93

Note. Respondents reported the percentage of science content they would integrate for courses they had taught, were teaching, and/or planned to teach.

The third research objective used structural equation modeling to describe a model of science integration (see Table 3). Within the measurement component of the model, factor loadings ranged from 0.33 to 0.89 and were statistically significant, a necessary element for model fit. Additionally, the chi-squared comparison of the conceptual model to the data was statistically insignificant ($\chi^2 = 90.47$; *p*-value = .094), indicating the data represented the hypothesized relationships. Finally, the fit indices (i.e. comparative fit index [i.e. CFI = 0.96] and root mean square of approximation [i.e. RMSEA = .03]) confirmed the hypothesized model was an appropriate representation of the data (Blunch, 2013; Hooper, Coughlan, & Mullen, 2008; Hu & Bentler, 1999).

Table 3

Model for Science Integration

	Dependent variable: Intention to Integrate Science					
	Zero-order correlation (*r*)	*p*-value	*B*	*SEB*	*γ*	*p*-value
Attitude	.27	<.001	13.32	7.13	.31	.062
Subjective Norms	.18	.008	0.58	3.45	.02	.867
Perceived Behavioral Control	.13	.058	-1.42	2.63	-.05	.589
Knowledge	.02	.807	-2.70	1.34	-.12	.044

Note. Based on Asymptotically Distribution-Free Estimates; $\chi^2 = 90.47$ (df = 74) *p*-value = .094; $R^2 = .10$, CFI = .96, RMSEA = .03; *γ* = standardized path coefficients; *B* = unstandardized path coefficients.

In total, the predictors explained 10% of the variance in the science integration intentions of AFNRE teachers ($R^2 = .10$). Only one of the predictors (i.e. knowledge) was a statistically significant, negative predictor of science integration intentions (*γ* = - .12; *p*-value = .044).

Conclusions, Implications, and Recommendations

AFNRE can be a valuable platform for educating students about science through the context of agriculture (National Research Council, 2010). Past research within science integration has focused on the efficacy of integration. While this research is valuable, it should be combined with studies exploring the role of the teacher in integrating science. In this study, we explored the science integration intentions of AFNRE teachers.

Our research found teachers had positive attitudes, subjective norms, and perceived behavioral control with regard to science integration. These findings are encouraging given the positive association between these predictors and behavioral intentions posited within the theory of planned behavior (Ajzen, 1983, 2011). Unfortunately, the positive findings were not replicated within knowledge of science, in which respondents rated themselves between "somewhat knowledgeable" and "knowledgeable." These findings align with existing research, using standardized assessments, which detail a lack of science competence among AFNRE teachers (Hamilton & Swortzel, 2007; Scales et al., 2009; Wilson et al., 2001). As a profession, we should identify and implement methods to enhance the science knowledge of all AFNRE teachers.

In addition to exploring the predictors of science integration, we explored the integration intentions of teachers. Not surprisingly, we saw a propensity for AFNRE teachers to integrate more science within life science-based agriculture courses (e.g. plant science and animal science) and less within other curricular experiences (e.g. FFA and agribusiness systems courses). While this finding may be expected, it does detail an opportunity to expand science integration outside the expected curriculum. For example, FFA offers many opportunities to integrate science. Not only does FFA offer agricultural science fairs, but career development events like livestock judging, public speaking, and soil judging provide opportunities for teachers to integrate scientific inquiry to support student learning of agricultural and science knowledge and practices.

In the final research objective, two critically important findings emerged. First, additional self-reported knowledge of science was related to statistically significant decreases in the amount of science content integrated within AFNRE curriculum. Two potential explanations are proposed, (a) teachers who are less knowledgeable about science (i.e. not just self-reported) are integrating science more or (b) teachers who are more knowledgeable about science have a more realistic perception of their science knowledge; therefore, they rate themselves lower in science knowledge, yet integrate science at a higher level. The objectives of this research were not designed to tease out which of these possibilities is correct; therefore, we recommend future qualitative research on teacher conceptualizations of science integration. The second critically important finding from the final objective was the importance of attitude toward science integration. While not statistically significant, the unstandardized beta (i.e. $B = 13.32$) suggests a one-unit increase in attitude was related to over 13% more science content being integrated within AFNRE curriculum. We recommend practitioners seek methods for enhancing the attitudes of preservice and inservice agriculture teachers regarding science integration.

Integrating science within AFNRE offers students a robust understanding of science, agriculture, and the essential connections between these disciplines. This research sought to explore the role of the teacher in science integration and, in so doing, new and unique relationships were discovered. We hope these new findings inform continued investigations and practices within science integration as we seek to explore ways to enhance student learning.

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Barriers to Incorporating Climate Change and Agriculture Issues into Research and Extension Programming in the Northeast

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Introduction

As climate change emerges as one of the most important and complex issues that society currently faces, it will be increasingly important for land-grant universities to address impacts on agriculture and natural resources through applied research and Extension. Brugger and Crimmins (2015) argue that Extension educators are uniquely positioned in local contexts to help facilitate flexible responses to climate change. As researchers conduct studies to inform outreach programming, Extension can play a key role as communication facilitator between those who generate information and those who use that information (Burnett et al. 2014; Colasanti et al. 2009; Wojcik et al. 2014). Furthermore, Extension has the ability to build on its existing programming, as Nebraska has started with its Climate Master's program, modeled after the long-running Master Gardeners Program (Pathak, Bernadt, and Umphlett 2014).

Within Extension, studies are often conducted to assess barriers to and opportunities for effective applied research and Extension programming (Brain et al., 2009; Rennekamp and Gerhard, 1992; Richardson, Williams, and Mustian, 2003). From a theoretical perspective, assessing barriers and opportunities to encourage behavior change must be first undertaken before seeking to implement programming (Burke, 2002; McKenzie-Mohr and Smith, 1999). One obvious constraint to Extension programming is diminished budgets and personnel (Brugger and Crimmins 2015). Burnett et al. (2014) assessed perceptions of climate change outreach among Extension professionals in North Carolina, finding that the three greatest barriers were lack of audience interest, conflicting information, and lack of applied information. The barrier perceived as most limiting, lack of audience interest, is likely related to the skepticism that farmers often express regarding anthropogenic climate change (Arbuckle et al. 2013; Liu et al. 2014; Prokopy et al. 2015; Rejesus et al. 2013).

Collectively, the literature indicates that land-grant universities confront an array of challenges as they seek to translate their research on climate change into Extension programming that encourages farmers to adopt adaptation and mitigation practices. While several case studies have been conducted on barriers to Extension programming, broader analyses of how land-grant university researchers and Extension personnel perceive challenges to applied work on climate change and agriculture are lacking. With an eye towards the development of appropriate and relevant programming on climate change adaptation and mitigation in agriculture, our study extends the current understanding of barriers to climate change programming by surveying land-

grant university researchers, Extension specialists, and Extension educators in the Northeastern United States to identify the most important barriers to address.

Purpose and Objectives

The overall purpose of the study was to identify barriers related to information, the workplace, and target audiences that impede the capacity of land-grant researchers and Extension personnel in the Northeastern United States to address climate change impacts on agriculture. The objectives of the study were to:

1. Determine the profile of Extension specialists, Extension educators, and research faculty at land-grant universities in the Northeastern U.S.,

2. Identify barriers related to information, the workplace, and target audiences as perceived by Extension specialists, Extension educators, and research faculty, and

3. Determine differences in perceived barriers, if any, among Extension specialists, Extension educators, and research faculty.

Methodology

Population and Sample

The sampling frame for this study consisted of all research faculty and Extension specialists and educators in colleges of agriculture who worked in program areas related to agriculture, natural resources, or forestry across the 16 land-grant universities in the Northeast (N=3,757). Although the organizational structures of the universities varied, care was taken to identify the colleges and programmatic areas at each university housing relevant disciplines.

Instrumentation

An online survey was developed using Qualtrics in which respondents were asked to respond to a series of semi-closed ended questions. Variables included disciplinary focus, university, appointment at university, percentage of time dedicated to climate change, level of education, age, and gender. Perceived barriers consisted of Likert-type scales (1=Not at all a barrier to 5=A major barrier). Individual items were categorized according to three conceptual areas of barriers: information (eight items), workplace (seven items), and target audiences (eight items). Construction of these scales was based on the literature including Burnett et al. (2014) in particular and enhanced through a panel of experts representing diverse disciplines and university appointments. To ensure validity and reliability, the survey instrument was field tested and pilot tested in the Southeastern U.S. with researchers and Extension personnel. Pilot responses revealed that the three barrier constructs (information, workplace, and target audiences) had acceptable reliability. Cronbach's alpha scores ranged from 0.67 to 0.86.

Data Collection and Analysis

In total, the survey was sent to 3,757 research participants. After two-follow-ups, a total of 1,211 participants responded for a response rate of 32.2%. Data collection occurred over a six-week period from April to May 2015 and was guided using The Tailored Design Method (Dillman, Smyth, & Christian, 2009). During data analysis, it was determined that only those respondents who indicated at least 1-20% of their time dedicated to climate change work would be analyzed. Of the 1,211 respondents, 554 (45.7%) met this criterion. Descriptive and inferential statistics were used to analyze the data.

Results

Objective 1: Demographic Profile

A majority of the respondents were research faculty (44%) followed by Extension educators (26%) and Extension specialists (23%). Percent time dedicated to climate change varied with a majority (71%) dedicating only 1-20% of their time to climate changes. The highest climate change focus area was for natural resources (39%) followed by cropping systems (31%), social sciences (23%) and plants (22%). A majority of respondents were male (60%). The average age of respondents was 52 years.

Objective 2: Barriers

Respondents were asked to indicate on a scale of one to five (1=Not at all a barrier to 5=A major barrier) their perceptions of barriers relative to climate information, workplace, and target audiences. Results are presented in Table 1. Of the climate information barriers, respondents perceived not enough information specific to local needs (M=3.34, SD=1.16) as somewhat of a barrier, followed by lack of specific adaptation practices to share with the audiences (M=3.29, SD=1.21), and lack of specific mitigation practices to share with target audiences (M=3.23, SD=1.22).

Regarding workplace factors, respondents perceived the lack of funding (M=3.83, SD=1.23) and lack of time (M=3.63, SD=1.29) as barriers to applied research and Extension programming (Table 1). Of the target audience barriers, the respondents indicated that the perception among target audiences that changing practices is too costly (M=3.53, SD=1.16) was the primary barrier, followed by the barrier of real costs being too high for target audiences to change practices (M=3.20, SD=1.13). In addition, respondents indicated that target audiences also perceived the risk in adopting new technologies as too high (M=3.10, SD=1.14).

Table 1
Mean scores and standard deviations of barrier items and scales.

Barriers*	M	SD
Information		
Too much information to interpret effectively (N=529)	2.53	1.20
Not enough information specific to local needs (N=531)	3.34	1.16
Lack of clarity in terms of what causes climate change (N=528)	2.24	1.38
Lack of decision-making tools (N=523)	3.01	1.14
Lack of specific adaptation practices to share with audiences (N=528)	3.29	1.21
Lack of specific mitigation practices to share with audiences (N=533)	3.23	1.22
Lack of access to expert knowledge (N=533)	2.49	1.25
Lack of training on climate change issues (N=532)	2.73	1.31
Total[a] (N=504)	22.83	6.56
Workplace		
Lack of funding (N=543)	3.83	1.23
Not part of my job responsibility (N=540)	2.28	1.34
Not enough time (N=542)	3.63	1.29
Not viewed as priority by supervisor/management (N=538)	2.22	1.33
Topic is politically contentious (N=539)	2.34	1.43
Not a priority for promotion/tenure (N=534)	1.83	1.20
Not interested in the topic (N=535)	1.43	0.89
Total[b] (N=524)	17.47	5.05
Target audiences		
Not a priority issue (N=533)	3.14	1.32
Lack of awareness of climate change impacts (N=535)	3.16	1.26
Too difficult an issue to communicate (N=531)	2.67	1.23
Topic is contentious (N=533)	3.08	1.35
Real costs are too high to change practices (N=529)	3.20	1.13
Perception that changing practices is too costly (N=535)	3.53	1.16
Actual risk is too high to adopt new technologies (N=528)	2.76	1.04
Perception that risk is too high to adopt new technologies (N=525)	3.10	1.14
Total[a] (N=516)	24.59	6.55
Overall barriers (N=475)[c]	65.24	13.97

*Mean computed on a scale of 1=Not at all a barrier to 5=A major barrier.
[a] The theoretical range was from 8-40 with a theoretical midpoint of 24.
[b] The theoretical range was from 7-35 with a theoretical midpoint of 21.
[c] The theoretical range was from 23-115 with a theoretical midpoint of 69.

Objective 3: Differences among Three Groups of Respondents

One-way analysis of variance was used to determine differences, if any, among Extension specialists, Extension educators, and research faculty) and perceived barriers (information, workplace, and target audiences). ANOVA results revealed significant differences between the three groups of respondents and perceived information barriers (F=26.23, df=2, p <.001), workplace factors (F=11.207, df=2, p <.001), and target audience barriers (F=6.61, df=2, p <.001). Further examination of mean scores (Scheffe Post hoc analysis) revealed that Extension educators perceived all three barriers significantly higher than research faculty and Extension specialists. While Extension specialists perceived information barriers significantly higher than research faculty, no significant differences were found between the two groups relative to workplace and target audience barriers.

Conclusions, Discussion and Recommendations

Overall, respondents did not perceive any of the three conceptual areas – information, workplace, and target audiences – as major barriers, given that the actual composite means from each barrier scale very closely aligned with the theoretical midpoints. However, respondents did indicate that individual items presented challenges to their climate change work.

In terms of information, respondents were primarily concerned with the lack of specific information relevant to local contexts. This finding is consistent with the literature, in which studies have found that although farmers are most interested in information relevant to their operations (Hibbs et al., 2014), the climate projections and information developed by scientists do not often adequately indicate effects on specific localities (Bartels et al., 2012). As for workplace barriers, the lack of time and funding were identified as primary barriers, not surprising given the dwindling resources that Extension is facing across the nation. Target audiences presented challenges because of their lack of interest in and awareness of climate change impacts, as well as their concerns that making changes to their agricultural operations is too risky. These findings reflect the skepticism that farmers often express regarding human-caused climate change (Arbuckle et al., 2013; Liu et al., 2014; Prokopy et al., 2015).

The findings also indicate that Extension educators perceive more difficulty with barriers to their climate change work than Extension specialists or researchers. Across all three areas of barriers, Extension educators' perceptions of barriers were significantly higher than their counterparts. These findings can likely be explained by the typical responsibilities of Extension educators, which include translating climate research into useful information to target audiences and interacting with audiences at the local level who often express skepticism of and ambivalence towards climate change.

Based on the findings, the following recommendations should guide future research and Extension programming:

- Researchers, Extension specialists, and Extension educators should be encouraged to co-develop climate change-related research and programming agendas based on stakeholder needs assessment to ensure that the information generated from research will be useful to specific local contexts and needs.
- Given the doubts that farmers often express about human-caused climate change, it will be most useful for researchers and Extension personnel to frame messages and provide locally relevant and production specific resources and solutions to help farmers address the impacts they are facing.
- Because concern exists that farmers perceive too much risk in adapting to climate change, cost-benefit analyses should be undertaken to document the investments and outcomes when farmers engage in strategies to adapt to and mitigate climate change.

Given the immense challenge that climate change presents to agriculture, research and programming that is thoroughly and carefully monitored and evaluated is essential for developing and delivering high quality and high impact programs.

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Acculturation Orientations of Indiana 4-H Adult Volunteers toward Underrepresented Minorities

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Introduction

Acculturation is the phenomenon which results when groups from differing backgrounds come into contact. These interactions are a combination of maintaining one's own original cultural values and adopting other groups' cultural values. From these variables, there are four main outcomes of acculturation: Integration, Assimilation, Marginalization, and Separation. Berry (1997) proposed that there are four possible outcomes of acculturation: 1) Integration which occurs when individuals are able to adopt some of the cultural values of the majority culture while maintaining the integrity of their original heritage culture; 2) Assimilation which involves individuals rejecting the minority culture and fully adopting to the majority cultural norms; 3) Separation occurs when individuals reject the majority culture in favor of preserving their original heritage culture; and 4) Marginalization which refers to individuals rejecting both their original heritage culture and the dominant host culture.

During the interaction of two cultural groups, both bring with them a variety of unique qualities and characteristics (Sam & Berry, 2010). No cultural group remains unchanged following cultural contact; acculturation is a two-way interaction, resulting in actions and reactions to the contact situation (Sam & Berry). Immigrating individuals and groups bring cultural and psychological qualities with them to the host society, and the host society also has a variety of such qualities. Understanding the acculturation process may help us understand the compatibility (or incompatibility) between two cultural groups (Sam & Berry). Acculturation can be measured with both the majority (or host) culture as well as the adapting (or minority) culture (Sam & Berry).

Bourhis, Moise, Perreault, and Senecal (1997) contributed to Berry's work by adding a fifth acculturation orientation. Bourhis et al. proposed that five acculturation orientations can be endorsed by dominant host majority members toward specific immigrant minorities which include: 1) Integration, 2) Assimilation, 3) Segregation, 4) Exclusion, and 5) Individualism. Additionally, previous researchers (e.g., Ardens-Toth & Van de Vijver, 2004) have argued acculturation strategies that dominant group members prefer might differ depending on specific life domains (i.e., public and private). Perhaps the most significant contribution made by Bourhis et al. was the recognition that the perspective of the immigrant group is just as important as that of the host society with regard to new incoming groups. The perspective of both the majority and minority group are interdependent as the behaviors and attitudes of one culture can influence how the other group will acculturate.

Several researchers have found that it is important to divide the general acculturation context into different domains, and within each domain individuals can adopt different acculturation strategies (Berry 1990; Horenczky 1996; Sam & Berry, 1997). Navas and her colleagues have adopted this strategy in their model, the Relative Acculturation Extended Model (RAEM), by

creating seven separate domains (Navas et al., 2005). These domains range from areas that are closest to material elements, to the furthest of ideological and religious views (Navas et al., 2005).

As the U.S. population continues to diversify, the Cooperative Extension Service will be faced with the challenge of serving all residents, regardless of their race or ethnicity. As the 4-H Youth Development program relies on volunteers to extend programming efforts, it is important that volunteers are willing to work with minorities. The white, non-Hispanic 4-H adult volunteer is the host majority. This group's acculturation orientation, or attitude, towards a minority culture will influence the way the volunteers interact with that minority culture. An acculturation outcome of separation, or marginalization by the 4-H volunteers could create an unwelcoming environment for minorities hoping to become involved in the 4-H Youth Development program. This could result in the Cooperative Extension Service not being able to fulfill its mission of serving all individuals regardless of their racial or cultural backgrounds.

Bourhis and his colleagues (1997) argue that the host society, just like the minority group, will typically display a preference for one of the four acculturation strategies. In other words, the host society has specific ideas about how they want to deal with immigrants and about how they want the immigrants to behave. However, research on the host society strategy preference has been sparse. An appreciation of the importance of the host society's acculturation attitudes as well as those of immigrant groups then raises the question of compatibility between them (Zagefka & Brown, 2002). A weakness of classic acculturation models is the lack of importance given to how the dominant host majority can shape and be shaped by the acculturation orientations of immigrant groups (Berry J. W., 1990; LaFromboise, Coleman, & Gerton, 1993; Ward, 1996).

Conceptual Framework

This study is guided conceptually by the Relative Acculturation Extended Model (RAEM) (Navas et al., 2005). Merging the research of many acculturation models, the Relative Acculturation Extended Model (RAEM) was developed by combining many of the previous acculturation theories while incorporating new innovations to previous models (Navas, et al., 2005). The RAEM seeks to build on the contributions of other models while incorporating new aspects. The first element of RAEM is that there is a joint consideration of the immigrant group and the host group as originally proposed by Bourhis et al. (1997). Secondly, the RAEM makes a distinction between what is an Ideal Situation and a Real Situation. That is, acculturation attitudes preferred by both populations is a step from an Ideal situation (the option they would prefer to occur) and the Real situation (the option they have actually put into practice or what they think that immigrants have put into place). The final component of the RAEM is that there are various domains in which acculturation strategies and attitudes are proposed (Berry, 1990) and include: political & government work, economic, social relations, family relations, religious beliefs and principle & vlaues.

Purpose and Research Questions

The purpose of this study was to explore the acculturation orientations of 4-H adult volunteers toward minorities. The research questions of this study were:

1. What are the acculturation orientations of 4-H adult volunteers toward minorities?
2. How do 4-H adult volunteers' desired choice of minority acculturation strategies compare to their perception of currently adopted acculturation strategies of minorities?
3. Are there differences among 4-H adult volunteers' acculturation orientations across each domain?

Methods and Procedures

This study utilized a convenience sample (*n*=1,253) of current 4-H adult volunteers with a valid email address in the Purdue Extension database system from 20 counties throughout Indiana. The counties that participated in this study were selected based on geographic representation, to accommodate rural/urban representations and to assure the Indiana Extension 4-H Youth Development position was not vacant at the time of the study.

Data were collected using a questionnaire eliciting information on six independent and four dependent variables. The questionnaire for this study was an adapted version of the measure Acculturation Scale created by Navas, Garcia, Sanchez, Rojas, Pumares, and Fernandez (2005) for measuring acculturation orientations. The independent variables in this study were the Real Situation (i.e., what is perceived to have happened in society), Ideal Situation (i.e., what is perceived should happen), Maintenance of Original Cultural Values, and the Adoption of Mainstream Cultural Values. Each independent variable was measured within the following domains: Work, Economic, Social Relations, Family Relations, Religious Beliefs, and Principles & Values. The dependent variables were the four acculturation orientations: Separation, Marginalization, Assimilation, and Integration.

The questionnaire was composed of five sections which included 67 items. Part one of the questionnaire included the demographic items requesting information such as race, gender, age and highest level of education of the participants. These demographic items were adapted from a 4-H Volunteer Impact Study measurement tool used in a prior research study conducted in the North Central Region. 4-H volunteer participation was determined by their volunteer role, number of youth they interact with, years they have been a volunteer, and the county in which they volunteer. Over 97% of the volunteers were white. Eight hundred and forty-four (70.5%) of the participants were female, and 353 (29.5%) of the participants were male. The mean age was 48 years old and ranged from 18 years to 84 years. Twenty nine percent of the participants indicated their highest level of education was a bachelor's degree, while 23% indicated they had some college experience as their highest level of education.

Section two included items measuring the participants' beliefs that minorities have maintained their cultural values. Section three included items measuring perceptions of the extent to which minorities have adopted mainstream cultural values. Section four included items measuring the extent to which individuals perceived that minorities should maintain their original cultural values. Finally, section five included items measuring the extent to which individuals have perceived that minorities should adopt mainstream cultural values. Participants were reminded in the instructions to answer each question honestly to reflect how they feel, rather than what is socially acceptable. This was done in order to minimize participants from answering how they

think they should answer based on standards set by society rather than how they actually feel. This is especially important on sensitive topics such as race and ethnicity.

Data were analyzed using descriptive statistics including means, standard deviations, frequencies, and percentages. Dependent sample t-tests were used to describe mean differences in the real and ideal situations as well as each domain.

Conclusions and Implications

Findings indicated that the majority of participants adopted the Integration orientation in both the real and ideal situations and all domains. Overall, the largest percentage of volunteers adopted the Integration orientation. However, this was not the majority of volunteers. There was not one orientation that the majority of volunteers adopted. In fact, volunteers adopted all nine of the possible orientations. For being a fairly homogenous sample group, it is surprising that so many of the volunteers had very different perceptions. Furthermore, it is noteworthy that the second largest percentage group of volunteers reflected the Separation orientation.

The mean scores for the Ideal Situation were more aligned with the Integration orientation when compared to the Real Situation. This suggests that volunteers would prefer that Integration is reflected when compared to what they perceived has happened. The results indicate that if given the chance, most participants would agree that they would like to interact with minorities. However, this study also indicates that there is a significant number of volunteers who would prefer the Separation orientation within the Ideal Situation. Across all but the Work domain, Separation is reflected by the second and third largest percentage groups of volunteers. Acculturation orientations in the Real Situation did not vary quite as much as the Ideal Situation.

The mean scores of each domain when maintaining and adopting cultural values in both the Real and Ideal Situations are above three, meaning Integration was reflected for each domain. Within the Real Situation, participants indicated higher means for the Maintain categories when compared to the Adopt category. This infers that participants agreed that minorities should maintain their cultural values more than they should adopt mainstream cultural values. This suggests that volunteers perceive society to be flexible when minorities are displaying their cultural values within the six different domains. The Work domain is closer to Assimilation than Religious beliefs or Principles and Values. This suggests that participants believe minorities should be able to maintain more of their original cultural values in personal domains like Religion and Principles and Values, and should maintain slightly less in material domains like Work and Economic.

Findings suggest the importance of measuring acculturation orientations within the Real and Ideal Situations. Furthermore, it is important to measure the acculturation orientations by domain. By considering both the situations and domains, we have a more complete picture as to the acculturation orientations being adopted. Findings also suggest that more work needs to be done in order to get all volunteers to reflect the Integration orientation. This can be done by gradually introducing volunteers of the host culture to members of minority cultures. 4-H Educators should work on developing relationships with minority groups within their communities while gradually introducing them to the traditional 4-H program. By doing so,

members of the majority population will be slowly introduced to working and volunteering with minorities. Finally, it is important that the host culture views members of the minority culture as valuable members to society, and in this case, valuable additions to the 4-H program.

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Impact of Serving as an Extension Camping Instructor on Life Skills Development

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Introduction

A 1991 study found a significant difference between the perceptions of the level of life skills attained between 4-H members and non 4-H members. The areas in which 4-H members perceived higher levels of skills included understanding self, communicating, making decisions, and leadership (Boyd, Herring, & Briers, 1992).

In response to a study of leadership life skill development, eight essential elements of 4-H positive youth development were identified. The elements were composed of a positive relationship with a caring adult, an inclusive environment, a safe environment, opportunity to see oneself as an active participant in the future, opportunity for self-determination, engagement in learning, opportunity for mastery, and opportunity to value and practice service for others (Martz et al., 1999).

The West Virginia Extension Service (WVES) has taken the Essential Elements of Positive Youth Development and have implemented them throughout its 4-H programs. The 4-H program philosophy states that one of its purposes is to enhance the development of all youth (West Virginia Extension Service, 2014).

In 2007, the WVES initiated the Extension Camping Instructors program (ECI). The purpose of the ECI was to engage the youth, act as assistants to the director of the 4-H venue and to create a positive atmosphere. The group consisted of college-aged members who were trained in the Essential Elements of Positive Youth Development and sent to different 4-H venues throughout the state. The ECIs would be sent alone, or in groups of two or more depending on the need.

Problem

Life skills are defined as competencies needed to make the most out of life and live to our potential. Research shows that programs such as 4-H can dramatically increase life skill development (Anderson, 2014; Armstrong, 2010; Arnold, Bourdeau, & Nagele, 2005; Boyd et al., 1992; Duncan, 2000; Garst & Johnson, 2005; Garton, Miltenberger, & Pruett, 2007), however there is no research on ECIs influence on life skill development. Since ECIs are a part of the Extension Service, further research is needed to determine their part in accomplishing Extension's mission.

Theoretical Framework

Maslow's (1943) Theory of Human Motivation states that motivation is the result from satisfying a set of needs that everyone has. Maslow's hierarchy is comprised of five levels of basic needs that include physiological, safety, love, esteem, and self-actualization. The highest level is the need for self-actualization. The idea of fulfilling one's purpose can be correlated to one's happiness. "We shall call people who are satisfied in these needs, basically satisfied people, and it is from these that we may expect the fullest (and healthiest) creativeness" (Maslow, 1943, p. 383).

Youth development professionals are concerned with helping youth meet their basic needs and development competencies needed for their immediate and future success. 4-H utilizes the framework Targeting Life Skills Model (Hendricks, 1999) based on the 4-H Pledge to organize the delivery of experiences and skills that support youth development and growth.

Purpose and Objectives

The purpose of this study was to determine if ECIs were influencing the life skills development of 4-H youth while also developing life skills of their own. This study utilized the unique perceptions of ECIs who were employed from the summer of 2007 to October of 2015 by examining their current level of life skills, how they felt being employed as an ECI influenced the development of each skill, and how they felt their role impacted the life skill development of 4-H youth.

The following research questions were used to guide this study:

1. How do ECIs perceive their current level of life skill development?
2. How do ECIs perceive the impact of their employment on their current level of life skills?
3. How do ECIs perceive their role impacted the life skill development of the 4-H youth?

Methods/Procedures

Research Design

The researchers used a descriptive research design (Ary, Jacobs, Sorenson, & Walker, 2014). The target population for the study was all ECIs that were employed from the summer of 2007 to October 2015. The accessible population was the 192 current and former ECIs provided in a list from the WVES 4-H Youth Development office. A census of the accessible population was used.

Instrumentation

Based a review of literature, including the Targeting Life Skills Model (Hendricks, 1996) and a similar study by Anderson (2014), the researchers developed an online questionnaire using Qualtrics Survey Software. Sampling and selection errors were controlled by conducting a census. Content and face validity were established by a panel of experts, consisting of West Virginia faculty from the Agricultural and Extension Education Department and an Extension Specialist. Reliability for the survey instrument was determined using a Split-half methodology.

Based on the data, a rating of exemplary (Robinson, Shaver, & Wrightsman, 1991) was found with a Spearman-Brown Coefficient of .919.

The survey instrument was designed to collect the unique perspectives of the ECIs to determine whether or not they felt they influenced the life skill development of 4-H youth while developing life skills of their own. The survey instrument was divided into three main sections; life skills, demographic information, and opinions of the target population.

A list of 35 life skills were taken from the Targeting Life Skills Model (Hendricks, 1996) and were broken down into the four aspects; Head, Heart, Hands and Health. For each group of life skills, three questions were asked. The first question asked for the ECI's to rate their current level of ability for each skill using a scale of 1 – Very Poor, 2 – Poor, 3 – Average, 4 – Good, and 5 – Excellent.

The second question sought to determine how influential working as an ECI was on the development of each skill by asking the participants to rate the influence on a five point scale where: 1 – Not At All Influential, 2 – Mildly Influential, 3 – Moderately Influential, 4 – Highly Influential, and 5 – Almost Essential. Utilizing the same scale, the third question examined how the ECI's perceived their role as an ECI influenced a youth's participant's development of each life skill. The survey instrument also included basic demographic information.

Data Collection Techniques

Data collection procedures were based on Dillman, Smyth, & Christian's (2009) Total Design Method. A list of 192 email addresses were assembled. An individually addressed email was sent to each address containing a link to the survey instrument, a brief message detailing the study, and a deadline to complete the survey. A reminder email with a second deadline was sent to non-responders. The survey attained a response rate of 80.73 percent.

A comparison of early respondents to late respondents were made to address the non-response error (Miller & Smith, 1983). Three variables were used in this comparison: Years the ECI had worked, number of county camps worked, and the number of state camps worked. Chi-Square statistical analyses showed no significant differences, therefore findings were generalized to the entire target population.

Findings/Results

Nearly half of the participants (47.45%) reported that they had heard of the ECI position from other 4-H members. Over half of the respondents (52.24%) indicated that other 4-H members were an almost essential influence on them applying for the position, while an Extension agent was reported to have had a strong influence on 26.12% of the participant's decisions to apply for an ECI position.

The majority of the participants (78.68%) reported to have worked as ECIs for "1 – 3" years. The second highest number of years worked was "4 – 6" years by an additional 18 percent of the respondents. A very small number (3.86%) reported having worked as an ECI 7 to 9 years.

A majority of the participants have worked between 1 and 5 county camps, state camps, and other 4-H events. It was obvious that county camps were the primary venue for ECIs. Almost every participant (99.25%) indicated that they had been trained properly for their assignments as an ECI.

A majority (82.71%) of the respondents rated their ECI experience as a learning experience. Respondents had mixed feelings about whether the job was stressful or relaxed; terrifying or wonderful and tiring or exhilarating. Most would agree that it was wonderful, tiring and often times stressful. As several noted in the comments, it depended on the day and the situation.

Almost all of the participants (99.26%) indicated they would recommend someone apply to be an ECI. Four skills which respondents perceived to be the most useful skill that they gained from being an ECI included the ability to adapt to any given situation and think on their feet, leadership, communicate effectively, and creating a cultural awareness in working effectively with different groups of people.

When rating their current levels of ability for the 35 life skills, most participants considered their skill level to be between average and excellent. The life skill rated highest was "concern for others" which was rated excellent by 67.88% of the participants. Other life skills that were rated excellent were "teamwork" (65.28%), "accepting differences" (67.15%), and "empathy" (64.23%). The only life skills listed that was rated below average were "keeping records" and "stress management," where several participants rated their current ability as poor or very poor.

ECIs indicated that their involvement as an ECI had positively influenced the development of their own life skills, with several being highly influential. Leadership had the highest perceived level of influence with nearly half of the participants (49.66%) rating it as almost essential. Influence of being an ECI was perceived to be highly influential in the skill "development of community service/volunteer" (56.55%), "teamwork" (53.47%), "problem solving" (52.48%), and "communication" (52.55%).

Skills perceived to be less influenced by being an ECI included areas where it was mildly influential were "disease prevention" (19.86%), "keeping records" (15.11%), "stress management" (14.89%), and "managing feelings" (14.79%). Two life skills reported as not at all influenced by being an ECI were "disease prevention" (15.60%) and "keeping records" (6.47%).

A majority of the ECIs who responded to the survey indicated that they perceived their role as an ECI was highly influential in youth camper's development of life skills in "leadership" (63.01%), "teamwork" (58.33%), "self-esteem" (56.94%), and "community service/volunteering" (53.10%). ECIs perceived they had a lower level of influence on a youth's life skill development in "keeping records" (20.71%), "disease prevention" (18.31%), "stress management" (15.49%), and "personal safety" (12.06%). With being not at all influential in the skill categories of "keeping records" and "disease prevention."

The life skill areas where ECIs feel their being an ECI was highly influential on their own development and their influence on youth camper's development mirror each other. As do areas that they feel are not influential at all in both situations.

Conclusions and Recommendations

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

1. ECI's viewed fellow 4-H members and Extension Agents as influential in one's decision to apply for the ECI position.
2. ECIs viewed their role as highly influential on the development of their own life skills, particularly in areas of leadership, community service/volunteering, teamwork, and self-responsibility.
3. ECIs view their role as highly influential on the development of 4-H youth's development of leadership, teamwork, self-esteem, and community service which reflects the previous research.
4. Skills listed under the categories of head and health, particularly stress management, disease prevention, and keeping records are consistently considered to not be influenced by the ECI role for the individual or the youth with whom they interact.
5. Life skills such as adaptability, leadership, communication, and working with others are highly valued skills perceived to be developed through being an ECI.

Based on the findings of this study, these recommendations are made:

1. Extension agents need to clearly understand the amount of influence they have on older youth becoming ECIs.
2. Additional focus on the Health related life skills such as stress management, disease prevention, and personal safety should be considered when creating educational content for training ECIs.

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Graduate Students' Knowledge and Beliefs of Teaching and Learning STEM by using Integrated STEM Education through Agriculture, Food and Natural Resources

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Abstract

Recruiting undergraduate and science technology, engineering and mathematics (STEM) career professionals and training them become qualified future STEM educators is a strategy to address STEM teacher shortage. The study explored four graduate students' knowledge and beliefs of teaching integrated STEM education through Agriculture, Food and Natural Resources (AFNR). The findings suggest graduate students have different viewpoints than school teachers and curriculum regarding integrated STEM education.

Introduction

Nearly one in four of the 15,500 annual job openings in agriculture, food, and natural resources (AFNR) are related to STEM (USDA, 2015). To fulfill the STEM pipeline in AFNR, increasing the number of STEM graduates is inevitable. Yet, the shortage of certified STEM teachers is a major concern (Stronge, 2007). To address STEM teacher shortage, we need to recruit teacher candidates that range from students who are both undergraduate and STEM career professionals, and prepare them to become licensed to teach STEM subjects (Darling-Hammod & Skyes, 1999; Hutchison, 2012). In order to prepare undergraduate and graduate students in STEM majors to become qualified future STEM educators, there is a clear need for research to explore their beliefs about integrating STEM through AFNR. For example, due to lack of teaching experience, it is important to know how STEM graduate students' professional knowledge, such as animal science or wildlife biology and forestry, and their past learning experience play roles in how they develop lesson plans and teaching pedagogies by using an integrated approach through AFNR.

Conceptual & Theoretical Framework

Theoretically, teaching beliefs have been studied for several decades and there are common understandings about the nature of teaching beliefs. Teaching beliefs play an important role in how one teaches (Woolfolk Hoy, Davis & Pape, 2006), and beliefs are informed by previous educational experiences (Pajares, 1992), observing others (Lortie, 1975), how one learns (Schraw, 2013) and common assumptions of a discipline (Buehl & Alexander, 2002). Beliefs are activated through reflections, which can be guided by prompts from an expert, discussions with peers, and/or introspectively looking inward as an individually through professional development (Fullan, 1999). Pajares (1992) recommended teaching beliefs be studied qualitatively in specific contexts with regard to personal and system-level beliefs.

STEM Integration

The study was conceptually framed using a model of integrated STEM education developed by the National Research Council (2014). Developing a precise definition of

integrated STEM education has been a challenge (NRC, 2014). Although teachers believe curriculum integration helps students to connect school learning with their personal lives and future work (Hargreaves & Moore, 2000; Mason, 1996; Schlechty, 1990), it raises a number of practical questions, such as what does *integration* really mean? Does *integration* need to present in each lesson plan or in large unit? Recognizing the need for the model of integrated STEM education, National Academy of Engineering (NAE) and the Board on Science Education of the National Research Council (NRC) convened a committee to identify and characterize current approaches to integrate the STEM disciplines (NRC, 2014). The committee used the framework to help characterize and clarify selected STEM programs. This study adapted the framework to illustrate and characterize graduate students in STEM major's beliefs about integrating STEM through AFNR to provide meaningful discussion about efforts in the name of STEM integration through AFNR. More specifically in agricultural education, a team summarized 16 articles into several principles for interdisciplinary teaching and teacher education, including emphasis on practice, knowledge in context of real-world issues, problem solving, integration of content with pedagogical content knowledge, and career readiness competencies (Stubbs et al., 2016).

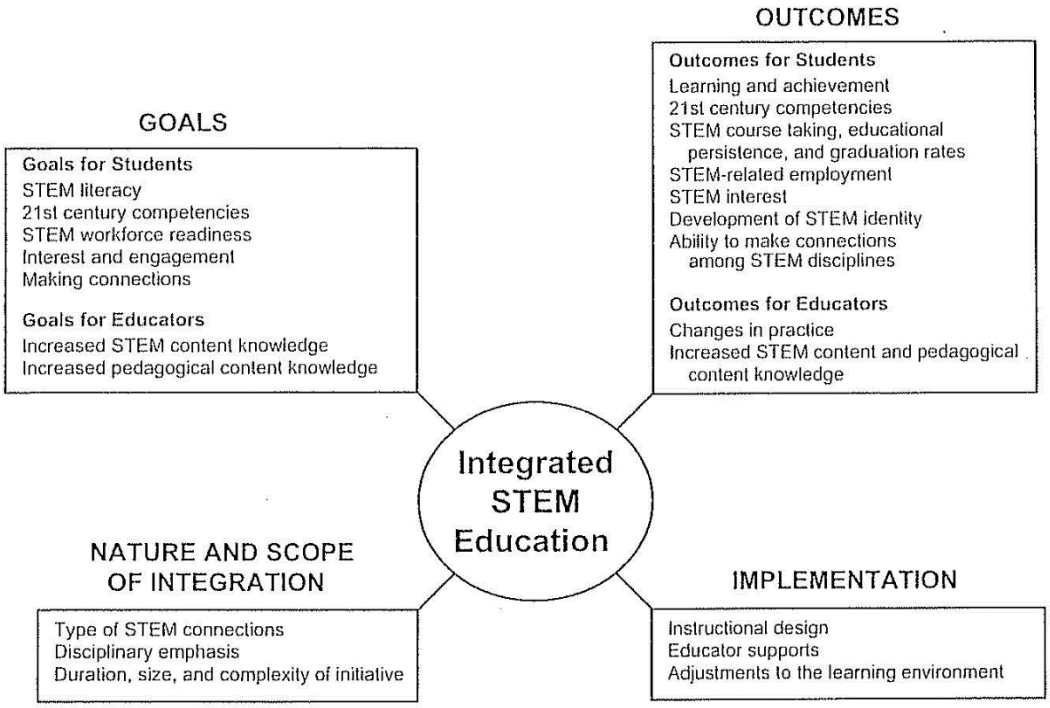

Figure 1. The conceptual framework was adapted from the Descriptive Framework that is developed in the STEM integration in K-12 Education (NRC, 2014, p. 32).

Purpose and Research Questions

The purpose of this study was to explore and describe graduate students' knowledge and experiences after participating in a teaching methods course focused on teaching STEM using AFNR as a context for integrated learning experiences. The specific research questions were: (1) How did graduate students learn to teach prior to participating in the course? (2) What were graduate students' knowledge and beliefs of integrated STEM education (i.e., nature and scope

of integration, goals, implementation, outcomes) after participating the course? (3) In what ways were students' knowledge and beliefs of integrated STEM teaching and learning through AFNR informed by their domain-specific beliefs (e.g., life sciences, technology, education)?

Methods and Procedures

Descriptive Qualitative Research Study

Case study research method (Baxter & Black, 2008) was used to structure the study. A two-credit graduate course was developed and taught to help graduate students (aka, participants), who are interested in becoming educators, in a college of agriculture learn how to teach STEM through AFNR. We framed this innovative course as interdisciplinary learning (Ivanitskaya, Clark, Montgomery, & Primeau, 2002) for the development of integrated STEM lessons. Students to develop STEM integrated lesson plans through AFNR and implemented the lesson plans with fifth grade students in an afterschool program. The students were instructed that no one existing integrated model is the best model to teach STEM through AFNR, which gave them the freedom to develop their STEM integrated lesson plans by using what they believed is the best integrated model and practices for teaching STEM through AFNR.

Data Collection

Students' assignments served as artifacts of data sources (i.e., six reflection papers, lesson plan, assessment plan, post-teaching self-evaluation paper, lesson plan rationale). In addition to students' assignments, face-to-face semi-structured interview were conducted with four participants after the course ended. Five students were enrolled the course, and four of them volunteered to be interviewed. Each interview was about 60 minutes in length. The interview questions focused on acquiring more information from students about how their domain-specific (professional) knowledge informed the process of designing their STEM integrated lesson plans and instruction. Example interview questions included "What previous learning experiences (as a youth, K-12 student, college student, etc.) helped shape how you think about teaching and learning, in general" and "Did your experiences and your identity inform how you planned, delivered and reflected on your integrated STEM lesson in the course?"

Data Analysis

Qualitative data analysis software (i.e., Nvivo 11) was used to conduct for initial data analysis. The framework (Figure 1) from NRC (2014) was adapted to illustrate and characterize graduate students' beliefs about integrating STEM through AFNR, and both students' assignments and interview transcripts were analyzed by the team of researchers using holistic coding and provisional coding for initial coding (Saldaña, 2016). After central concepts and related responses were analyzed, analysis focused on creating themes and eventually assertions (Saldaña, 2016). Trustworthiness and credibility were supported using several strategies such as multiple data sources, prolonged engagement, triangulation, referential adequacy, direct quotes, and an audit trail (Shenton, 2004).

Findings & Conclusions

Research Question 1: Graduate Students' Previous Experiences that Informed Teaching

Critical thinking and excitement were two main themes that emerged to illustrate how graduate students learned how to teach. For example, a student said, "I've had really great teachers throughout my career, and one common trend among them is that they really are good

facilitators of discussion…[a good facilitator] brings about those discussions and really get people thinking and fired up about [the topic].” Through their prior experiences, the participants highly valued experiences that were individualized and could recall moments of engaged critical thinking. For example, a student indicated, “I am pretty frequently bored about school and there was a number of teachers who were really happy to work with me…in enrichment opportunities or like work quickly through a lesson and then do an individual project.” They believed an effective teacher needs to treat students as individuals and recognized students have different needs in terms of learning. They criticized their past learning experiences when they were asked to memorize concepts, but they shared that teachers did not help them process the meaning of the concepts. The participants expressed they enjoyed learning when they were giving freedom to express themselves and internalize the “to be learned” knowledge to fit their individual learning interests. They believed one way to help students feel excited about learning is to make learning meaningful, and relevance was the key word that is associated with meaningful learning. Therefore, when the graduate students developed their STEM integrated lesson plans, they tried to connect their lesson plans with students’ everyday lives, such as food and local environment.

Research Question 2: Graduate Students’ Knowledge and Beliefs of Integrated STEM Education

The graduate students believed integrated STEM education helps students learn and practice skills, such as critical thinking and problem solving that are important for STEM careers. For example, a student suggested, “We’re working with 5th graders so the way that we can get them career ready is to get them to start critically thinking.” Participants also expressed inquiry-based integrated STEM education would excite students to continue STEM learning and to connect STEM disciplines. A student said, “I believe that STEM integration should seek to teach students through inquiry-based learning to provide students with both the knowledge and inquiry skills to answer real-life questions.” Therefore, increasing STEM interests and help students make connections of STEM disciplines are the major outcomes of integrated STEM education. Our participants also believed that integrated STEM education is not about how many subjects are integrated in a lesson plan, but how authentically it mimics STEM professional practices. For example, a student said, “Think that where [STEM integration] expanded for me is not putting these very specific boxes around S-T-E-M and having them be very rigid…” As for the instructional design of integrated STEM education needs to not only make learning fun and get students excited to continue learning STEM, but also equip students with workforce readiness skills, such as asking questions, questioning understandings, making broad STEM connections, and solving problems (Figure 2).

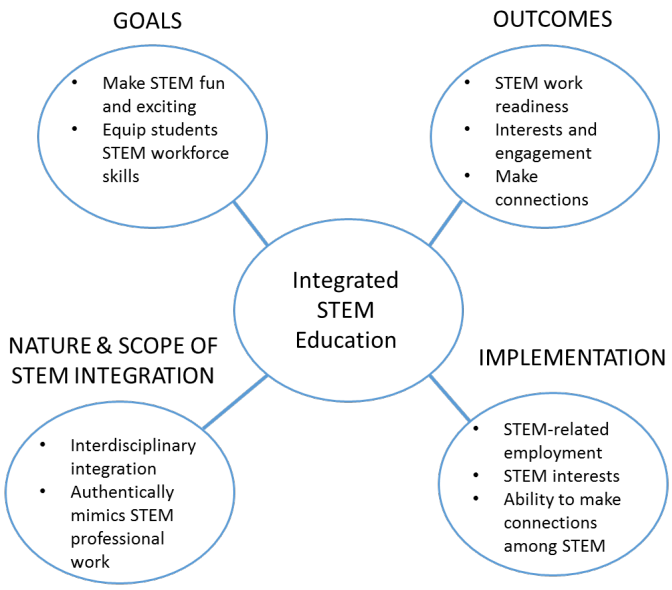

Figure 2. STEM graduate students' conceptual framework of integrated STEM education based on the Descriptive Frameowrk (NRC, 2014, p. 32).

Research Question 3: Graduate Students' Knowledge and Beliefs that were Informed by their Domain-Specific Beliefs

Although domain-specific knowledge played an important role when STEM graduate students developed integrated STEM lesson plans, it was not the only criteria to decide the direction of the lesson plans that they developed. Participants tried to put themselves back in the elementary students' shoes and to think what their students would be excited about. A student indicated, "By showing students the connection between the skills they are learning and relevance in their potential future career, it may create more interests with the STEM materials." All our participants believed that AFNR provided relevance to teach STEM, and could be used both as context and content to deliver real-world connections while teaching integrated STEM. A student said, "Students are engaged agriculture and food production are great topics for STEM integration because the process of agriculture is inherently STEM."

Most of the lesson plans that were developed by the participants focused heavily on engineering design and science. Engineering design was used to incorporate other subject areas. Our participants believed that engineering design helps students to see the connections not just within discipline but across disciplines. Integrating engineering design into AFNR made learning relatable and fun. As for science, inquiry (aka, scientific method) was used in a majority of the lesson plans. Our participants also believed asking questions is an essential component to prompt students' critical thinking.

Implications/Recommendations

Williams (2011) shared concerns that STEM integrated education related mainly to vocational and economic goals. Yet, our results suggest that non-traditional STEM educators, such as STEM graduate students, believed that STEM integrated education through AFNR should focus on preparing STEM work readiness, and also emphasize teaching and practicing soft skills, such as critical thinking, problem solving and communication (Hargreaves & Moore, 2000; Mason, 1996; Schlechty, 1990). For the graduate students in this study, they reflected on

their previous learning experiences as K-12 students, and considered their students' needs and interests when they designed their lesson plans, such as animals, food, and nature resources. They had expectations that these topics and activities would intrigue their students' STEM interests and engage students with relevant phenomena to make abstract STEM ideas plausible, and helped students meaningfully learn the phenomena that were presented in the lessons (Stubbs et al., 2016). This showed a different viewpoint than school teachers, which focused more on content knowledge and state standards (Wang et al., 2011), and curriculum, which rarely addressed students' needs (Kesidou & Roseman, 2002).

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Students' Experiences in an Integrated STEM Teaching Methods Course

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Introduction

Recent STEM education reform initiatives call for integrated STEM education approaches in which students learn how to solve problems by connecting contents and practices of various STEM fields (e.g., Next Generation Science Standards, Agriculture, Food and Natural Resources Standards). In this context, it is critical to prepare preservice STEM teachers to successfully teach STEM-subjects through integrated approaches (National Research Council [NRC], 2014). While there are some exceptions (e.g., Adams, Miller, Saul & Pegg, 2014; Berlin & White, 2012; Koirala & Bowman, 2003; O'Brien, 2010), secondary preservice teachers in STEM-related subjects are typically taught in teaching methods courses that are content-specific. As teacher educators, we face the need to design and provide teacher education programs that prepare teacher candidates to be able to adopt this changing context of STEM education and teach STEM through integrated approaches.

Purpose and Research Questions

The purpose of the study was to explore and describe how STEM teacher education students enrolled in an integrated STEM teaching methods course came to understand integrated STEM education and implement integrated STEM teaching. The following research questions guided the study: (1) How did the students develop and teach integrated STEM lesson plans? (2) What were challenges that students faced in developing and implementing integrated STEM lessons? (3) What were key elements that the students perceived to support successful integrated STEM education?

Conceptual and Theoretical Framework

Over the past decade, STEM integration has received increasing attention, and growing numbers of teachers and teacher educators have focused on characterizing integrated STEM education. It has been argued that STEM education should transcend the disciplinary boundaries in order to advance students' STEM literacy, 21st century skills, and capability to understand and address STEM-related global issues (Bybee, 2013; NRC, 2014). A curricular approach that integrates STEM learning provides students with opportunities to engage in real-world problems while learning STEM disciplinary ideas and practices, rather than to learn abstract and fragmented bits and pieces and then to have to assimilate them at a later time (Tsupros, Kohler & Hallinen, 2009).

Multiple definitions and approaches have been proposed for integrated STEM education with respect to what traditional subject areas are integrated and to what degree the boundaries are blurred (Bybee, 2013; NRC, 2014). Different subject areas are integrated (e.g., science and mathematics, mathematics and agriculture, and science and engineering), and the integration is

used to refer to, for instance, connected, interdisciplinary, multidisciplinary, or transdisciplinary. In this study, we conceptualized integrated STEM education drawing on Wang, Moore, Roehrig and Park's (2011) work that defines it as explicit and intentional blendings of science, technology, engineering, mathematics, and agriculture into a learning experience in order to:

> (1) deepen student understanding of each discipline by contextualizing concepts, (2) broaden student understanding of STEM disciplines through exposure to socially and culturally relevant STEM contexts, and (3) increase interest in STEM disciplines by increasing the pathways for students to enter the STEM fields (p. 2).

In addition, while the STEM acronym stands for Science, Technology, Engineering and Mathematics disciplines, we included agriculture for several reasons. Agriculture provides a platform for integrating multiple STEM-disciplines as abstract ideas of science and mathematics are applied in agricultural contexts. Studies have shown that agriculture teachers indeed have positive views on integrating science into their agriculture classes (Smith, Rayfield, & McKim, 2015) and integrating mathematics into agriculture courses improve students' mathematics performance (Parr, Edwards, & Leising, 2006). Elementary teachers also had positive views of integrating agriculture into their courses (Knobloch, 2008) and shared agriculture increased authenticity and connected academic subjects to real-world problems and applications in local communities (Knobloch, Ball & Allen, 2007). Furthermore, agriculture can facilitate integrated learning experiences in solving intertwined grand challenges such as climate change, biodiversity, and food security, which depend on and transcend the standalone disciplines of science and others (Barnosky, Ehrlich, & Hadly, 2016).

We used ideas from a *situative perspective* on teacher learning (Putnam & Borko, 2000) and teachers' *funds of knowledge* (Hedges, 2012) to design a teaching methods course for preservice teachers to successfully integrate STEM education while taking into consideration the challenges that they may face in a K-12 classroom. These two frameworks share a core assumption that learning of preservice teachers occurs and is mediated by multiple social actors, environments, and experiences that individuals bring to the learning setting (Hammersely, 2005). The question that teacher educators should ask is in what contexts preservice teachers' knowledge and learning is situated (Putnam & Borko, 2000) and what funds of knowledge preservice teachers bring to make sense of pedagogical practices introduced to them in educational courses (Hedge, 2012). Thus, our purposes, as teacher educator researchers, were not to evaluate preservice teachers' performance with research-based standards stripped from specific contexts of their teaching and learning, but to examine preservice teachers' reasoning behind certain decision-makings and how contexts and funds of knowledge shape their decision-making throughout the process of lesson planning, teaching, and reflecting.

Methods and Procedures

An integrated STEM teaching methods course at a large land-grant university served as the research context of the study. The course was a 3-credit semester course designed for undergraduate and graduate students who seek to attain teaching certificate in integrated STEM education. The second and third authors in two different disciplines (technology and engineering education, agricultural education) co-taught the course, and the first author (science education) participated in the course as a guest observer with a minimal role in the instruction. Students

were engaged in learning and practicing (1) foundational learning theories (NRC, 2000), (2) reform-oriented discipline-general pedagogical approaches, in particular learner-centered teaching (Weimer, 2002), problem-based learning (Hmelo-Silver, 2004), and backward design lesson planning (Wiggins & McTighe, 2005), and (3) discipline-specific instructional approaches (e.g., mathematical modeling, scientific inquiry, engineering/technology design). Throughout the semester, student planned and delivered four lessons. All lessons were practiced in a classroom on-campus to peers and course instructors, and a revised integrated STEM lesson that was delivered in the partner school with 7-12 grade students. Participants of the study were six students enrolled in this course (Table 1). We note that while the course was designed to prepare teacher candidates, two Ph.D. students (S2 and S3) did not plan to teach K-12 students upon completion of the degree. They opted to take the course because of their research interests in integrated STEM education and to prepare for future teaching in higher education settings.

Table 1. Participants of the study

	Degree Program	**Career Goal**
S1	M.S. Teaching certificate in Technology and Engineering Education	Teaching high school technology
S2	Ph.D. in Youth Development and Agricultural Education	Teaching to prepare science teachers in university
S3	Ph.D. in Science Education	Teaching undergraduate physics course
S4	M.S. in Youth Development and Agricultural Education	Teaching in informal settings, such as public garden
S5	B.S. Teaching certificate in Technology and Engineering Education	Teaching high school technology
S6	B.S. Teaching certificate in Technology and Engineering Education	Teaching high school technology

Data sources included one-hour long semi-structured interviews with six participants and artifacts that they generated for the completion of the course (e.g., lesson plans, reflection papers, final papers). After completion of the course, the first author invited all student participants to an interview. Interview questions focused on the procedure of lesson plan development and challenges they faced in the planning and teaching. We transcribed audio recordings of the interviews verbatim and read the transcripts multiple times to identify emerging themes (p. 87, van Manen, 1990). In order to refine and converge the sense-making of the three authors, the three authors regularly met for peer-debriefing and extensively discussed the themes we individually noticed in the interview data. Based on the discussions, we generated an initial coding scheme, coded the data with the initial coding scheme, and revised and reorganized our coding scheme. Several strategies were used to ensure trustworthiness and believability (Shenton, 2004). The process was iterative and dialogic in that we constantly revisited our sense-making of the data and codes to negotiate meanings (Miles & Huberman, 1994). Student-generated artifacts were used to triangulate and validate our analysis of the interview data (Miles & Huberman, 1994).

Findings, Discussion & Implications

Due to space limitations, the key findings for each research question are mentioned. Regarding Research Question 1, two themes were found in the students' approaches to develop their STEM integration patterns: strategic internet search and building on their funds of knowledge. Regarding Research Question 2, three challenges were shared by students regarding the development and teaching of integrated STEM lessons: existing school structure and instructional practices, limited interdisciplinary understandings, and absence of role models. Regarding Research Question 3, four key features of successfully implementing integrated STEM education were shared from the participants: authenticity with respect to students' lives, authenticity with respect to the professional fields, employing non-traditional pedagogical approaches, and collaboration among teachers.

Our analysis showed that preservice teachers were challenged in designing and implementing integrated STEM lessons because of existing school culture and structure, limited knowledge in STEM fields, and an absence of role models. Putnam and Borko (2000) argued that the existing powerful discourse communities of schools could easily "enculturate" preservice teachers into the community of traditional teaching practices and may discourage teaching in new ways. Resonated with this argument, our findings showed how the contexts in which teacher preparation program was situated—that encompass early schooling experiences, university coursework, practicum, and practicum school environment—can be a hurdle to teaching STEM in an integrated way. However, the analysis also demonstrated the strengths the participants had developed and brought to STEM integration education. The participants actively utilized tools (e.g., the Internet), drew on their own funds of knowledge, and identified strategies to mitigate some challenges for their future endeavor.

In response to the call for preservice teacher education for successful STEM integration (NRC, 2014), we would like to propose a few implications for teacher education program. Our suggestions are primarily to address challenges that the participants faced and capitalize on the strengths they brought. First, we suggest a strategic partnership with schools and teachers in order to provide preservice teachers with opportunities to observe practicing teachers and teach their integrated STEM lessons. Second, the participants' extensive use of online resources suggests that a successful lesson planning is influenced by effective and critical use of the online resources. Third, we propose that methods courses use examples of interdisciplinary work in the professional fields to demonstrate how STEM fields are integrated in reality. While the study participants hoped to design their lessons authentic to the professional fields, not all participants had experienced or known what such interdisciplinary work looks like. Furthermore, we observed that too much focus on STEM acronym could obscure what STEM integration really is, by connecting STEM-subfields for the sake of connecting them or ignoring other closely related fields such as agriculture. We believe global challenges (e.g., climate change, food security, and water scarcity) can be good resources to demonstrate interdisciplinary work (Bybee, 2013; NRC, 2014). These problems lie in a complex system that involves various kinds of expertise and requires professionals to work in interdisciplinary teams. In addition, these topics can bring another important aspect of STEM education, to educate students to be aware of socioscientific issues and become an informed citizens and decision makers (Knobloch et al., 2007), whether or not they pursue STEM-related careers (NRC, 2014).

Conclusion

Preservice teachers faced several challenges in designing and implementing integrated STEM lessons and their strengths in doing so (Ball, Knobloch, & Hoop, 2007). However, the strengths and strategies that the participants brought to mitigate challenges were promising. In particular, the participants believed that nontraditional teaching methods (Weimer, 2002) that move beyond teacher-led lectures (e.g., project-based learning, students' hands-on activities, student-centered, allowing multiple answers, allowing students to pursue their questions and interests) are key features of STEM integration (NRC, 2014). We believe that the transition in instructional methods can be an added benefit of integrated STEM teaching. This encourages teachers to grow from traditional methods that do not consider whether and how students learn toward engaging students in the learning processes and building on their knowledge and interests.

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An Exploratory Study of Advanced Agriscience Students' Views of the Nature of Science

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Introduction

One of the goals in today's society is to ensure that high school students exiting school have the ability to understand, develop, and comprehend scientific information. For students to be able to meet these societal requirements, it is imperative that students become scientifically literate and understand the concept of Nature of Science (NOS). One way to achieve this goal is to help students begin making scientific connections within other disciplines, such as Agricultural Education. For many years science integration has been a priority in the field of Agricultural Education to further prepare students for an ever-changing society. With this expectation the level of science rigor within Agricultural Education courses has continued to increase throughout the years. Along with the increasing rigor in agricultural education courses, it has become apparent that scientific literacy and NOS components need to be included if integration of science is to occur.

One of the key components of contemporary science education reform is the idea of students being scientifically literate (Dogan & Ozcan, 2008; National Research Council [NRC], 2012). Scientific literacy is defined as "the ability to make informed decisions on science and technology-based issues and is linked to deep understandings of scientific concepts, the processes of scientific inquiry, and the nature of science" (Bell, Blair, Crawford, & Lederman, 2003, p. 488). One of the fundamental components of science literacy is an adequate understanding of the Nature of Science (NOS) (Lederman & Zeidler, 1987). An adequate view of the NOS includes how science works and progresses. The NOS has been defined by Lederman, Abd-El-Khalick, Bell, and Schwartz (2002) "as the epistemology and sociology of science, science as a way of knowing, or the values and beliefs inherent to scientific knowledge and its development" (p. 145). There are many tenets that are considered to be important constructs for NOS understanding, however, seven have been deemed important for K-12 education: 1) the empirical nature of science, 2) creativity and imagination, 3) social and cultural embeddedness, 4) laws and theories, 5) subjectivity in science, 6) tentative nature of science, and 7) observations and inferences (Young, 2011; Melville, 2011; Abd-El-Khalick, Bell, & Lederman, 1997).

As the need for increasing students' science understanding has become a priority, so has the idea of integrating more science into the Agricultural Education curriculum. Grady, Dolan, and Glasson (2010) indicated that, "in addition to understanding and applying science concepts, formal and informal Agricultural Education emphasizes learning about the processes and nature of science" (p. 10). It has also been found that agriculture teachers support teaching integrated agriculture courses as well as offering the courses for science credit for graduation (Cherry, 2011; Chiasson & Burnett, 2001; Johnson, 1996).

In light of NOS research having been conducted on secondary students in various science courses, to date only two studies have been conducted in Agricultural Education on the topic of NOS. For example, Grady, Dolan, and Glasson (2010) conducted a study on a secondary

agriscience teacher and her students. In their study, only three tenets of NOS were examined: empirical nature of science, theory-ladenness nature of science, and science knowledge is socially and culturally embedded. Findings indicated that students' "reinforced a combination of accepted, underdeveloped, and incorrect assumptions of NOS" (p. 14).

Recently, Nortrup (2013) conducted a study to determine the conceptions of the NOS held by Agricultural Science and Business (ASB) teachers. Nortrup (2013) examined ASB teachers through a mixed-methods survey approach. Nortrup found that "many [teachers] lacked a fundamental understanding of the science enterprise, the relationship between theories and laws, the social and cultural embeddedness of science knowledge, how science is practiced and how knowledge is constructed" (p. xiv). Overall, students continue to be studied to determine the methods and courses through which a student can best learn NOS. However, research continues to indicate that students lack an understanding of the important components of NOS (Grady, Dolan, & Glasson, 2010; Parker, Krockover, Lasher-Trapp, & Eichinger, 2008).

Purpose and Research Questions

The purpose of this study was to explore NOS views of students who are currently enrolled in a science-intensive agriculture course and the extent to which their views change of NOS during the course of a spring academic semester. The research questions guiding this study were:

1. What are agricultural science students' initial views of the NOS before taking an advanced life science agriculture course?

2. What are changes, if any, of agricultural science students' views of the NOS after taking an advanced life science agriculture course?

Methods and Procedures

The approach utilized for this study was a qualitative research design. The focus was a single case study of a science-intensive agriculture course. Creswell (2007) describes a case study as "research [that] involves the study of an issue explored through one or more cases within a bounded system (i.e., a setting, or context)" (p. 73). The case study focused on one school and two different types of classes, an advanced agricultural science (AAS) course and an Anatomy course. For this study, three different AAS courses were utilized: animals, plants, and food science. Additionally, an Anatomy course was used to compare how students' views of NOS changed during the academic semester.

The instructor taught the AAS courses utilizing pedagogical methods that are recommended and discussed extensively in training workshops that all AAS teachers are required to attend. During the AAS training workshop, teachers are encouraged to teach the AAS curriculum utilizing inquiry-based learning methods, as well as many different hands-on learning techniques. Finally, the instructor's school also has high academic standards and offers a wide array of coursework to students. The high academic standards are reflected in the school's rating as an "A" and "4-star" school within Indiana by the Indiana Department of Education.

An Anatomy course, and its students, were selected as the control for this study because the requirements to take the course and the advanced level of material being taught is comparable to the AAS courses. Students in the Anatomy course were chosen for the sole purpose of ensuring that the students in the AAS course were not beginning with a greater understanding of NOS than students not enrolled in an AAS course.

The individual courses chosen were determined based upon the course schedule at the high school. For example, because the school was on block scheduling, it was important to have all of the courses, AAS (Animals, Plants, and Foods) and Anatomy, in one day so that data from all of the courses could be collected in the same day. The AAS instructor selected the day during the week that data collection would occur.

The AAS curriculum overall contains some reference to NOS for teachers to follow. However, not all seven accepted tenets for K-12 education are present. Further, the AAS curriculum does not include explicit teaching of NOS. Rather, NOS that is present is in an implicit format. When the Plants curriculum was analyzed for NOS it was found that there was only moderate representation of the empirical NOS, subjective nature of NOS, and the social context of science (Anderson & Esters, 2012).

Students for this study were selected based upon several criteria. First, students were selected based on their course enrollment. Specifically, a student had to be enrolled in one of the three AAS courses or in the Anatomy course. Before students are allowed to register for an AAS course, they must meet certain requirements to ensure they will be successful in the course. The first requirement is that a student must be a high school junior or senior. Second, each student must have taken one year of Biology and Chemistry, or one year of Biology and Integrated Chemistry and Physics (ICP). Further, the student must not have taken an AAS course prior to the current academic school year. This requirement was included because many students take multiple AAS courses to enhance their science understanding and college preparedness. Additionally, if a student had already taken an AAS course, it was possible they have more informed views of NOS, making it difficult to determine if their NOS understanding had been influenced by taking an AAS course.

Before students can enroll in an Anatomy course they must have first taken Biology I and Chemistry I or Integrated Chemistry and Physics (ICP). Additionally, for this study it is important that the Anatomy students not have previously taken or be currently enrolled in an AAS course. If a student had previously taken an ALS course they were removed from the study.

The primary questionnaire used for this study was the Views of the Nature of Science-Form C (Lederman, Abd-El-Khalick, Bell, & Schwartz, 2002). This questionnaire was selected due to the open-response format, which allowed for the most freedom in obtaining student responses. Specifically, the student can write as much as they would like about a single question. The VNOS-C contains 10 open-ended questions that address seven different aspects of NOS. For this study, three sources of data were collected: (a) student responses on the VNOS-C; (b) interviews based upon the student's answers to the VNOS-C; and (c) student demographic information.

Conclusions and Implications

Overall, there was no change in students' understanding of NOS for both the AAS and Anatomy courses. However, responses on the post VNOS-C questionnaire from AAS students showed some change in understanding of the social and cultural embeddedness through their written responses. There are several implications for research that result from this study for the area of Agricultural Education in relation to NOS understanding and science integration. First, NOS needs to be further explored to better understand student NOS understanding in relation to their enrollment in Agricultural Education courses. A second implication for research can be extended to how science is being presented and taught in Agricultural Education courses. Findings from this study indicate that even in advanced science courses, students who took previous high school science courses were not gaining adequate levels of understanding of NOS. A third implication for research would be to explore implicit vs. explicit teaching of NOS in Agricultural Education courses.

The implications for practice from this study focus on issues related to curriculum development, Agricultural Education instruction, and teacher preparation. First, having explicit strategies embedded within the Agricultural Education curriculum could assist in guiding in-service teachers to better implement activities with reflection that could enhance curricula and student connections and understanding of NOS. Additionally, including NOS in teacher preparation programs would greater assist teachers in furthering the understanding of NOS for their students through their in-classroom instruction. Simply, if teachers are more comfortable with and knowledgeable as to how science works, students will have a greater chance of making the connections between science, agriculture, and society. Finally, to further aid in assisting teachers in understanding NOS so that it can be taught within agricultural education classrooms, NOS-focused professional development opportunities geared toward teachers should be offered.

Recommendations for Future Research

Future research should focus on a larger and more diverse group of students who are enrolled in a variety of agricultural education courses. The current study focused on a course that is not offered in states beyond Indiana and sampled a small number of students from one school. To gain a more comprehensive understanding of the influence of agricultural education on student NOS understanding, more courses and across all grade levels of students should be explored.

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Previous Experience Not Required: Contextualizing the Choice to Teach School-Based Agricultural Education

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Introduction and Review of Literature

The shortage of school-based agricultural education (SBAE) teachers across the United States is not a newly emerging issue. Within the past decade, an average of 71% of qualified teacher candidates choose teaching as their career with remaining graduates choosing alternative professions (Kantrovich, 2010; Foster, Lawver, & Smith, 2014). Teacher candidates are not obligated to seek teaching positions upon graduation, nor can those who want to leave the profession be persuaded to stay. Efforts to expand the profession and meet the needs of local programs should focus on the recruitment of more qualified candidates into agricultural teacher education programs (Ball & Torres, 2010; Kantrovich, 2010). Park and Rudd (2005) indicated SBAE teachers are credited by their students for serving as a role model toward selecting teaching as a career. Beyond current teachers, options for improvement do exist in the amalgam of recruitment approaches teacher education programs currently employ (Calvin & Pense, 2013).

To create effective mechanisms for teacher recruitment, it is important to recognize motivations for choosing teaching as a career. Bastick (1999) concluded motivations to enter the teaching profession are primarily guided by extrinsic reasons. Conversely, Lawver and Torres (2011) reported intrinsic factors and drive to pursue teaching demonstrated the greatest predictive power toward describing career choice. Kyriacou and Coulthard (2000) suggested tailoring recruitment strategies toward the areas students find important in a career could sway them toward teaching. Teaching appeals to those who believe it aligns with career attributes sought in their career selection/exploration (See, 2004).

Lawver and Torres (2011, 2012) recommended recruitment efforts and strategies focused on populations outside of SBAE. Additionally, focus on further study of agricultural education majors and current teachers who do not possess the typical SBAE background found amidst SBAE teachers. It appears that expecting current SBAE programs to produce all future teaching candidates is not realistic. Certainly, such a narrow approach to recruitment ignores the opportunity for connecting with prospective teachers outside of SBAE. As such, how might we reconfigure and inform the recruitment process for SBAE to attract and invite a more diverse candidate population?

Theoretical Framework

The Ag Ed FIT-Choice® model adapted by Lawver (2012) and developed by Richardson and Watt (2006, 2007) provided the investigative framework to design this study. Designed within the context of the expectancy-value theory of motivation (Wigfield & Eccles, 2000), the Ag Ed FIT Choice® model provides a guide for describing why individuals choose the career of teaching SBAE.

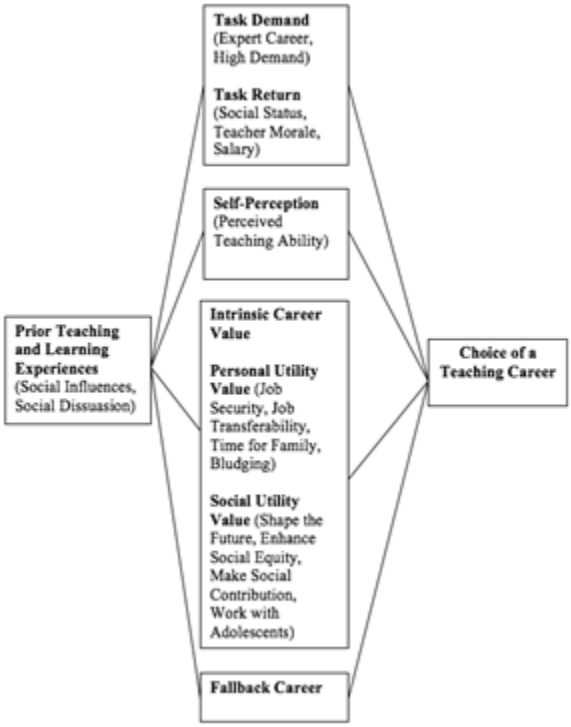

Figure 1. Ag Ed FIT-Choice® Model, Lawver (2012).

Purpose

The purpose of this study was to identify key factors influencing students without experience in school-based agricultural education at three land-grant institutions toward pursuing agricultural education. The AAAE research priority area four guided inquiry (Roberts, Harder, & Brashears, 2016). The following research questions were addressed:

1. What mechanisms lead those without a background in or previous exposure to SBAE engage in SBAE as a career choice?
2. What personal factors guided decision making toward SBAE?
3. What previous knowledge about SBAE influenced decision making?
4. What aspects of SBAE captured interest in the profession?

Methods

This study employed a single-category focus group design (Krueger & Casey, 2009). The purpose of this design is to attempt to reach theoretical saturation through the incorporation and preliminary analysis of separate homogeneous groups. Ten guiding questions were selected, taking into account the Ag Ed Fit-Choice® Model. A critical incident approach to analytic design (Krueger & Casey, 2009) was incorporated whereby the key task was to identify the crucial events, actions, or situations expressed by the individuals. Participants met requirements of: a) currently enrolled in a traditional licensure agricultural teacher education program, and b) no previous SBAE enrollment as a secondary student.

Focus group one included six (*n*=6) participants and five (*n*=5) in group two. All researchers participated in each iteration of data collection and met following to provide oral summary as recommended by Krueger and Casey (2009). Following the data collection and transcription, the four researchers separately completed open coding and field notes through the lens of prefigured categories (Crabtree & Miller, 1992 in Creswell, 2013) in the Ag Ed Fit-Choice Model (Lawver, 2012). Separate findings were ultimately reconciled by the researchers. Trustworthiness of data procedures were established using recommendations from Creswell (2013) and Yin (2009) through triangulation of data sources and the use of multiple investigators to provide consensual validation of the analysis and dimensionality to the data itself.

Findings

Findings were organized around categories of the Ag Ed Fit-Choice Model (Lawver, 2012) with the exception of one additional category, believed unique to this group. This section represents the participants' experiences and pathways toward selecting agricultural education with preliminary intentions to teach.

Prior Experiences

Participants reflected on a variety of non-formal teaching experiences which built efficacy for pursuing teaching. The experiences were as broad as camp counselor to overseeing adult education in nutrition. Previous agricultural experiences ranged from the family farm, 4-H, community gardens, military service, to none.

Tasks of Teaching

Task perceptions related to an individual's choice to teach are considered as task demand or task return (Figure 1). Participants commented on the positive outlook of teachers within the profession, and were encouraged by observing and experiencing strong teacher morale. One female participant offered, "in this program... you've got people saying, 'Oh, this [profession] is wonderful! And, this is how you make it work in your current life situation.'" Additionally, the welcoming nature of the SBAE "family" helped nurture participants' development. The support network experienced throughout early field experiences helped solidify participants' intent to teach. One student commented, "I have received so much support from other Ag teachers." Participants shared a positive perception of professional connectedness, feeling as if they were already a part of an existing community of practice. At the same time, SBAE was acknowledged

as a high demand task requiring commitment and hard work. One stated, “There’s so much we have to know. And, there’s so much to teach in the four short years you have [with students].”

Self-Perception

Participants’ self-perceptions reflect their ability to be a quality teacher and categorizes their personal alignment with SBAE. Perceived abilities were first expressed by longtime desires to teach. A female participant stated “…teaching was [always] going to be a good career option [for me],” and other participants echoed. Participants envisioned and expressed a desire to teach in an environment similar to the school where they grew up: “I grew up in a small community and that’s what I’ve always known.” Other participants articulated a need for agricultural education in urban areas matched their personal vision. “I think a lot of kids in the city could definitely learn so much from agriculture [courses]…” Participants also mentioned interest in beginning new programs indicating this would allow them to make a direct and fulfilling impact; “It was always kind of the plan to go back and start a program [at home] because I always wanted one when I was in school.”

Values Toward SBAE

Within the Ag Ed FIT-Choice model, it is posited that the career seeker possesses intrinsic value in the career of teaching agriculture. Several participants cited the connection between teaching agriculture, their farm upbringing, and content interests as propellants toward the career: “It [SBAE] fits well with my passion for agriculture…” stated one female participant. Broad applicability of an agricultural education degree was attractive for many participants. One female participant discussed her previous thoughts about entering into another teaching area questioning; “What am I going to do with this degree [another CTE area] if I don’t want to teach in the end?”

A distinct influential factor with this group's outlook toward SBAE seemed to revolve around the perceived social utility value of the career. “I think ag is really good at capturing those students [who don’t fit in] and helping them into something that would work for them, and help them to be successful outside of school.” Participants’ outlook on the teacher’s influence spilled into their overall view of SBAE’s contribution to youth and society. “[What’s encouraging is] inspiring them to learn about the natural world instead of having them looking at a computer screen all day,” countered one male participant.

Fallback Career

Because participants often lacked knowledge about the existence of SBAE, teaching agriculture was a fallback career for most. Many stumbled across the degree program, which initiated their interest. One pre-service student stated, “I love chemistry, but it didn’t love me; I had to try and find something else.” A female participant stated, “I always wanted [an SBAE program] when I was in school. Then I came here and got introduced to it and it all fell into place...” Through military experience, one female participant recounted her deployment experience through which she helped Afghani women raise their own food and subsequently found the opportunity to pursue SBAE.

Detractors
Participants identified many components of agricultural education specifically, regarding in-group lingo and behaviors, that posed challenges or potential barriers. Participants perceived that individuals with specific prior SBAE experiences comprised the in-group. One female participant stated, "There's a lot of people who are like state FFA officers. You sit there like, 'Cool, I have no idea what you are talking about.'" Participants articulated a belief that this ingroup believed they have a predetermined skillset for being successful in SBAE. Further, participants identified a lack of cultural competence in programs. A female participant noted, the "FFA culture.. prayers at meals exclude some students. How do we fit all of this in and make this inclusive program?"

Conclusions, Implications, & Recommendations

The premise of this study was to provide context to the career choice process of a group of preservice teachers without experience in school-based agricultural education at three Midwestern land-grant universities. As such, unique participants in these focus groups presented important considerations for teacher preparation programs. Participants expressed a variety of factors visible within the Ag Ed Fit-Choice model, depending on their personal and programmatic experiences. Consistently, participants seemed to wrestle with personal and social intrinsic career value, similar to findings in See (2004). This could be due to participants looking at how they will balance time with family, job security, and shaping a professional future. Further, within the model there is an interconnectedness of domains and the way in which future teachers reflect upon career decision. Participants engaged in near constant value-checking and introspective career evaluation resulting from field experiences. Engaging with the SBAE family through field experiences was recognized as an encouraging factor, as in other studies (Lawver & Torres, 2011; Park & Rudd, 2005). On the other hand, peers within the programs served as exclusionary roadblocks. Oftentimes, a lack of acceptance among peers with SBAE experience was off-putting. Teacher educators should be aware of how this impacts students without SBAE experience. Critical conversations involving all teacher preparation students and attention to professional attributes of each candidate may be helpful in addressing this challenge.

A myriad of experiences led participants to consider SBAE as a career. Certainly, it can be concluded that a passion for agricultural education does not solely stem from prior SBAE experiences. 4-H, military training, or dietetics and nutrition training each provided for diverse pathways to SBAE and have far-reaching implications for program recruitment (Calvin & Pense, 2013). To that end, how can programs and the profession be better promoted, so more prospective students are career aware and fewer "stumble upon it"? Recruitment activities should be aligned to reach non-traditional audiences. Members of such populations may be instrumental in advancing SBAE, particularly in urban and suburban areas.

Future research involving the Ag Ed Fit-Choice® model and SBAE career decision could begin by replicating and expanding the present study. Similarly, comparing the choice to teach SBAE among those without SBAE experience to those with SBAE experience would provide further insight into influences and the decision process. The present study generated additional questions on the most effective ways to recruit students who are non-traditional SBAE students. As

stewards of SBAE, we must better understand the needs of all prospective SBAE teachers in order to recruit and retain more diverse teacher candidates.

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Managerial Expectations and Experiences of Listening in the Agricultural Workforce

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Introduction and Literature Review

Educators at all levels have focused on preparing their students for the world of work (Lesley, 2014). Numerous studies (Bruening & Scanlon, 1995; Crawford, Lang, Fink, Dalton, & Fieltiz, 2010; Robinson, Garton, & Vaughn, 2007; Williams, Robertson, Keith, & Deal, 2014) have focused on the technical and soft skills needed for employment. Employers have had a history of highly valuing communication skills such as speaking and listening (Bruening & Scanlon, 1995; Crawford et al., 2010) and identifying them as important in the hiring process.

Of the various factors that could be included under the communication umbrella, listening was cited either as the most important (Bruening & Scanlon, 1995; Crawford et al., 2011) or a "very important" skill (Williams et al., 2014). Currently, a disconnect between employers and employees/potential employees exists in the area of listening. Very little is known about listening in the workforce, even though it has been identified as one of the most important skills and in need of the most improvement (Bruening & Scanlon, 1995; Robinson et al., 2007). Crawford et al. (2011) found students thought they were the most prepared in soft skills, such as listening, but employers rated them as being least prepared in that area, a misconception mirrored in the agricultural workforce (Bruening & Scanlon, 1995; Robinson et al., 2007). To effectively develop future employees for the workforce, we must examine what listening looks like in the workforce.

Contextual Framework

There are several frameworks that assisted us in the contextualization of this problem as opposed to being used a post-positivist framework through which the study is defined. Listening in the workplace is an intersection of the communication process, information processing theory, and adult learning. The communication process helps us understand how information is transmitted from person to person. The communication process is made up of three components: the sender, the receiver, and the message (Levi, 2014). Upon receiving a message, information processing theory explains how the brain processes it and commits it to memory. The information processing model is divided into three unique parts: sensory information, short-term memory, and long-term (Newell, Shaw, & Simon, 1958). This ensures the information is encoded into memory and can be acted on in the future. Finally, adult learning theory helps us understand how adults are motivated to learn (Birkenholz, 1999) and thus the role motivation plays in listening. We recognized the complexities of listening and used these frameworks to help demonstrate that complexity.

Purpose

The purpose of this grounded theory study was to describe the traits of listening in the agricultural workforce as perceived by managers. The central question was how does listening play a role in the agricultural workplace?

Research Methods

The population for this study was managers in the agricultural workforce. The Career Services office within the College of Agriculture, Food and Natural Resources at the Univsersity of Missouri was utilized to generate a list of potential participants. Purposive sampling was used to achieve maximum sample variation regarding number of employees supervised, field of employment, and length in a managerial position. Participants worked in production agriculture, sales, and service areas, held a managerial position for a minimum of twelve months, and directly supervised at least of four employees. Semi-structured, face-to-face interviews occurred and were recorded and transcribed. Seven interviews occurred; data saturation began to appear after five and complete saturation occurred at seven. The researchers utilized as pragmatic epistemological lens to conduct this study. Open, axial, and selective coding were used to develop categories and themes (Strauss & Corbin, 1998). Memoing, constant comparative analysis, and member checking were used extensively throughout the research process.

Findings

Five main themes emerged based on the information provided by the participants. The themes centered on participants' personal experiences regarding employee listening behaviors in a variety of settings. They also reflected on their own listening behaviors.

Theme 1: Listening's Impact on Business

Good listening is important to the company, the manager, and the customer. Employees are able to listen positively stand out from their co-workers. Matt stated, "Listening is that percentage that can separate you from an average performer to a top performer. It's that icing on the cake that makes your efforts . . . more productive."

Many managers reported wanting workers who were passionate and enthusiastic about their jobs, but their listening ability was most beneficial to the business by increasing efficiency. Chloe, who worked in an office setting, described the need for good listening as "they have to follow instructions and be independent. [Be]cause otherwise they're just asking questions constantly." Phil stated, "When you get someone who pays attention to details, follows through on things, my day is much more efficient now because I made one visit with that person and the issue is taken care of."

Listening has a direct impact on the company's profits. C.J. shared his thoughts, "You have to satisfy a customer's wants and needs and you are never going to know if you don't listen. Good listening prevents problems down the road." Listening by employees has a positive impact on the company. They are better able to keep customers happy. Individuals who are good

listeners are more responsive to customers, coworkers, and managers in the workplace than their peers.

Theme 2: Behaviors of Active Listening

Participants noted a wide variety of behaviors to identify when an employee was listening. Paul noted the listening process starts with attitude. "They have to be willing to listen, willing to learn something. Otherwise, it's just a waste of time." The participants noted typical nonverbal cues, such as eye contact and nodding of the head. Two of the participants stated listening behaviors played a role in the interview process.

Every participant highlighted the importance of taking notes, particularly on paper in regards to listening. CJ noted how easily information can be forgotten, "Even the most basic pieces of information when you are sitting there having a conversation tend to slip out of your mind . . . you got to write that stuff down."

Another behavioral characteristic of listening was the ability to ask questions. CJ summed it up as, "A good listener talks less and asks more questions." Asking questions allows people to clarify statements and "show action on your part," said Matt. Asking questions to clarify instructions is important, too. "[Asking questions] just proves that okay, they have heard what I said and yet they still have the interest to learn more, to clarify things," Megan said.

Employees who are not listening have distinctive pattern of behaviors, focusing primarily on body language and electronic usage. CJ summed it up as:

> You can tell if someone starts losing eye contact with you, they are looking around the room, they're tapping their pencil, they're tapping their foot, looking at their watch. They're obviously not listening, they have other things on their mind. . . If they are checking their phone or laptop you might as well just end the meeting.

Theme 3: Coaching and Mentoring

All participants noted they use at least one strategy to help employees improve listening skills at work. Role play was a common strategy for participants involved in customer service or sales. Paul discussed how his scenario served two purposes: to make sure the employee understood the information he was trying to communicate and they could apply it in a real world setting. CJ discussed the benefits of debriefing with employees after a sales call:

> Maybe we leave the meeting and I [will] ask [questions]. . . [My goal is to] just try to make them think about it afterwards. We always have something to talk about.

Many participants employed the use of peer-to-peer communication or mentoring. When asked why, Chloe said, "I think they just tend to listen to one another better."

Theme 4: Listening Barriers

We asked participants specifically about barriers to listening. The participants were reflective on personal and employee behaviors. Lack of buy-in or applicability of the message was a major issue for many participants. Phil stated, "if it's something that really upsets me from a company standpoint that I don't agree with . . . I will block it out." While Paul said, "if they have a goal to hit . . . or their ideas aren't working, they are always a little more open to outside sources." Lack of novelty was a common issue the participants noted. CJ said a common reason to check out was "I don't need to learn this again because I am familiar with it." A sentiment that was echoed by Paul and Chloe.

Theme 5: Technology and Listening

Technology has also appeared in other themes. However, we brought attention to technology here because of the unique opportunities and challenges it presents for listening in the agriculture workforce. Participants noted technology will not disappear, but were excited at the possibilities it brings. It all depends on how technology is used. Several participants lamented the fact traditional modes of electronic communication (email, phone call, text messaging) lack nonverbal feedback associated with listening.

However, several participants expressed optimism about how new technology can have a positive influence over business and listening behaviors. CJ discussed how FaceTime helped develop positive relationship with his customers. He also discussed how virtual meetings and nonverbal communication is conveyed. "I'd rather see the person talk on like an agronomic issue. Our [specialist] will talk, and if you see him doing nonverbal [cues] and you see him saying 'well this is *terrible* 'it already hits home with me." Participants stated the biggest benefit to technology was being able to see and listen other people's nonverbal cues. They felt like they were better listeners because of it.

Discussion

Listening plays a direct role in business. It helps increase employee efficiency, workplace safety, and employee responsiveness. Employees who listen and are responsive to customers have a positive impact on the business (Ramsey & Sohi, 1997). Making new employees aware of the positive influences listening on a business is the first step to getting them to actively listen during the communication cycle.

Participants stated they expect to see typical nonverbal cues associated with listening. They also perceived note taking as positive to help employees recall information. This idea is emergent from the information processing framework. Historically, note taking has been linked with increased memory retention (Annis & Davis, 1975; Fisher & Harris, 1973). Asking questions has long been associated with problem-solving schema (Singer & Donlan, 1982) and should be encouraged with employees.

Barriers posed an obstacle to listening. As noted earlier, being willing is the first step in the listening process, which may be a challenge. Mood has shown to have an influence over attention, information processing (Forgas & Koch, 2013). Lack of novelty, buy-in, or applicability of the message where cited as common reasons for not listening, which is emergent from adult learning framework (Lieb & Goodlad, 2005). When communicating a message, it is important for managers to remember adult learners are practical, goal-orientated, relevancy-orientated, and maximize their learning potential when they are cognitively interested (Lieb & Goodlad, 2005). Although this study did not examine the manager's role in the listening process, the clarity to which the message is being conveyed is important.

Many of the themes focused on helping employees encode information into long term memory. Encoding is a natural part of the memory process. When someone fails to encode information they are not able to retrieve it to use it later (Newell et al., 1958). Further research is recommended to help identify why this is a commonly missed step in the memory formation process and ways to overcome it.

Listening has a direct influence on business; however, research has yet to assign an official cost of poor listening. A future study should help determine the amount of money lost over the lack of listening. Understanding the fiscal implications related to listening is important avenue that should be explored. Additional studies should be conducted explore how novelty influences employee attitudes and behaviors.

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Agricultural Employees' Use and Perceptions of Education and Training Opportunities

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Introduction

The level of education an individual attains often affects the quality of life for the individual and their family (Greenstone & Looney, 2012). In today's postsecondary educational environment, there are a range of educational opportunities from formal to non-formal and credit-bearing to noncredit-bearing. These opportunities are offered by a range of groups such as public and private colleges and universities, technical schools, businesses, commodity groups, and the Cooperative Extension Service. However, the best methods or formats for delivering educational programs are still a matter of debate. Allen and Seaman (2013) described four delivery methods for postsecondary education: (a) traditional, (b) web facilitated, (c) blended/hybrid, and (d) online. Traditional courses provide the learner with face-to-face instruction, which centers on oral and written information (Allen & Seaman, 2013). Web facilitated courses use instructional technology and provide a platform in which the instructor may post course documents for the students to access (Allen & Seaman, 2013). The blended/hybrid method combines the use of face-to-face meetings with instructional technology that allows for online discussion groups and the means to post content online (Allen & Seaman, 2013). According to Allen and Seaman, the blended/hybrid method often allows for the reduction of face-to-face class sessions. The online method allows the instructor to deliver the course in a manner that removes face-to-face meetings from the course and provides the content online for the students to access (Allen & Seaman, 2013). In addition to these traditional methods, some institutions are offering Massive Open Online Courses (MOOCs; Allen & Smith, 2013). MOOCs expand traditional distance education models, as an educator delivers instruction through a learning management system to thousands of learners who typically enroll for free, certification, or credit (Liyanagunawardena, Adams, & Williams, 2013). Similar methods to those mentioned above are used by organizations such as the Cooperative Extension Service to provide non-formal offerings (Davis, 2014; Friedl, Ober, Stein, & Andreu, 2015). Additionally non-formal delivery methods include webinars, training programs, publications, newsletters, and certificate programs (Allen & Seaman, 2013). This paper reports on agricultural employees' use and perceptions of education and training opportunities.

Theoretical Framework

The expectancy-value theory framed this study (Atkinson, 1957; Vroom, 1964). According to Schunk (2004), the expectancy-value theory allows for individuals to evaluate how much they value a specific outcome, and this value determines their behavior and contributes to how much effort is put into obtaining a particular outcome. Individuals typically seek realistic outcomes and do not invest energy in unattainable goals (Schunk, 2004). The model for this study is from Bauer and Erdogan (2012) and is based on Vroom's (1964) and Porter and Lawler (1968) (See Figure 1).

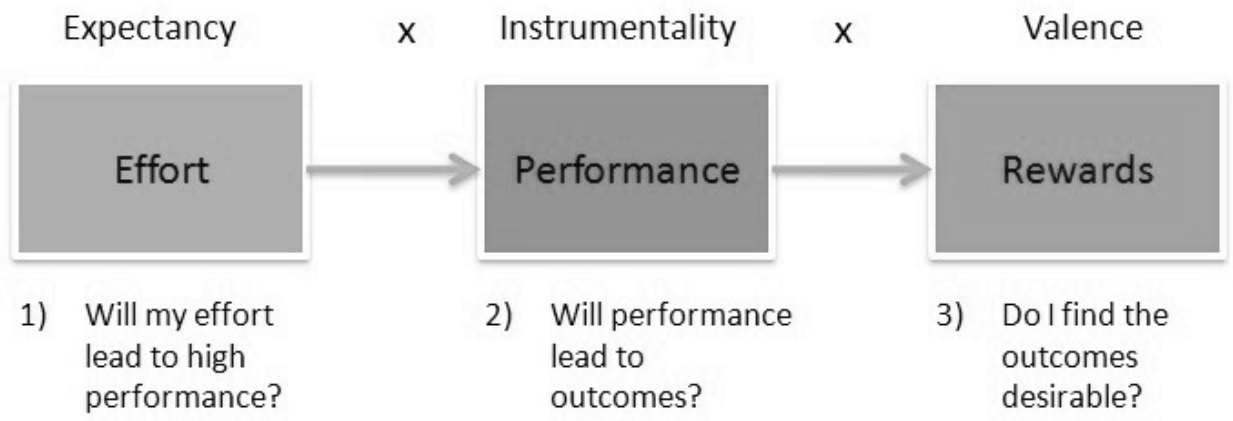

Figure 1. Summary of Expectancy Theory (Bauer & Erdogan, 2012, Expectancy Theory, para. 1; Based on Porter & Lawler, 1968 and Vroom, 1964).

Operationalized to this study, expectancy is an individual's belief about the likelihood that effort will lead to achieving educational or training learning outcomes. The higher the belief that effort will lead to success, the higher the expectancy. Instrumentality is a belief that outcomes are positively associated with completing educational or training programs. An example of high instrumentality would be a person believing that completing a specific certification will lead to earning a specific job. Rewards refer to the belief that the outcomes are valuable. Elaborating on the previous example, a specific job may only be valuable if it pays more or if it is intrinsically rewarding. Thus, valence refers specifically to the value placed on the outcome associated with the training or educational program. Holding everything else constant, a person is more likely to engage in a specific behavior if any of the three elements of the theory, expectancy, instrumentality, or valence, is increased. Motivation to engage in a specific behavior is enhanced by increasing expectancy, instrumentality, or valence.

Purpose and Objectives

The purpose of this study was to examine the type of education and training opportunities in which Nebraska agricultural employees participate and their satisfaction with different delivery formats. The objectives of this study were:

1. To determine the type of education or training programs rural agricultural employees have participated in over the last two years.
2. To determine the differences between attitudes towards face-to-face versus online education and training approaches.

Methods/Procedures

Data from 189 self-identified agricultural employees from the Nebraska Rural Poll (Center for Applied Rural Innovation, 2015) were used. The poll is a 14-page questionnaire with items related to well-being, community, climate and energy, community involvement, and education. Three subsets of items used for this study included: (1) demographic questions, (2) questions related to participation in training and education, and (3) four statements focused on

satisfaction with training and education. The satisfaction with training and education response options ranged from *very dissatisfied* to *very satisfied*; a response of *does not apply* was also available. The questionnaire was mailed to 6,228 households, a representative sample of nonmetropolitan households in [State]. Responses were received from 1,991 households, which resulted in the 189 self-identified agricultural employees.

The total design method (Dillman, 1978) guided the data collection, and the following four steps were taken:

1. A pre-notification letter was sent to participants, informing them of the research and questionnaire.
2. Seven days later, a questionnaire was mailed to each participant and a cover letter signed by the project director accompanied the survey.
3. Seven days after the questionnaire and letter were mailed, a follow-up postcard was sent to each participant as a reminder.
4. If the questionnaire was not received approximately 14 days after the original mailing, a replacement questionnaire was sent to the participant.

To analyze the data, SPSS was used. Descriptive statistics were used to describe the demographic information, participation in education and training opportunities, and level of satisfaction with education and training opportunities. Generalizing results to other rural populations should be done with caution as a single state were used.

Results/Findings

Demographic information provided by the participants indicated 139 were male (73.6%), 47 were female (25.0%), and 3 participants did not respond. The minimum and maximum ages of respondents were 23 and 87, respectively, with a mean of 47.8 (*SD* = 16.1). One respondent indicated Spanish/Hispanic/Latino best described his/her ethnicity. Additionally, for race, one respondent chose American Indian or Alaska, one respondent marked other, three respondents did not choose a response, and 185 respondents (97.6%) indicated White best described their race. Table 1 provides the breakdown of education levels across respondents.

Table 1
Education Levels of Respondents (n = 189)

Education	*n*	%
Less than 9th	1	.3
9th grade to 12th grade (no diploma)	3	1.5
High school diploma	43	22.7
Some college, no degree	31	16.5
Associate degree	45	23.6
Bachelor's degree	52	27.7
Graduate of professional degree	11	5.9
Missing	3	1.8

Of the respondents, 94 (49.7%) indicated they had participated in some type of formal education courses, workshops, webinars, or other training in the past 2 years. The types of training the respondents participated in are provided in table 2. For all categories of education and training, the face-to-face delivery format was attended more often. For both face-to-face and online education, *seminars, workshops or webinars for my job* was the most common type of training attended.

Table 2

Types of Education or Training (n = 189)

	Face-to-Face		Online	
Type of Training	*f*	%	*f*	%
Courses to complete or count toward an associate degree (2 year degree)	16	8.5	2	1.1
Course to complete or count toward a bachelor's degree (4 year degree)	11	5.8	2	1.1
Courses to complete or count toward a masters or other advanced degree	5	2.6	2	1.1
Courses to complete or count toward a certification program	44	23.3	18	9.5
Courses for continuing education units	29	15.3	21	11.1
Seminars, workshops or webinars for my job	68	36.0	27	14.3
Non-credit courses for my own general interest	28	14.8	6	3.2
Seminars, workshops or webinars for my own general interest	35	18.5	13	6.9
Other	6	3.2	0	0.0

Frequency of participant satisfaction responses with different types of training is displayed in Table 3. Only responses from participants who indicated engaging in specific education or training delivery methods are included. Across all four types of training, more participants indicated being *satisfied* or *very satisfied* than being *very dissatisfied* or *dissatisfied*. A majority of respondents found two types of training generally satisfying: (a) traditional in-person credit courses and (b) in-person seminars or workshops. Respondents generally had *no opinion* of online credit courses, and 50% found online webinars or workshops satisfying.

Table 3

Satisfaction with Types of Training

Type of Training	*N*	VD		D		NO		S		VS	
		f	%	*f*	%	*f*	%	*f*	%	*f*	%
Online credit courses	52	3	5.8	10	19.2	21	40.4	13	25.0	5	9.6
Online webinars or workshops	58	0	0.0	10	17.2	19	32.8	21	36.2	8	13.8
Traditional in-person credit courses	54	0	0.0	3	5.6	14	25.9	28	51.9	9	16.7
In-person seminars or workshops	84	0	0.0	3	3.6	10	11.9	52	61.9	19	22.6

Note. VD= *very dissatisfied*; D = *dissatisfied*; NO = *no opinion*; S = *satisfied*; VS = *very satisfied*.

Conclusions/Recommendations/Implications

Understanding the degree to which agricultural professionals participate and are satisfied with different types of education and training opportunities could be used to inform training and education developers on what type of methods to use in the programs they develop. If we consider the expectancy-value theory (Atkinson, 1957; Vroom, 1964), agricultural professionals should be motivated to engage in education or training in which they will have success, and satisfaction is likely an indicator that could predict future behavior. With that in mind, past satisfaction with specific delivery formats could be an important predictor for choices regarding delivery formats in the future.

Generally, respondents tended to participate in and be more satisfied with face-to-face education and training offerings (Table 2; Table 3). While there is pressure to deliver instruction online (National Research Council, 2009), agricultural workers are still interested in and satisfied with face-to-face, real-time education and training programs. Therefore, we recommend education and training providers continue to offer face-to-face and online opportunities to provide flexible learner-centered experiences. Future research should seek to determine why agricultural employees participate in more frequently and are more satisfied with face-to-face than online offerings; the scope of this study prevented us from understanding why face-to-face offerings are preferred. This information would help providers in choosing and improving delivery formats.

Furthermore, the most often attended types of training were *seminars, workshops, or webinars for my job* for both face-to-face and online formats. This result is not surprising given

the pace with which information is generated and technology is being developed. Agricultural employees were also participating in education and training opportunities that resulted in a certification. Certifications may lend themselves to agricultural employees, because they tend to be focused on developing a specific skill or set of skills over a short period of time. Offering certification may be a means for increasing education and training participation. Future research should investigate why agricultural employees are participating in certification opportunities.

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Experiences from a Leadership Academy

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Introduction

People have yearned for a greater understanding of leadership for centuries. That desire to know more and the development of skills in leadership are sought by many individuals through formal and non-formal ways. College and university campuses across the nation are providing many formal opportunities to develop students' leadership abilities (Gardener, 1995; Cress, Astin, Zimmerman-Oster, & Burkhardt, 2000). Many of those leadership opportunities are deemed to be impactful (Rosch & Caza, 2012); however, researchers have noted the need for scientific evaluation of leadership education programs to stay rigorous and academically relevant (Braun et al., 2009). Therefore, this case study sought to explore the nature and impact of the Litton Leadership Scholars program at the University of Missouri.

The Litton Leadership Scholars program is a year-long leadership academy for College of Agriculture, Food and Natural Resource (CAFNR) undergraduate students. The program was developed in 2012 in conjunction with the Jerry Litton Family Memorial Foundation. Jerry Litton was a politician and agribusiness man with strong ties to agriculture, FFA, and the University of Missouri. Litton, his wife, and two young children were tragically killed in 1976 in a plane crash. To continue the legacy of the Litton family and aid in developing leaders for agriculture the Litton Family Memorial Foundation created an endowment at the University of Missouri to fund several areas, including the Litton Leadership Scholars program. The program provides leadership education through a three credit hour seminar style course. The course is centered around 13 leadership constructs (understanding leadership, awareness of self, practices ethical behavior, sustains leadership, values diversity, enhances communication skills, manages conflict, develops teams, leads change, manages projects, practices citizenship, understands community complexity, and committed to serving others), academic and field based mentorship, and producing impactful change.

Framework

Astin's (1984) theory of student involvement was utilized as a framework for the study. Astin postulated the amount of student learning and development is directly proportional to the involvement in an academic environment. Astin (1984) defines involvement as the amount of physical and psychological energy a student puts forth toward an experience. As administrators and faculty, it is key to regard students' time and energy as finite. To capitalize upon the limited time and energy, one must attempt to fully engage and involve students in the learning experience. This may include increased interaction with faculty, peer groups, and finding ways to stimulate interest. Thus, as involvement increases so do potential outcomes.

Methods

This case study focused on the central question of what made the leadership academy experience impactful. A purposive convenience sample was utilized to achieve maximum sample variation (Creswell, 2013). Potential participants were contacted via email inviting them to be a part of the study. Those who were interested (one student declined) were then asked to schedule an interview. All three of the cohorts that had completed the Litton Leadership Scholars program were represented in the interview process. The participants represented a wide variety of majors within CAFNR. Seven interviews were conducted each lasted approximately 45 minutes. Interviews served as the primary source of data with document analysis of course syllabi and coursework serving as secondary sources. To ensure trustworthiness of the findings, data triangulation, peer debrief, and member checking were utilized (Stake 1995).

Findings

The interviews yielded five themes regarding participants' experiences in the Litton Scholars program.

Theme 1: Personal Connection to Jerry Litton
All of the participants interviewed stated they felt connected to Jerry Litton and his story which helped enhance the experience. Litton embodied all 13 leadership constructs discussed in the academy. Being able to personally identify with a person helped increase their ability to understand leadership within a context. Peter said, "I think it's amazing also, that Jerry Litton didn't have any leadership classes. . . It's interesting to me that for him it came natural. I think that says a lot about his character." He went on to note, "I think of him as a role model." Matt said, "Jerry Litton was such a big voice for the agricultural community, I've definitely been inspired." Alex reflected on how Litton showed leadership in a variety of settings, "you have to take on leadership roles, especially even if it's not glamorous, there's not tons of benefits for you. If you care about an organization or a cause, you would have to go for that role." The personal connection to Litton allowed students to engage with the content and explore leadership in context.

Theme 2: Connections Within the Cohort
The participants stated they felt a strong sense of community with each other. They may have known one another beforehand, but the academy offered them a chance to enhance those relationships. The sense of community allowed students to more easily express and share personal experiences and opinions comfortably, which again enhanced the learning environment. Matt shared, "I was definitely able to do more because I felt like I was able to be more open." Anna stated how the connections worked outside of the classroom and fostered quality discussions, "We carpooled to all the events. We talked about things. We worked on homework together. We talked about leadership stuff. We were very open in class." Kate identified the positive classroom atmosphere created by the sense of community, "The synergy would be a good description of it too. When everyone was in the classroom being able to feed off of each other when we were discussing things." The participants discussed how it was easier to approach and discuss sometimes deeply personal viewpoints because they felt comfortable and connected to their peers in the class. Those connections enhanced the learning environment.

Theme 3: Networking
The structure of the academy allowed for a multitude of networking opportunities for the students. Networking included interactions of students, faculty, mentors, and business individuals. Alex said, "when we had speakers come in or whenever we were able to interact at an event with [foundation], to me, that was really beneficial." Bea noted one of the most beneficial parts of the program "was just making those personal connections." The Litton name can also help students network within the business world as Bea found out. "It can be difficult to get in [job shadow program] but when you say 'the Litton Program' doors open that normally won't." The participants recognized and valued the chance to network within the agriculture industry. They understood the importance of those connections for their future careers.

Theme 4: Reason for Applying
All the participants noted one of two specific reasons for applying to the leadership academy. They were personally aware of who Jerry Litton was and wanted to be involved in the program, or they were specifically recruited by someone who had connections to the program. Bill noted, "I knew what [Litton] stood for and thought it would be a good idea for me to apply." While several others stated they were actively recruited by friends as Kate pointed out, "I became friends with some people who had been in it before or were currently in it, and they talked about it, and really encouraged me to apply. I looked into it a little more and thought why not?" Traditional methods of advertising (flyers, emails, etc.) are not what drew the participants to the program. Personal connections were the reason they became involved. Seeing how others benefitted and grew from the program served as motivation to become involved.

Theme 5: Length of the Program
The academy is a year-long program. The length of the program was identified as a strength. It allowed participants time to reflect on personal grow and apply some of the leadership skills and techniques they had discussed. Bill stated, "you can kind of see how you progress over the course of a year better than you do over a semester. . . and being able to apply what you learn throughout the year really helps." Some leadership programs are only a day or a few weeks in length. While those have been effective in producing positive change (Rosch & Caza, 2012), the length of this program was identified as very beneficial. It gave the participants a chance to dig deeper into the leadership concepts, more exposure to the topics, opportunity to practice, and time to reflect.

Discussion

Overall, the participants stated the Litton Leadership Scholars program experience was positive and impactful. The uniqueness of the academy focusing on a single individual (along with associated family members) was cited as beneficial by the participants. The personal connection to Litton allowed for students to contextualize leadership in real world settings and become inspired to serve as leaders in their communities and organizations. By discussing Jerry Litton and his life, the participants felt connected to him and could identify with him in many ways. Those connections served as a way for the program to stimulate interest in the topic of leadership, which was one way Astin (1984) postulated to help students engage in learning.

Participants also found having close personal connections with members of the cohort enhanced the learning environment. They felt they were able to share more freely in the academy. Having increased interaction among peer groups is important to help increase students' involvement in the learning environment (Astin, 1984). Furthermore, several participants also stated their connections with their classmates continued outside the classroom. Many still keep in touch with friends they made during the Litton Leadership Scholars program and view it as a community.

The Litton Leadership scholars have many opportunities to network with a variety of individuals, and the participants found this very useful. They often cited connections with business contacts as a potential career benefit. However, participants noted the deep personal connection they felt with the Litton Foundation Board members as a positive and important connection. The theory of student involvement focuses on the importance of faculty interaction (Astin, 1985); it can be argued that interaction with industry professionals fulfills the similar need. The industry experts have important knowledge and skills to transfer to the students. The more exposure they have to each other, the more motivated the students become to be active in the learning experiences.

Applying to the program was not an accident. Several participants stated they knew who Litton was and decided to apply based on his reputation. The rest were encouraged, or in a few cases actively recruited, to apply for the program. Traditional marketing was not influential according to these students. Having an outside voice promoting the program made a difference in the applicant process.

Finally, the year-long length of the academy was seen as a benefit by all the participants. The additional time allowed for them to reflect on personal leadership growth. The program's duration required participants to allocate a larger amount of time and energy to the topics. The amount of energy invested in a topic can lead to a more rewarding experience (Astin, 1985). Due to the extended experience, participants felt they were better able to immediately apply leadership skills and strategies to a variety of settings.

While the findings are specific to the Litton Leadership Scholars program, further research should be conducted. Future research should be conducted on other year-long leadership academies to determine if those participants have similar experiences. Additionally, research on short range (e.g. day/week long) leadership programs conducted to determine how those programs could be potentially altered to maximize impact based on some of the benefits described in this study. Finally, follow up research should be done with Litton completers several years after graduation to see if/how the experience impacted them in their leadership endeavors.

Even though the findings are not generalizable, there are several recommendations for practice that can be applied to other types of leadership academies. Recommendations for practice include providing a relatable context for the leadership education, developing a feeling of community, capitalizing upon networking, and providing time for reflection on personal growth and application of skills. Finally, use previous program graduates as an active recruiting tool to continue momentum within a program.

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Leadership Integration: The Role of the Agriculture Teacher

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Introduction

Leadership knowledge and ways of knowing (i.e. ability to lead) are critically important for working collaboratively to solve social, ecological, and technological problems (Bennis & Nanus, 1985; Morgan, Fuhrman, King, Flanders, & Rudd, 2013). Unfortunately, recent trends suggest a "skills gap" in which new employees lack these critical leadership skills (Hora, Benbow, & Oleson, 2015; Kagay, Marx, & Simonsen, 2015). One potential for addressing this "skills gap" is by engaging students in leadership learning within a specific context, like agriculture (Association of Public Land-Grant Universities, 2009; National Research Council, 2009; Stone, 2011; Stubbs & Meyers, 2015). However, the contextual learning potential of leadership through agriculture, food, and natural resources education (i.e. AFNRE) depends on the knowledge and motivation of teachers to integrate leadership content throughout their curriculum (McKim, Sorensen, & Velez, 2015). In this study, researchers utilized a national sample to describe the role of the AFNRE teacher in leadership integration.

Theoretical Framework and Research Objectives

The theory of planned behavior served as the foundation for this investigation. The theory of planned behavior includes three determinants to behavioral intentions: (a) attitude – the degree to which an individual has a favorable appraisal of an action (b) subjective norms – the support an individual perceives from others to enact a behavior, and (c) perceived behavior control – the control an individual perceives over their own behavior, including overcoming, avoiding, and/or mitigating barriers (Ajzen, 1985, 1991, 2011). In addition, a fourth potential predictor was included, self-perceived knowledge.

Within this study, we sought to elucidate the variables and relationships suggested within the conceptual model (see Figure 1). Specifically, the following objectives were developed: (1) describe the attitude, subjective norms, perceived behavioral control, and knowledge of leadership among AFNRE teachers; (2) describe the leadership integration intentions of AFNRE teachers; and (3) determine the relationship between attitude, subjective norms, behavioral control, knowledge, and intentions to integrate leadership.

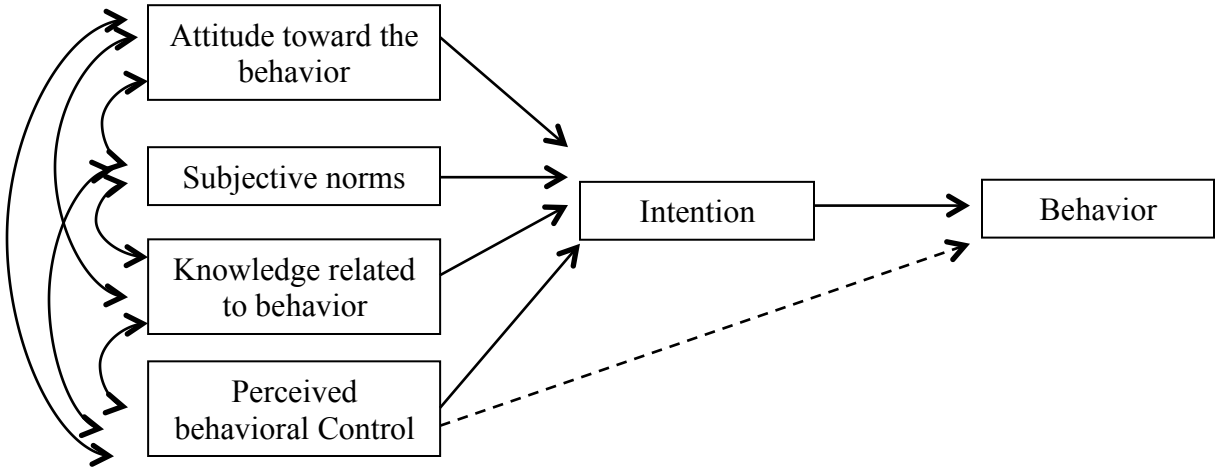

Figure 1. Model of the theory of planned behavior with the addition of knowledge.

Methods

This research was completed via survey and structural modeling analyses. The target population included all AFNRE teachers in the United States during the 2015-2016 school year. Necessary sample size was determined by the requirements of structural equation modeling. Kline (2005) suggested sample sizes exceed a 5:1 case to parameter ratio. Within our structural model, there are a total of 32 parameters; therefore, the sample size needed to exceed 160 (Kline, 2005). A sample frame of 950 AFNRE teachers was requested from the National FFA Organization. This sample frame ensured a 20% response rate would meet the minimum responses needed (Kline, 2005; MacCallum, Browne, & Sugawara, 1996).

Within the instrument, the attitude construct included four questions (e.g. "as an agriculture teacher, I enjoy integrating leadership content in the curriculum I teach"), modified from Davis, Ajzen, Saunders, and Williams (2002). The subjective norms were measured using three questions (e.g. "stakeholders to my agriculture program support the integration of leadership content in my agriculture curriculum"), adapted from Cheon, Lee, Crooks, and Song (2012). The perceived behavioral control construct included four questions (e.g. "I have complete control over the level at which I integrate leadership content in my agriculture curriculum") adapted from Cheon et al. (2012). Each of these variables were measured on six-point scales ranging from 1 (*strongly disagree*) to 6 (*strongly agree*).

The self-reported knowledge of respondents was measured for three elements of leadership, (a) leadership styles, (b) creating a vision, and (c) conflict management (Northouse, 2012), a method modeled after research from Diamond, Maerten-Rivera, Rohrer, and Lee (2013). Respondents rated their knowledge within these sub-topics on a four-point scale, ranging from 1 (*not knowledgeable*) to 4 (*very knowledgeable*). The outcome variable (i.e. intentions to integrate leadership) was measured using a researcher developed construct. For courses AFNRE teachers had taught, were teaching, or planned to teach, respondents indicated the percentage of curriculum in which they would integrate leadership. Face and content validity were established prior to the instrument being used for data collection.

Data were collected in November and December of 2015. Data collection procedures were based on Dillman's (2007) tailored design method. Due to errors within the frame, the list of potential respondents was reduced from 950 to 828. A total of 212 useable responses were received for a 25.60% response rate (n = 212). Per methods described by Lindner, Murphy, and Briers (2001), late responders (n = 44) were compared to on-time respondents (n = 168) in the variables of interest. These analyses revealed no statistical differences (i.e. p-values > .05) between on-time and late responders; therefore, there was no evidence of non-response bias (Lindner et al., 2001; Miller & Smith, 1983).

Assumptions of structural equation modeling were also evaluated. Attitude was found to be skewed left and leptokurtic (Kline, 2005); therefore, a robust structural equation modeling procedure (i.e. asymptotically distribution free; Bentler & Yuan, 1999) was utilized. Additionally, intentions to integrate leadership contained statistical outliers. These outliers were replaced by the value of the most extreme response, not identified as an outlier (Guttman & Smith, 1969; Moyer & Geissler, 1991).

Research objectives one and two were accomplished using means and standard deviations. Research objective three was accomplished using structural equation modeling. Readers are encouraged to review detailed accounts of structural equation modeling (e.g. Bowen & Guo, 2012; Ullman, 2013) for a description of this procedure.

Findings

Respondents included 52.70% (f = 106) males and 47.30% (f = 95) females ranging from 22 to 70 years old with an average age of 39.21. AFNRE teachers from 40 states and Puerto Rico responded to this questionnaire. Research objective one sought to describe the attitudes, subjective norms, perceived behavioral control, and knowledge of leadership among teachers (see Table 1). Respondents reported positive attitudes (M = 5.60; SD = 0.65), subjective norms (M = 5.19; SD = 0.82), perceived behavior control (M = 5.03; SD = 0.77), and knowledge of leadership (M = 3.23; SD = 0.65).

Table 1

Attitudes, Subjective Norms, Perceived Behavioral Control, and Knowledge of Leadership

	Minimum	Maximum	*M*	*SD*
Attitudes	1.00	6.00	5.60	0.65
Subjective Norms	1.00	6.00	5.19	0.82
Perceived Behavioral Control	1.00	6.00	5.03	0.77
Knowledge	1.00	4.00	3.23	0.65

Note. Items measuring attitude, subjective norms, and perceived behavioral control toward leadership integration were scaled from 1 (*strongly disagree*) to 6 (*strongly agree*). Items measuring knowledge of leadership were scaled from 1 (*not knowledgeable*) to 4 (*very knowledgeable*).

Research objective two sought to describe the integration intentions of teachers (see Table 2). Across eleven curricular offerings, respondents indicated intentions to integrate leadership into just over one quarter of their curriculum (*M* = 28.49%; *SD* = 14.03%). The two curricular opportunities typically occurring outside the classroom (i.e. SAE and FFA) contained the most leadership integration (FFA: *M* = 65.40%, *SD* = 27.60%; SAE: *M* = 37.54%, *SD* = 23.68%). Within the traditional classroom subjects, General Agriculture (*M* = 27.25%; *SD* = 16.62%) had the highest amount of leadership integration while Food Products and Processing Systems (*M* = 15.25%; *SD* = 9.86%) had the lowest.

Table 2

Intentions to Integrate Leadership

	f	Minimum	Maximum	*M*	*SD*
FFA	198	0.00	100.00	65.40	27.60
SAE: Supervised Agricultural Experience	197	0.00	100.00	37.54	23.68
General Agriculture	191	0.00	100.00	27.25	16.62
Agribusiness Systems	139	0.00	100.00	26.78	18.51
Environmental Service Systems	97	0.00	75.00	17.35	15.58
Plant Systems	165	0.00	100.00	16.78	13.79
Animal Systems	178	0.00	100.00	16.70	12.20
Natural Resource Systems	137	0.00	75.00	16.52	11.31
Power, Structure, and Technology Systems	143	0.00	100.00	16.00	13.55
Biotechnology Systems	83	0.00	75.00	15.72	11.32
Food Products and Processing Systems	92	0.00	50.00	15.25	9.86
Total	212	4.00	81.25	28.49	14.03

Note. Respondents were asked to report the percentage of leadership content they would integrate for courses they had taught, were teaching, and/or planned to teach.

Research objective three sought to determine the relationship between predictors and intentions to integrate leadership (see Table 3). Within the model, factor loadings ranged from .47 to .96 and were all statistically significant (i.e. *p*-values < .05). The observed model was statistically similar to the hypothetical model proposed in the analysis (χ^2 = 91.26, df = 72, p-value = .062), a requirement for an acceptable model. Additionally, the comparative fit index (CFI = .96) exceeded the established minimum of .90 and root mean square of approximation (RMSEA = .04) fell below the established maximum of .08, indicating the final model was a good fit for the data (Blunch, 2013; Hooper, Coughlan, & Mullen, 2008; Hu & Bentler, 1999).

Table 3

Results for Intentions to Integrate Leadership

	Dependent variable: Intention to Integrate Leadership					
	Zero-order correlation (*r*)	*p*-value	*B*	*SEB*	*γ*	*p*-value
Attitude	.114	.098	4.10	1.56	.16	.009
Subjective Norms	.114	.102	3.09	1.17	.14	.009
Perceived Behavioral Control	.115	.102	4.71	2.81	.17	.094
Knowledge	.153	.031	-2.13	2.50	-.08	.395

Note. Based on Asymptotically Distribution-Free Estimates; χ^2 = 91.26 (df = 72) *p*-value = .062; R^2 = .11; CFI = .96; RMSEA = .04.

In combination, the four predictors accounted for 11% of the variance in intentions to integrate leadership (R^2 = .11). Two of the predictors, attitude toward leadership integration (γ = .16, p-value = .009) and subjective norms (γ = .14, p-value = .009), were identified as statistically significant, positive predicators of intentions to integrate leadership.

Conclusions, Implications, and Recommendations

The favorable attitudes, subjective norms, perceived behavioral control, and knowledge among respondents is promising considering the positive association of these constructs with behavioral intentions (Ajzen, 1985, 2011). These findings suggest AFNRE teachers could serve as a valuable method for leadership education at the secondary school level. While this finding is encouraging, it does not address differences in how AFNRE teachers conceptualize leadership education. We encourage research into different conceptualizations of leadership education across various teacher and programmatic variables.

Considering intentions to integrate leadership, the focus is through FFA, in which responding AFNRE teachers reported over 65% of their curriculum would include leadership content. The emphasis of leadership integration through FFA is congruent with existing literature highlighting FFA as the primary context for leadership development with AFNRE (Kagay et al., 2015; Morgan et al., 2013).

In addition to FFA, teachers identified integration intentions within coursework. These findings suggest leadership content appears more often in foundational (i.e. General Agriculture) courses than specialized agricultural subjects (i.e. Food Products and Processing Systems; Biotechnology Systems). While the current study investigated the level of leadership content integrated, researchers did not address *how* this content was being presented. We recommend research exploring methods used to integrate leadership, as this research would inform the profession of how leadership can be integrated throughout the scope of curriculum offered.

The final objective described the model for intentions to integrate leadership. The findings support the theory of planned behavior, specifically the positive relationships between

established predictors and behavioral intentions (Ajzen, 1985). However, the additional predictor (i.e. knowledge) was negatively associated with intentions to integrate leadership. While the lack of statistical significance limits generalizability, it is nonetheless disconcerting that *reduced* knowledge of leadership was related to *increased* leadership integration. We recommend deeper analysis, using qualitative methods, into the unique relationship between self-perceived knowledge and integration intentions.

Both attitude and subjective norms were statistically significant, positive predictors of integration intentions. More specifically, findings suggest a one-unit increase in attitude was related to 4% more leadership integration and a one-unit increase in subjective norms was related to 3% more leadership integration. The importance of leadership learning among future members of society (Association of Public Land-Grant Universities, 2009; Kagay et al., 2015) suggests an additional 3-4% more leadership content is worth pursuing; therefore, we recommend consideration toward improving the attitudes and subjective norms among AFNRE teachers.

This research provides an initial understanding of why, and at what level, AFNRE teachers are planning to integrate leadership content. This foundation should be built upon by deeper investigations into the role of the AFNRE teacher in enhancing the leadership learning of future generations.

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Preservice Teachers' Perceptions of Science Integration in Secondary Agriscience

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Educational reform movements have increased pressure to improve student performance in science, technology, engineering and mathematics (STEM; American Association for the Advancement of Science, 1989, 1993; Sanders, 2009). As a result, public school administrators face great pressure to strengthen the rigor of STEM-related curricula in order to prepare students to meet the demands of global leadership (Cambron-McCabe &McCarthy, 2005). Attempts have been made to expand knowledge in STEM courses and stimulate higher order thinking (Ball & Garton, 2005; Clark, Parr, Peake, & Flanders, 2012; Savery, 2015).

Agriculture's relationship with biological, chemical, and physical science has well-positioned agriscience education as a platform for enhancing scientific skills and knowledge (Balschweid & Thompson, 2002; Conroy & Walker, 2000; Enderlin & Osborne, 1992). Science integration in the agricultural classroom gained momentum when the National Research Council (1988) recommended updating the agricultural education curricula to include scientific principles and concepts. Additionally, the American Association for Agricultural Education's National Research Agenda called for effective integration of STEM content into the agricultural curriculum and to adequately prepare teachers to facilitate STEM integration (Roberts, Harder, & Brashear, 2016).

In order to effectively integrate STEM concepts into agricultural curricula, teachers must be sufficiently educated (Myers & Washburn, 2008). Previous studies indicated agriscience teachers feel equipped and qualified to integrate science in their curriculum (Osborne & Dyer, 1998; Thompson & Balschweid, 1999). However, Houck and Kitchel (2010) found a large variance in agricultural content preparation for preservice teachers. Floden and Meniketti (2005) found preservice teachers' coursework led to basic knowledge, but not an adequate understanding of content and scientific process. A deep understanding of content is essential not only for effective science integration in agricultural instruction, but effective teaching in general (Darling-Hammond & Bransford, 2005).

Theoretical Framework

In order to better understand preservice agricultural teachers' preparedness to integrate science into the classroom, it is necessary to examine factors that influence their abilities to do so. Social cognitive theory, developed by Bandura (1986) and applied to agricultural education by Smith, Rayfield and McKim (2015), guided this study.

According to Bandura (1986), human function is the result of interactions between behavioral, personal and environmental factors. When considering science integration in high school agricultural courses, the desired behavior would be successful and meaningful instruction by the

teacher. Personal factors include outcome expectations, self-efficacy (Smith, Rayfield, & McKim, 2015), and perceptions. Finally, environmental determinants play an integral role in human function (Bandura, 1997). Length of teaching career, interaction with peers, and perception of colleague's science integration can impact behavior and confidence in integrating science in the classroom (Smith et al., 2015). Examining the relationship between behavioral, personal, and environmental factors of preservice teachers could provide insight into preservice teachers' perceptions of STEM integration in agricultural classrooms.

Purpose

The purpose of this study was to identify and describe preservice teachers' perceptions of science integration in secondary agriscience classrooms after a 40-hour early field experience practicum, and their perceived preparedness to integrate science into their future agricultural education programs.

Methods

Undergraduate agricultural education students enrolled in an Early Field Experience course for preservice agriscience educators at the University of Nebraska were recruited to participate in this study. The course included a 40-hour early field experience practicum in a secondary agriscience program or a skilled and technical sciences program. The practicums were conducted throughout Nebraska with both rural and urban programs represented. Twenty-seven students were enrolled in the course, and all 27 (25 females; 2 males) students voluntarily participated. Twenty-six students were preservice agriscience-teachers, and the one remaining student was a preservice skilled and technical sciences teacher. Students consisted of freshmen, sophomores, and juniors.

Data were collected through the use of two focus groups that were facilitated by a graduate student. Students were randomly assigned to one of the focus group sessions. Each focus group lasted approximately one hour and was digitally recorded and transcribed verbatim. Data were also collected in the form of observational notes that were recorded by hand during the focus group sessions. All data collection procedures were approved by the IRB at the university of Nebraska.

The thematic analysis method was used to "focus on repeated words or phrases in order to reduce data and to allow themes to emerge" (Grbich, 2007, p. 32). The block and file method was used to reduce the data (Grbich, 2007). The data were color-coded and broken into categories which served as themes. Titles were then developed for each theme, and the data were used as evidence to support the themes. Lincoln and Guba's (1985) suggested procedures to enhance trustworthiness were followed. Triangulation occurred by comparing data from the notes and the two focus groups, and by using multiple researchers. Verbal member checking was used throughout each focus group to verify the interpretation and meaning of the data. Methodological journaling in the margins of the transcripts helped to link the findings to the data and to increase the dependability and confirmability of this study.

Findings

The following themes were identified: (a) agriculture as a context for science, (b) need for science preparation/CASE (c) hands-on learning, (d) practical applications, (e) colleague collaboration, and (f) challenges of science integration. These major themes and their sub-themes are presented in the following section and are linked to Bandura's (1986) social cognitive theory from the perspective of a future agriscience teacher and Bandura's three determinates. Participants' names are not used in order to protect identities. The designations of P1-P27 are used as participant identifiers.

Agriculture as a Context for Science

Ease of integration. (Behavioral)

After completing classroom observations, many preservice teachers recognized the ease of which science was integrated into the classroom. Related concepts such as animal husbandry and genetics provided "a natural way to tie [science] in [to agriculture]" (P16). Utilizing agriculture as a context for science, P8 commented how agriscience teachers were able to "reinforce those science concepts to further [the students'] understanding of the agricultural concept." P5 stated there are "a variety of different sciences within agriculture" that can be integrated.

Importance of foundational science knowledge. (Personal)

Preservice teachers professed importance of teachers' knowledge in core science areas. The necessity of having "a broad understanding of all the sciences" in order to teach agriscience was recognized by P8. Because of the bigger role science is playing in the agriscience classroom, P3 stressed how "important [it is] to just have a common background [in the sciences]" to fulfill this demand. P11 noted awareness before classroom observations, stating "I knew I needed to know the basics [of scientific principles]."

Need for Science Preparation/CASE (Personal)

The benefit of a foundational science course for preservice teachers was apparent to participants. P1 recommended not only covering science content in a foundational course, but also including how to connect science concepts to agriculture. "The problem is… knowing how to take that and [put] it into [an agricultural context] and teaching it all together" [P1]. Other participants referenced the Curriculum for Agricultural Science Education (CASE) program. "One thing… that will help me to integrate the science concepts is to use the CASE curriculum," (P8). P11 stated the CASE training "[gives] you a deeper background… in the science and better ways to integrate it." The CASE curriculum gave preservice teachers a feeling of confidence in their ability to effectively cover science topics.

Hands-on Learning (Behavioral)

Within the observed agriscience classrooms, much of the learning took place in the form of hands-on projects and labs. P2 noted "in Ag-sized classes you get more hands-on" and "it is easier to learn something when [you are] working and doing it [yourself]." Because of the engaging nature of these activities, students enjoyed the learning process. In one observed classroom, P4 saw students "[were] really excited to learn" and that they "want to be in [the teacher's] class." P1 shared that sentiment, stating it's "very beneficial that a student comes into

a class excited to learn about it." This excitement transcends agriculture – P9 reasoned, "If [students] are excited about their agriculture, they are going to be excited about learning science."

Practical Applications (Environmental)
A recurrent strategy preservice teachers observed in the agriscience classroom was the application of science in student activities, organizations and interests, which proved beneficial to student understanding of the importance of foundational science knowledge. Agriculture education, as noted by P11, provides "a way to apply what you are learning" and helps solidify "why it's important in an area outside of just the typical science structure." Many class activities allowed students to prepare for community events such as FFA fundraisers and land judging Career Development Events. Witnessing science's applicability to their personal interests "helps [students] with the relevance of it" (P11).

Colleague Collaboration

Importance of collaboration. (Environmental)
Participants recognized working with colleagues to effectively coordinate lesson plans would greatly enhance student experience and understanding. P10 reasoned "if you can work with the science teacher" and "had classes paired together or you could co-teach in class… it would be beneficial for all the kids to see." P7 agreed, noting it would also be important to "coordinate with other teachers [to] know exactly what level the students are on" so that you "don't backtrack too much or are way over their heads." The importance of collaboration was so apparent that some participants have begun to work this into their future teaching plans. P10 discussed future plans to coordinate with the science teachers to develop lesson plans that incorporate science and agriculture in both courses.

Collaboration challenges. (Environmental)
While some preservice teachers witnessed the benefits of collaboration, others noticed the challenges of facilitating this communication. P3 observed a miscommunication between the agriculture teacher and science teacher. "[The teacher] said it's just hard," noting some students had already covered topics that were being taught in the agriscience course. P1 stated "it's definitely going to be a struggle to try [to] talk to the other teachers because sometimes they might take it as offensive."

Challenges of Science Integration (Behavioral)
Preservice teachers also voiced several concerns related to science integration. Aside from colleague collaboration, participants voiced concerns that agriscience teaching positions would focus too greatly on science. P12 observed a teacher who taught both science and agriscience courses, and saw that "more time and energy [was spent] teaching the core [sciences]." Despite the connections between science and agriculture, participants were worried budget cuts would lead to the exclusion of agricultural concepts.

Conclusions

Three of the themes/sub-themes were labeled behavioral, three were labeled environmental, and two were labeled personal. Themes linked to the behavioral determinant indicated preservice teachers realize the breadth and depth of science in agriculture and are willing to use scientific concepts to provide meaningful instruction in their future classroom, which will be enhanced by incorporating hands-on activities. The environmental determinant is evident through the willingness to create an environment in which the agriscience and science teachers collaborate to provide the best possible learning experience. However, miscommunication could negatively impact the environment, thus impacting the agriscience program. Data supports that the design of the agriscience program allows for an environment that naturally provides an opportunity for science integration. Finally, themes linked to the personal determinant indicated a strong understanding of foundational science increases self-efficacy. However, it is imperative preservice teachers know how to effectively highlight and connect science concepts to agriculture. Participants showed a desire for training or coursework focused on ways to effectively integrate science into agricultural concepts, illustrating their personal desire to incorporate science topics and to seek a deep understanding of science integration and teaching, which aligns with Darling-Hammond and Bransford (2005).

The emergent themes can be used to enhance courses and curriculum for preservice teachers. Curriculum should be designed to provide basic understanding of biology, chemistry, and physical science (Balschweid & Thompson, 2002) and should have a strong emphasis on connecting science concepts to agriculture. Course development should include both the agricultural teacher educator and the discipline specific professor. Collaboration would help to ensure quality and rigor, meaningful instruction, and demonstrate positive collaboration. Future research should examine effective practices when co-developing courses for preservice teachers.

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Examining the Beliefs of Pre-Service Teachers toward the Use of Inquiry Teaching

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Introduction/Review of Literature/Research Question

Teachers' knowledge and beliefs are persistent, not easily molded, and serve as a filter through which teaching and learning occur (Clark & Peterson, 1986; Darling-Hammond, 2006). Just as teachers have beliefs, pre-service teachers enter teacher preparation programs with beliefs in place that are persistent throughout their time as undergraduates (Gutshall, 2014; Kagan, 1992). These beliefs are formed from their experiences as students and eventually enter the classroom upon graduation (Eick & Reed, 2002; Kagan, 1992).

The National Research Council (1996) described inquiry as both a teaching approach and learning outcome. It allows students to learn lesson content, as well as develop science skills as they learn. They describe levels of inquiry determined by the amount of teacher and student-centeredness exhibited in the lesson (see Figure 1). Since 2003, over 200 agriculture teachers have been trained in inquiry (National Association of Agricultural Educators, 2015). Through these teachers, agricultural education has developed a strong knowledge base about student outcomes related to inquiry (Easterly & Myers, 2011; Thoron & Burleson, 2014; Witt et al., 2014).

Essential Features of Classroom Inquiry and Their Variations

Less ----------Learner Self Direction----------More

More---------- Direction from Teacher or Material----------Less

FEATURE				
1. Learner engages in scientifically oriented questions.	A. Learner engages in question provided by teacher, materials, or other source	B. Learner sharpens or clarifies question provided by teacher, materials, or other source	C. Learner selects among questions, poses new questions	D. Learner poses a question
2. Learner gives priority to evidence in responding to questions	A. Learner given data and told how to analyze	B. Learner given data and asked to analyze	C. Learner directed to collect certain data	D. Learner determines what constitutes evidence and collects it
3. Learner formulate explanations from evidence	A. Learner provided with evidence	B. Learner given possible ways to use evidence to formulate explanation	C. Learner guided in process of formulating explanations from evidence	D. Learner formulates explanation after summarizing evidence
4. Learner connects explanations to scientific knowledge	A. Learner given all connections	B. Learner given possible connections	C. Learner directed toward areas and sources of scientific knowledge	D. Learner independently examines other resources and forms links to explanations
5. Learner communicates and justifies explanations	A. Learner given steps and procedures for communication	B. Learner provided broad guidelines to use to sharpen communication	C. Learner coached in development of communication	D. Learner forms reasonable and logical argument to communicate explanations

Figure 1. National Research Council (1996) Model of Inquiry.

Wardlow and Osborne (2010) assert the importance of beliefs in agricultural education. However, little research exists about general teaching beliefs or beliefs related to specific methodologies (Johnston & Roberts, 2011; Rayfield, McKim, Smith, & Lawrence, 2014; Rice, 2015). With this in mind, it is important to study beliefs of agriculture teachers to understand the underpinnings of the decisions they make in their classrooms. Rice (2015) described the beliefs agriculture teachers hold about teaching and the purpose of agricultural education, but no research exists on specific methodologies. Thus, the research question guiding this study is: What are the beliefs of pre-service teachers in agricultural education about inquiry teaching and what are the sources of those beliefs?

Methodology

A grounded theory methodology and pragmatic epistemology were utilized for this study (Corbin & Strauss, 2008). The participants were senior pre-service teachers enrolled in teaching methods during Fall 2015 ($N = 12$). Data were collected through one-on-one interviews where participants completed a card sorting task using teaching scenarios following the conventions of Friedrichsen and Dana (2003) and answered general questions about their beliefs regarding inquiry. Open, axial, and selective coding were used to analyze data. Thick, rich description, member checking, and reflexivity were used as validation strategies throughout data analysis (Creswell, 2013).

Findings

Three major themes emerged from the data analysis: general beliefs about science and inquiry; beliefs about teacher readiness for using inquiry; and beliefs about student readiness to learn through inquiry. Each of these themes had several dimensions which will be explored in these findings.

Beliefs about Science and Inquiry

As agriculture becomes more modernized, participants believed instilling knowledge of science and science skills was important in their classrooms. One participant, David, shared, "Science is the future of agriculture and if they don't know that or they don't know how to use science, I don't know exactly if they'll be one of the ones to help with the movement in agriculture." Other participants believed teaching science for its own sake was a goal for them in order to instill a curiosity about the world and teach their students how to answer their own questions. On this, Lisa said, "They need to be able to work through how to get an answer versus calling somebody or doing a quick Google search. They need to be able to think about things that they know and process through that issue." However, most participants, while agreeing science was important, felt agriculture teachers should solely focus on applied science and not basic science. They wanted to build on what students learned in their core content courses rather than replicate that knowledge.

In describing the nature of inquiry, participants' descriptions were similar to what they were taught in their teaching methods course. They described the levels used in many inquiry models and finding balance between teacher and student-centeredness in their future classes, recognizing the need for scaffolding both within lessons and courses. Participants also described

the positive outcomes of inquiry, including cognitive and soft skills students gain learning through inquiry. Skills such as problem solving, critical thinking, independence, responsibility for learning, and others were discussed.

Beliefs about Teacher Readiness

Several dimensions of the teacher readiness theme emerged during data analysis. These included: lack of experience with the inquiry pedagogy; balancing student and teacher-centeredness; planning for scaffolding; content knowledge; choosing and developing resources; clarity; and teacher creativity. Due to space limitations, not all dimensions will be described.

One of the overarching dimensions of this theme was the participants' lack of experience teaching with inquiry. When asked how they would feel walking into a classroom the next day to teach an inquiry lesson, the response most often used was nervous. All of the participants stated they felt uneasy planning and implementing inquiry lessons and tied this to their lack of experience. Throughout this theme, participants detail the specific dimensions of teacher readiness they believed they lacked.

First, participants described inquiry as a balance of student and teacher-centeredness. However, these beliefs sit in contrast with their perceptions of their own abilities. Referencing the chart above, many of them admitted they felt more comfortable in the extremes of the chart rather than the middle, which they called a "gray area." Although they admitted the importance of striking that balance in certain lessons, many participants could not conceptualize what this would look like.

Content knowledge was another aspect of teacher readiness participants discussed. Usually when participants described the role of content knowledge in inquiry lessons, it involved responding to student questions throughout the lesson or leading discussions at the close of lessons. In general, participants felt a lack of content knowledge would be a difficulty in many inquiry lessons. In addition, matching content to the inquiry methodology was another area of readiness participants discussed. Simply choosing content appropriate for inquiry was deemed a challenge by many participants; others discussed how some content was inappropriate for inquiry because of its lack of complexity.

When asked specifically about challenges they perceived they would have, clarity of directions was the most common response. While participants believed direction sets are important in any lesson, they thought they were especially important in inquiry lessons. Realizing this, all of the participants felt this was a skill they were not proficient enough in with regard to inquiry lessons.

Beliefs about Student Readiness

Just as participants held beliefs about teacher readiness, they also held them about the perceived readiness of their future students. Dimensions of this theme included: issues related to student age; lack of student trust; students' need for background knowledge; lack of resilience;

and student struggles with ambiguity. As with the last theme, not all dimensions will be described here because of space limitations.

One of the core beliefs all of the participants held related to the age of their students. They felt inquiry lessons were better suited for older students and young students were not ready for inquiry. One card sorting task scenario specifically described a freshman-level class. At first, participants sorted the upper level inquiry cards into a pile they disagreed would be appropriate teaching methods. When pressed about their choices if the students were older, they shared they would be much more open to using those cards they initially disagreed with. They were concerned with the ability of freshmen to cognitively engage with inquiry, as well as behavior management during inquiry lessons with freshmen.

Next, participants also believed students to be unready for the task of constructing their own content knowledge and did not trust them to have the skills to perform on the student-centered end of the inquiry chart. A question many participants asked explicitly and implicitly during their interviews was, "How do we know students learned the right thing?" Participants were nervous about students making wrong connections throughout lessons and inaccurately learning material.

Student frustration during inquiry lessons was a frequent concern for most of the participants. This was for a set of reasons ranging from simply disliking an inquiry teaching style to becoming frustrated because they do not learn well from it. Many participants feared students would become confused and not be resilient enough to persevere through the lesson. Others believed they as teachers would then tell students what to do, removing some of the inquiry process from the lesson.

Discussion

Based on the themes identified during data analysis, a substantive theory was developed to describe the beliefs about inquiry pre-service teachers in agricultural education hold (see Figure 2).

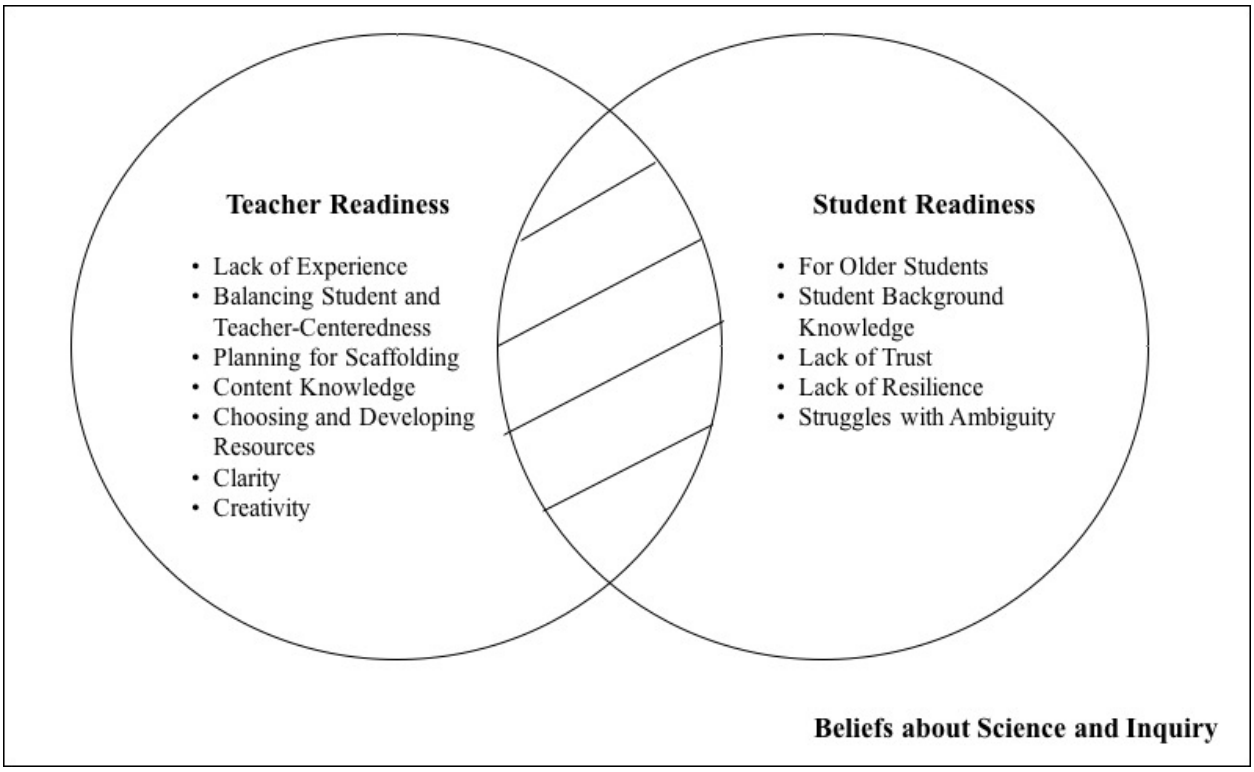

Figure 2. Substantive Theory Describing Pre-Service Teachers' Beliefs about Inquiry

This substantive theory provides many questions about how agricultural education asks pre-service teachers to engage in inquiry and their readiness for that responsibility. Readiness was the primary theme derived during the data analysis. In terms of willingness to engage in inquiry, these pre-service teachers were more than ready to use it as a teaching method. They held positive attitudes and saw many benefits of inquiry, which is consistent with prior research (Lotter, 2003). However, these positive attitudes led many participants to attempt inquiry lessons during teaching methods, which is where many of them suddenly described feeling overwhelmed and unready with the many challenges pre-service teachers have with teaching.

First, they described struggling to conceptualize the workings of inquiry. Although they could generally define inquiry and identify the different levels of inquiry, they felt there was a "gray area" of inquiry. This occurred in the middle two columns, where scaffolding occurs and the student-centered aspects of inquiry begin to emerge (National Research Council, 1996). While participants shared it was important to operate in those two columns, they described it as difficult.

Another key belief most participants shared was that student readiness for inquiry was related to age or grade level. Wang, Kinzie, McGuire, and Pan (2010) discussed the ways in which elementary teachers can utilize inquiry in their classrooms. This sits in contrast with the beliefs presented by the participants, who shared inquiry is only suited for the oldest of students.

In addition to the beliefs shared by the participants, there were several aspects of belief development or inquiry that were absent from their interviews, including the role of content

knowledge in lesson development, use of formative assessments, and a discussion of cognitive skills utilized by students of inquiry. We should also be aware that unlike other teaching styles, the relatively new use of inquiry in agricultural education has led to a lack of modeling on which pre-service teachers can reflect while writing inquiry lessons. Since belief systems are primarily derived from past experiences (Eick & Reed, 2002), it is important for teacher educators to note current pre-service teachers may not hold beliefs about inquiry during their teacher preparation program. With these things in mind, a modified substantive theory was developed highlighting the gaps in participant discussion related to inquiry teaching (see Figure 3).

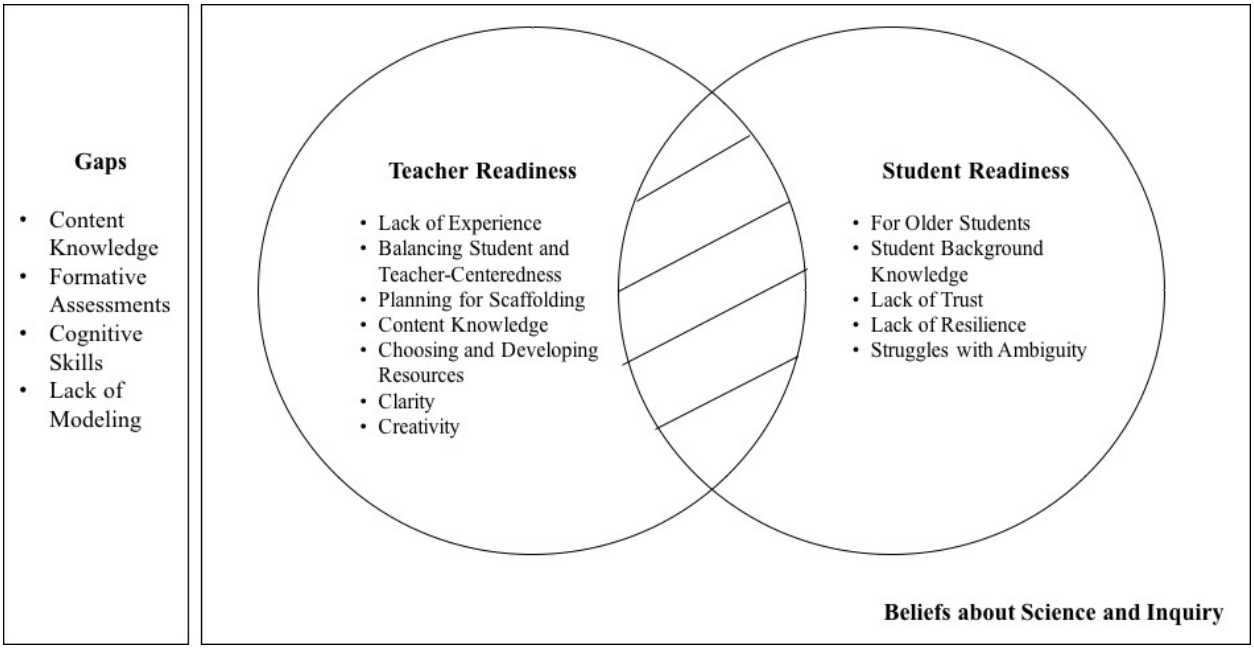

Figure 3. Modified Substantive Theory Describing Pre-Service Teachers' Beliefs about Inquiry

With these things in mind, teacher educators should be mindful of their students' readiness to handle the challenge of teaching inquiry. If inquiry is to be taught in agricultural education, we should consider the challenges presented here and discuss additional supports we can provide pre-service teachers to help them be more successful when using inquiry. Teacher educators should focus on honing specific skills, such as proving clear direction sets, to help alleviate some of the novice teacher issues discussed by participants and allow them to focus more on the pedagogy of inquiry.

Future research would benefit from replicating this study with pre-service teachers at other institutions to see if differences emerge and longitudinal studies could help describe how their beliefs shift throughout their teacher education program. Similar studies with practicing agriculture teachers who have had experience teaching with inquiry would provide a clearer picture of the beliefs of the wider agricultural education profession.

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Conceptualizing Integrative Agricultural Education to Develop Students' Quantitative Reasoning

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For students ready to plan for their future, having a broad based skill set is valuable and required in today's market place. Employers have moved away from the desire for employees that are trained with a single focus. Replacing this is the need for employees who are creative problem solvers, capable of working independently and effectively in a team, possess foundational knowledge that aids in understanding what new information is needed in complex situations, and skilled in explaining the problem and the solution process in a way that is appropriate for varying audiences (Moylan, 2008; National Research Council, 2011). These skills are generally referred to as 21st century skills. The National Research Council (2011) suggests that these skills are best learned before high school graduation but they also need to be learned and practiced in authentic context. Integrative agricultural education can provide a curriculum development framework to support students' 21st century skill development through the integration of academic content embedded in agriculture context. Through agricultural education, students can build these skills for more than simply beginning their career. Students also hone their problem solving and critical thinking skills that provide the bedrock for being a lifelong learner.

To reveal their 21st century skillset, students should demonstrate what they can do when they apply their knowledge (Silva, 2008). Developing a learning environment in which knowledge is seen as useful and necessary takes a teaching approach that sets students up to use their prior knowledge, build off their intuition, and self-monitor for the need to seek out new ideas or information in order to solve realistic problems (National Research Council, 2011). An interesting and broad context is necessary to help students make the connection between the academic concepts they learn in school and the usefulness of those concepts in their everyday lives (Bybee, 2013). Agriculture has a common and natural bond with science and technology. In agriculture, technology is both computer and tool based, an impressive combination of technology. Technology is a tool that aids in making an activity easier or more efficient. Exploiting these connections to integrate mathematical concepts pulls together a holistic experience that brings students to the bridge of academic learning and 21st century skill development.

Conceptualizing Integrative Agricultural Education

Intentionally developing agricultural education curriculum that provides students opportunities to develop and practice academic knowledge in authentic situations meets the expectations of academic integration set forth by the Carl D. Perkins Vocational Education Act of 1984 and the extension of the Act in 1990 (Phipps, Osborne, Dyer, & Ball, 2008). Established through this philosophical framework, integrative agricultural education provides a proposed curriculum development outline to support intentional academic integration in agricultural education while maintaining the interest and application of agriculture. The framework for integrative agricultural education was established from literature in integrative STEM education (Asunda, 2012; Berlin & White, 2012; Bybee, 2013; Ejiwale, 2012; Foutz, et al., 2011; Hansen & Gonzalez, 2014; Kennedy & Odell, 2014; Laboy-Rush, 2011; Moye, Dugger, & Stark-

Weather, 2014; Sahin & Top, 2015; Sanders, 2009; Stone, 2011; Wells, 2015; Zollman, 2012). The aim of STEM education is to be integrative in nature, establishing connections between two or more areas of study within a context that poses a problem in need of a solution (Sanders, 2009). The five characteristics of STEM education are defined as: (1) Instruction integrates two or more subject areas with in a context; (2) Students' work should be practical and/or authentic; (3) Intentionally target critical thinking and problem solving skill development; (4) Learning is student centered; (5) Technology is used regularly. Through the curriculum design process, students arrive at instances that provide teaching opportunities for need-to-know information that aid students in working toward a solution (Wells, 2015). Teaching in these need-to-know moments makes learning relevant and concepts useful (Ejiwale, 2012).

Borrowing from the details of these STEM education characteristics, integrative agricultural education strives to ensure that (a) agriculture content is regularly infused with academic content (integrative), (b) only academic concepts that are naturally present in the agriculture concepts are included in a lesson (context), (c) learning by doing is fundamental (experiences and critical thinking), and (d) authentic problems initiate meaningful knowledge and skill building (collaborative problem solving). Many of these practices are typical in agricultural education (Blum, 1996; Finch & Crunkilton, 1999) however, developing a curriculum with the intention of also closely following the characteristics of STEM education, integrative agricultural education provides students a unique, holistic learning experience that provides experiential application of academic science and math concepts.

Defining Quantitative Reasoning in Agricultural Education

Science integration in agricultural education is well established (Blum, 1996; Phipps et al., 2008). Using this as an advantage to also integrate mathematical concepts, broadens students' learning experience yet may test agriculture teachers' repertoires. Much like the goal of teaching agricultural literacy established by the National Council for Agricultural Education (2015), integrative agricultural education strives for academic literacy as well. Literacy is defined as being able to identify what is learned within everyday life and understanding the role that knowledge plays in the world. Demonstrating confidence, or a "productive disposition" (Madison, 2014), when engaging in situations that involve using what has been learned is also a hallmark of literacy (Bybee, 2013). Math literacy, also referred to as quantitative literacy, can be taken a step further to include reasoning mathematically. Quantitative reasoning within agriculture is essential given the science and technology that drives agricultural education.

Quantitative reasoning is characterized by the ability to think mathematically, procedurally or numerically, with confidence in everyday situations (Steen, 1997). Students demonstrate quantitative reasoning by applying math concepts to unique situations to solve complex problems. Students with strong quantitative reasoning understand how the concept will aid the process of finding a solution and can communicate that understanding clearly and with confidence (Steen, 1997, Wilkins, 2000). Quantitative reasoning, however, is not math (Steen, 2004). Rather, it is the use of mathematical concepts and mathematical thinking within real contexts (Steen, 1997). The foundation of quantitative reasoning is academic mathematics nonetheless (Cobb, 1997). Integrative agricultural education brings the context and application to mathematics that is often not seen in a traditional mathematics classroom. The application and usefulness students learn through agricultural education develops quantitative reasoning skills that are not possible to develop in a traditional math class (Agustin et al., 2012; Steen, 1997).

The Problem

While this approach produced improvements in mathematical achievement scores, the approach would need to be made more integrative to promote quantitative reasoning development in agriculture students. To develop quantitative reasoning, students need to use the academic mathematics they have learned in their math courses to help solve problems and communicate the solution process, including the mathematical thinking, to an audience. Authentic artifacts and human resources should be used by students to develop their ideas (Wiggins, 2003). Abstract mathematical concepts should remain in the context of agriculture to demonstrate the useful and relevant nature of mathematical thinking. Critical thinking and collaboration should be evident through projects, reflective writing, and peer evaluations. Supervised agriculture experiences and career development events should be used to provide additional learning opportunities. However, students should be expected to communicate the situations in which they applied math concepts and mathematical thinking during these experiential learning episodes. Through careful planning, agriculture teachers can provide students with opportunities to flex their quantitative reasoning skills and discover situations where students realize they can apply previously learned abstract math concepts in a useful and effective manner. In other cases, agricultural education teachers may set up situations that provide students a learning opportunity that pushes their mathematical understanding by asking thoughtful questions and learning to think as a math expert.

Purpose

Science integration is the norm in agricultural education and agriculture teachers report being confident in their abilities to include science concepts in their instruction (Smith, Rayfield, & McKim, 2015). Integration of academics outside of the science area pose a greater challenge for agriculture teachers (Asunda, 2012; Balschweid & Thompson, 2002). Teacher training in integrative agricultural education, as well as quantitative reasoning related preparation, and collaboration with academic teachers may be the support agriculture teachers need to promote quantitative reasoning development in agriculture students (Berlin & White, 2012; Stubbs & Myers, 2015). Further research can determine what training is needed to aid teachers in developing and implementing integrative agricultural education. With foundational information outlining the needs of agriculture teachers to integrate mathematical concepts into agriculture, pre-service teacher programs and in-service teacher training can provide teachers the needed support to see advances in student achievement and development into strong life-long learners.

Methods & Procedures

A systematic review of literature with strict inquiry guidelines was used to establish the basis of this theoretical framework. Peer-reviewed research-based literature was analyzed, ranked for significance, and themes established to form the foundation of the characteristics of integrative STEM education. A constructivist approach was employed, taking care to provide multiple perspectives of the definition of integrative STEM education established through the shared experiences of teachers and students involved in the process of teaching and learning. The focus of the review remained on integrative STEM education in particular to ensure the creation of tenets of integrative agricultural education were rooted in the context of agriculture with quantitative reasoning and mathematical elements embedded during curriculum planning and implementation.

Recommendations

Agricultural education holds great potential to provide students opportunities to see mathematics at work in real world situations. Moreover, the wide variety of projects and problem solving practice promotes hands-on learning and establishes obvious connections between academic mathematics and using mathematical thinking to produce artifacts and solve problems. The characteristics of integrative agricultural education described here can lay the foundation to use secondary agriculture courses as a catalyst to improve student academic understanding and performance on standardized tests. Building a curriculum that integrates mathematics with the intent of building quantitative reasoning also has potential to develop students' 21st century skills, preparing them to be career and college ready as well as giving them the skills to be life-long learners.

Agricultural education is being thrust into a new role in public education. Agricultural education educators should step into this support role with intention and focus on preparing students to practice relevant academic concepts alongside agricultural content. Providing support to students' academic growth is more than simply pointing out a random association between agriculture and academics. Integrative agricultural education may hold the key to giving teachers the framework to prepare for their new role as contextual academic support specialists by using students' interest in agriculture to make mathematics come alive.

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Initial Agricultural Mechanics Skills Possessed by Pre-service Agricultural Education Students

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Introduction

Teacher education programs face a myriad of challenges in preparing secondary Agricultural Education teachers. Student teachers reported high levels of anxiety associated with teaching agricultural mechanics prior to and during their student teaching (Foster, 1986). Numerous studies indicated that teacher knowledge of agricultural mechanics was in need of improvement both prior to and after accepting teaching positions (Schlautman and Siletto, 1992). Foster (1986) recommended that Agricultural Education majors participate in early experience programs designed to address those factors of highest anxiety, one being teaching agricultural mechanics.

Recent evidence (Burris, McLaughlin, McCulloch, Brashears, & Fraze, S. 2010) indicated many agricultural education teachers (particularly early-career teachers) felt less comfortable teaching agricultural mechanics than other agricultural content areas. Borne and Moss (1988) indicated that "on-the-job/self-study" made the greatest overall contributions to preparation as first year secondary Agricultural Education teachers. Given previous research, pre-service teachers need greater exposure and understanding of agricultural mechanics before becoming secondary Agricultural Educators. Research has indicated that previous experience in a particular content area (i.e., agricultural mechanics) creates higher self-confidence regarding the given subject (Burris et al., 2010; Stripling & Roberts, 2012).

Theoretical Framework

The theoretical framework guiding this study is Bandura's (1977) social learning theory. The social learning theory suggests that learning is a cognitive process that takes place in a social context and can occur through observation or direct instruction. Direct instruction is used to teach a specific skill, while observational learning is thought to be most important during childhood education. "Most human behavior is learned observationally through modeling: from observing others, one forms an idea of how new behaviors are performed, and on later occasions this coded information serves as a guide for action." (Bandura). "Social learning theory explains human behavior in terms of continuous reciprocal interaction between cognitive, behavioral, and environmental influences" (Bandura, 1986).

This theory was selected based on the nature of the majority of agricultural mechanics courses. Bandura's study (1986) offered four necessary conditions for effective modeling; attention retention, reproduction, and motivation. Shinn (1987) found that the amount of time devoted to laboratory instruction may compromise one-third to two-thirds of the total instructional time in many agriculture programs. The experiential learning processes provide opportunities for personal development, increased comprehension of skills, and valuable

educational opportunities that emphasize real-world learning, all of which are emphasized in the secondary agricultural education philosophy (Roberts, 2006).

Purpose and Objectives

The purpose of this study was to identify the initial agricultural mechanics skills possessed by pre-service Agricultural Education students enrolled in an agricultural mechanics course. This study aligns with the American Association for Agricultural Education's National Research Agenda (Doerfert, 2011) Research Priority Area 3: Sufficient Scientific and Professional Workforce That Addresses the Challenges of the 21st Century. Training in a technology-rich field, such as agricultural mechanics, can help to prepare secondary students for the rigors, needs, and challenges of the real world (Doerfert, 2011).

Methods

The population consisted of agricultural education students enrolled in an agricultural mechanics teaching methods course at Iowa State University from spring 2015 to spring 2016 (N = 44). The instrument was developed by faculty in Agricultural Systems Technology. Survey questions were based on the basic skills that students should possess in the following four constructs: electricity, small engines, surveying/precision farming, and metal work. The questionnaire was presented to a panel of experts consisting of agricultural education and agricultural system technology faculty members to establish face and content validity. The reliability coefficient (Cronbach's Alpha) for the questionnaire was 0.868. The competency levels were measured on a 5-point scale: 0 = no experience, 1= have observed, 2= done with assistance, 3= can perform without supervision and 4= perform(ed) routinely. Surveys were administered on the first day of each course to measure the skills of the incoming students. Basic demographic results indicated significantly more females (77.3%) enrolled in the course. Respondents primarily represented by agricultural education majors (93.2%). Approximately 81.8% of the participants had either lived or worked on a farm.

Results

As shown in table 1 students were assessed on a number of specified skills in four construct areas. Within these construct areas, metal working had the worst percentage of experience by respondents. The other three constructs precision agriculture, small engines, and electricity all followed each other respectively. Precision agriculture had the second highest response area with no experience at 58.7%.

Table 1.

Average Response Frequency by Construct Area

Area	No. of Skills	(0) No Experience		(1) Observed		(2) With Assistance		(3) With Supervision		(4) Perform Routinely	
		f	(%)	*f*	(%)	*f*	(%)	*f*	(%)	*f*	(%)
Electricity	11	255	(55.4)	88	(19.1)	64	(14.1)	15	(3.3)	17	(3.7)

Metal Working	5	137	(62.6)	33	(15.1)	27	(12.3)	19	(8.7)	3	(1.4)
Precision Ag.	9	227	(58.7)	73	(18.9)	49	(12.7)	23	(5.9)	15	(3.9)
Small Engines	8	200	(56.8)	62	(17.6)	41	(11.7)	26	(7.4)	23	(6.5)

Note: Response frequencies from each of 33 individual skills averaged within the four constructs.

As shown in table 2 students were assessed on eleven electrical skills. In the Install a light skill 75% of the respondents reported having no experience, with no respondents having perform the task routinely. In the skill Installing a 3-Way Switch 56.8% respondents had no experience, with no respondents reporting performing the task routinely. In the skill area Install a Receptacle 52.3% respondents reported having no experience, while there were only four respondents that reported being able to perform this skill routinely.

Table 2.

Average Response Frequency by Electricity Area

Skills Assessed	(0) No Experience		(1) Observed		(2) With Assistance		(3) With Supervision		(4) Perform Routinely	
	f	(%)	*f*	(%)	*f*	(%)	*f*	(%)	*f*	(%)
Install a Light	33	(75)	7	(15.9)	4	(9.1)	0	(0)	0	(0)
Install a 3 Way Switch	25	(56.8)	13	(29.5)	6	(13.6)	0	(0)	0	(0)
Install a 4 Way Switch	23	(52.3)	14	(31.8)	7	(15.9)	0	(0)	0	(0)
Install a Receptacle	23	(52.3)	6	(13.6)	10	(22.7)	1	(2.3)	4	(9.1)
Use Wire Stripper	27	(61.4)	7	(15.9)	6	(13.6)	2	(4.5)	2	(4.5)
Use Linesman Pliers	28	(63.6)	6	(13.6)	4	(9.1)	3	(6.8)	3	(6.8)
Use Cable Rippers	10	(22.7)	6	(13.6)	14	(31.8)	7	(15.9)	7	(15.9)
Use Wire Nuts	38	(86.4)	2	(4.5)	2	(4.5)	1	(2.3)	1	(2.3)
Wire a Series Circuit	32	(72.7)	7	(15.9)	4	(9.1)	0	(0)	1	(2.3)
Wire a Parallel Circuit	29	(65.9)	9	(20.5)	5	(11.4)	0	(0)	1	(2.3)
Wire Use National Electric Code	15	(34.1)	17	(38.6)	7	(15.9)	4	(9.1)	1	(2.3)

As shown in table 3 students were assessed on five welding skill. In the Flat Shielded Metal Arc Welding skill 59.1% the respondents had no experience, with only 4 of the respondents reporting being able to perform the skill routinely. In the Flat Metal Inert Gas Welding skill 47.7% of the respondents reported having no experience, with 6.8% being able to perform the skill routinely.

Table 3.

Average Response Frequency by Metal Working Area

Skills Assessed	(0) No Experience		(1) Observed		(2) With Assistance		(3) With Supervision		(4) Perform Routinely	
	f	(%)	*f*	(%)	*f*	(%)	*f*	(%)	*f*	(%)
Run Flat Shielded Metal Arc Welding Bead	26	(59.1)	6	(13.6)	6	(13.6)	2	(4.5)	4	(9.1)
Run Flat Metal Inert Gas Welding Bead	21	(47.7)	11	(25)	7	(15.9)	2	(4.5)	3	(6.8)
Cut with Plasma Cutter	10	(22.7)	11	(25)	6	(13.6)	9	(20.5)	8	(18.2)
Cut with Propane and/or Oxy-Acetylene Torch	20	(45.5)	9	(20.5)	7	(15.9)	5	(11.4)	3	(6.8)
Use Wire Wheel	31	(70.5)	6	(13.6)	7	(15.9)	0	(0)	0	(0)

As shown in table 4 students were assessed on nine different skill areas. In the skill area Read Rod 70.5% or 31 of the 44 respondents reported having no experience, with zero respondents being able to perform the skill routinely. In the skill area Use Pacing 33 or 75% of the respondents reported having no experience, with only 1 or 2.3% of the respondents being able to perform the skill routinely. In the skill area Use Taping 81.8% or 36 respondents reported having no experience, with zero respondents being able to perform the skill routinely.

Table 4.

Average Response Frequency by Precision Agriculture Area

Skills Assessed	(0) No Experience		(1) Observed		(2) With Assistance		(3) With Supervision		(4) Perform Routinely	
	f	(%)	*f*	(%)	*f*	(%)	*f*	(%)	*f*	(%)
Read Rod	31	(70.5)	6	(13.6)	7	(15.9)	0	(0)	0	(0)
Use Pacing	33	(75)	7	(15.9)	1	(2.3)	2	(4.5)	1	(2.3)
Use Taping	36	(81.8)	6	(13.6)	1	(2.3)	1	(2.3)	0	(0)
Use Odometer	23	(52.3)	6	(13.6)	6	(13.6)	5	(11.4)	4	(9.1)
Use of Handheld GPS	36	(81.8)	5	(11.4)	2	(4.5)	0	(0)	1	(2.3)
Setup Laser Level	30	(60.8)	7	(15.9)	5	(11.4)	1	(2.3)	1	(2.3)
Setup Boundaries	31	(70.5)	8	(18.2)	3	(6.8)	1	(2.3)	1	(2.3)

Establish Waypoints	14	(31.8)	7	(15.9)	9	(20.5)	9	(20.5)	5	(11.4)
Differential Leveling	9	(20.5)	6	(13.6)	13	(29.5)	12	(27.3)	4	(9.1)

As shown in table 5 students were assessed on eight small engine skills. Less than 5% of respondents reported performing any of the eight skills areas routinely. When asked about Service/installing a spark plug 50% of the respondents reported having no experience. In the skill area Service/install air filter 25 of the respondents reported having no experience, In the skill area Change oil 65.9% of the respondents reported having no experience, with only one respondent reported completing skill routinely.

Table 5.

Average Response Frequency by Small Engines Area

Skills Assessed	(0) No Experience		(1) Observed		(2) With Assistance		(3) With Supervision		(4) Perform Routinely	
	f	(%)	*f*	(%)	*f*	(%)	*f*	(%)	*f*	(%)
Service/Install Spark Plug	22	(50)	12	(27.3)	7	(15.9)	1	(2.3)	2	(4.5)
Service/Install Air Filter	25	(56.8)	10	(22.7)	5	(11.4)	4	(9.1)	0	(0)
Change Oil	29	(65.9)	8	(18.2)	4	(9.1)	2	(4.5)	1	(2.3)
Sharpen Blade	31	(70.5)	10	(22.7)	1	(2.3)	2	(4.5)	0	(0)
Adjust Carburetor	25	(56.8)	5	(11.4)	6	(13.6)	8	(18.2)	0	(0)
Use a Thickness Gauge	28	(63.6)	6	(13.6)	5	(11.4)	4	(9.1)	1	(2.3)
Use a Blade Balancer	27	(61.4)	10	(22.7)	6	(13.6)	1	(2.3)	0	(0)
Use a Torque Wrench	30	(68.2)	7	(15.9)	2	(4.5)	3	(6.8)	2	(4.5)

Conclusions/Implications/Recommandations

This study was designed to determine the skills possessed by pre-service Agricultural Education students. It should be noted that respondents had only observed or had no experience with the majority of all of the skills assessed. Based on the results, it can be concluded that there is a lack of agricultural mechanics skills possessed by Agricultural Education pre-service teachers entering the only agricultural mechanics course required for certification. As students enter the post-secondary agricultural mechanics course, over 50% of the students have no experience or only observed someone performing the skills. The lack of training at the post-secondary level is a good indication as to why pre-service agricultural education teachers are not comfortable teaching agricultural mechanics when they enter a classroom further supporting the suggestions of Burris, et al. (2010). Regarding teacher preparation practices, it is imperative that agricultural education teachers should receive as much positive exposure to agricultural mechanics as possible in order to en-sure future instruction at the secondary level (Burris et al.,

2005). Based on Bandura's social learning theory, adding additional coursework at the post-secondary level would give pre-service teachers the needed direct instruction to provide a cognitive background in agricultural mechanics. By adding additional coursework in agricultural mechanics, pre-service teachers would gain the needed modeling and repetition in order to effectively teach agricultural mechanics to future students.

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American Gothic: An Iconography And Twitter Analysis Of America's Most Illustrious Agrarian Couple In Popular Culture

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Introduction

Grant Woods was a struggling artist in his thirties, who lived above a funeral home carriage-house in Cedar Rapids, Iowa, when he created his iconic masterpiece *American Gothic* in 1930. This creation caused him to become one of the most recognizable artists in America. Earlier in 1930, while visiting Eldon, Iowa, for an art exhibition, Woods was enchanted by the home featured in the painting, originally built in 1881 by the Dibble family, because the home's architectural features reminded him of Europe (Puchko, 2015).

Figure 1. Grant Woods's painting of *American Gothic* (American Gothic House Center, 2015).

Despite the uniqueness of the home's architecture in Iowa, it is believed the home's iconic windows were ordered from a Sears and Roebuck catalog (Puchko, 2015). Woods asked his dentist, "62-year-old Byron McKeeby," and Woods's sister, Nan, to pose for the painting (Puchko, 2015, p. 1, para. 5). Woods entered his masterpiece into the "1930 annual exhibition at the Art Institute of Chicago, where it won a bronze medal and a $300 prize" and was immediately acquired for the Art Institute's collection, where it is still on display today (Puchko, 2015, p. 1, para. 1).

The *Chicago Evening Post* and numerous other publications disseminated an image of the painting, often with the caption of "*An Iowa Farmer and His Wife"* rather than the actual title of *American Gothic* (Puchko, 2015, p. 1, para. 9). Nan Woods and numerous Iowa residents were not fans of the painting. Nan did not like being referred to as the dentist's wife (as he was twice her age), but rather she insisted the painting was of a farmer and his daughter (Puchko, 2015; The Art Institute of Chicago, 2013). Many Iowans did not like the "sour potrayal" and "they resented being presented this way to the world" (Puchko, 2015, p. 1, para. 9).

Despite the initial backlash,

> "*American Gothic* remains one of the most famous paintings in the history of American art. It is a primary example of Regionalism, a movement that aggressively opposed European abstract art, preferring depictions of rural American subjects rendered in a representational style. The painting has become part of American popular culture, and the couple has been the subject of endless parodies. Some believe that Wood used this painting to satirize the narrow-mindedness and repression that has been said to characterize Midwestern culture, an accusation he denied. The painting may also be read as a glorification of moral virtue of rural America or even as an ambiguous mixture of praise and satire" (The Art Institute of Chicago, 2013, p. 1, para. 2).

This study analyzed how *American Gothic* has infiltrated popular culture to represent American agriculture 86 years after its creation. Parodies abound of the painting ranging from presidential candidates and their spouses to various forms of advertisements. *American Gothic* represents not only American culture, but more specifically the culture of individuals from rural or agrarian backgrounds (W.K. Kellogg Foundation, 2002). For this study, a content analysis of a Pinterest search of the image was analyzed to determine the breadth and popularity of *American Gothic* in popular culture. The purpose of this study was to determine what kinds of *American Gothic* likenesses have appeared and are trending in popular culture media. Social media posts related to *American Gothic* were also analyzed to determine the conversations occurring on Twitter.

Theoretical/Conceptual Framework

American cultural iconography is the study "of visual and verbal images to explore American cultural formations" (Reynolds & Hunter, 2000, p. 3). Iconography has been used to analyze photographs, film and media, as well as in cultural studies, and race and gender studies (Reynolds & Hunter, 2000). Literary scholars have long used iconography to study art forms, such as paintings, photographs, tourist sites, advertisements, and cartoons (Reynolds & Hunter, 2000). Iconography is based on four overlapping theoretical perspectives, specifically: "semiotics, Marxism, psychoanalysis, and Foucauldian postconstructuralism" (Reynolds & Hunter, 2000, p. 4).

Critical media literacy "expands the notion of literacy to include different forms of mass communication, popular culture, and new technologies" (Kellner & Share, 2007, p. 60). Typically critical media literacy analyzes the "effects of popular culture and media influences and on ways of education for increased consciousness" (Tisdell, 2007, p. 8). There are four

threads associated with critical media literacy: the notion of pleasure, how media reproduces or resists the dominant culture, postmodern, and gendered or group-based identities (Tisdell, 2007).

Purpose

American Gothic by Grant Woods is likely the greatest known representation of American farmers, whether or not this was the painting's true purpose. The painting has been on display at the Art Institute of Chicago since 1930, featured in numerous news publications, and has been the fodder of hundreds, if not thousands, of parodies. Since *American Gothic* parodies have been used to advertise everything from entertainment pieces, such as the film *Son-In-Law* and ABC's *Fresh Off the Boat* television show, to Legos and washing machines, it is important for agricultural communicators and educators to understand how this image has been utilized to not only promote the products being marketed, but also the image of American agriculture. This research project relates to Priority One of the National Research Agenda, because it is an analysis of the perpetuation of stereotypes and schemas surrounding the agricultural industry via popular social media sites. As American culture increasingly uses online tools of communication, this study analyzed the use of Pinterest and Twitter to perpetuate the conversation about Grant Woods's *American Gothic.*

Objectives

This study was intended as an overarching examination of the most popular images of *American Gothic* and its parodies via Pinterest, as well as an analysis of conversations on Twitter in relation to the painting. This study was guided by the following research questions:

RQ1: What were the most popular re-pinned pins associated with the search of "American Gothic" on Pinterest?

RQ2: What information did people who used the key words of "American Gothic" and "farmer" share on Twitter?

Methods/Procedures

A Pinterest search of "American Gothic" was used to find images of *American Gothic* and its parodies. As there is vast supply of *American Gothic* images through Pinterest, the first 60 posts that had been re-pinned over 500 times were identified by starting at the top of the feed and going down the page. The researcher individually examined each of the pins demographic and statistical information, which was provided by Pinterest. By selecting pins that had been re-pinned over 500 times identified what the most popular images were amongst Pinterest users.

Twitter information was determined by Sysomos MAP. Sysomos, an online social media analytics program, allows for "real-time access to an extensive database of social and traditional media conversations, as well as detailed information about sentiment, geo-demographics and key influencers" (PR Newswire, 2009, p. 1). "Blogs, news articles, social networks, forums, video sites, and micro-blogs" can be analyzed by Sysomos, which includes Twitter, Facebook, YouTube, Flickr, Instagram, LinkedIn and Tumblr (PR Newswire, 2009, p. 1). Initially, the

search in Sysomos was limited to just "American Gothic". However, this search query provided results that only pertained to the upcoming CBS prime-time murder mystery series called *American Gothic*. Therefore, to find Twitter content relevant to the painting, "farmer" was added to the Boolean search query. Searching for "American Gothic" and "farmer" in the main Boolean search query generated information from Sysomos for this research project. Adding a yearlong timeline for the search from June 12, 2015 to June 11, 2016 further filtered this search.

Findings/Results

RQ1: What were the most popular pins associated with the search of "American Gothic" on Pinterest?

A variety of pins were within the 60 identified for this study. Only 10 percent of the pins contained the original image of *American Gothic*, therefore 50 of the images were some arrangement of a parody. Three of the pins were videos, two were educational videos, while the other was a parody skit performed on *Saturday Night Live*. The average re-pinning rate was 1,551.92, with a minimum of 503 and a maximum of 7,800. Three pins were re-pinned over 6,500 times. These popular pins were for the following:

- Mexican-American Gothic – Day of the Dead art piece that was for sale on Etsy – re-pinned 6,500 times
- A article about the models who were used in *American Gothic* – re-pinned 6,900 times
- A Huffington Post article called 'Gothic Street Art Invades Rural Michigan' – re-pinned 7,800 times

Fictional characters are very popular in representing *American Gothic* parodies. Some of the characters or franchises found in this study's analysis of parodies include: *Breaking Bad*, *The Muppets*, Mona Lisa and Leonardo da Vinci, KISS, Barbie and Ken, Superman and Batman, Van Gogh, *Peanuts*, Mickey Mouse, *Beetlejuice*, *Shrek*, Sponge Bob, *Minions*, *Star Wars*, and *Harry Potter*.

Figure 2. A selection of popular images from Pinterest from a search of "American Gothic". From left to right: *Harry Potter* characters Minerva McGonnagall and Severus Snape depict *American Gothic* in a parody, "Mexican-American Gothic," the models who were used in American Gothic, and an image from the Huffington Post article about 'Gothic Street Art Invades Rural Michigan'.

RQ2: What information was shared on Twitter by people who used the key words of "American Gothic" and "farmer"?

During the time period of June 2015 to June 2016, there were 216 mentions of the key terms on Twitter. Men generated the majority of the tweets, representing 69 percent of the content. Ninety-three percent of the tweets were generated from the United States, while the other 6.5 percent were generated from Europe and India. The top 10 hashtags associated with the key words were: #funfact, #farmer, #ballislife, #nba, #basketball, #fineart, #holiday, #art, #jewelry, and #artring. The top four retweeted tweets were:

1. Adam silver looks like the farmer in American Gothic painting
2. Did you know? In the iconic painting "American Gothic" by Grant Wood, the farmer is actually the artist's dentist.
3. #Holiday #Greetings Funny American Gothic Farmer Snowman & Wife Hallmark Shoebox Greeting Card #Greeting Cards
4. American Gothic Mickey & Minnie #DisneySide #MonkeyKingdomEvent #FreshEpcot #Farmer #Epcot

Conclusions and Recommendations

American Gothic is fully ingrained in America's culture not only as a piece of art, but also as a representation of American agriculture. The conclusions of this study indicate that all genres of entertainment have utilized *American Gothic* as a parody. Films, television programming, magazines, print advertisements, and numerous fan artwork depictions flood search queries. *American Gothic* has an agricultural context; however, it has been used to sell entertainment, products, sex, and an idyllic lifestyle that has been harpooned from the conservative couple depicted in the original painting to reflect the changing needs of advertisers and the demand of American consumers across the nation for over 86 years.

Unfortunately, agricultural communicators and educators must not only look forward to future and current innovations within the agricultural industry to understand what consumers perceive about agriculture, but also look to the past to see reoccurring images directing the conversation for agriculturalists. Although *American Gothic* is a frequent recreation that harkens a time of classic agrarian agriculture, the painting is not alone in this type of portrayal. The Kellogg Foundation studies (2002) found that key terms of "pastoral, peaceful, picturesque, quiet, sleepy, quaint, Currier & Ives and Normal Rockwell" are also perpetuated throughout media to represent and describe the agricultural industry and rural communities (W.K. Kellogg Foundation, 2002, p. 21). The painting has become so famous that the parodies do not necessarily need to have an agricultural context for viewers to still see the original image and reminisce *American Gothic*. While the images vary, the majority of the images have a positive, if not whimsical, approach to the painting, providing viewers with a positive spin on a representation of the agricultural industry. It is important for agricultural communicators to understand what kinds of images are being shared in relation to gain insight on what consumers share.

Future studies shall include quasi-experimental interviews to gauge the public's perception of the painting to determine the use of the image's meaning for modern day agriculturalists in the eyes of consumers.

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A Project-Based Learning Approach for Developing Digital Literacy Skills in Undergraduate Agricultural Communication

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Introduction

Agricultural and environmental sciences communication (AESC) undergraduate degree programs continually need to prepare students to utilize new communication models and to evolve with the communications industry. Irani and Doerfert (2013) noted digital online media have allowed for constant access to news from numerous sources. Kurtzo, Hansen, Rucker, and Edgar (2016) stated agricultural communication students need to be able to adapt quickly to changes in technologies related to communication and information dissemination.

In addition to adapting to a constantly changing communication landscape, competitive graduates should be able to work individually or in teams, communicate, exhibit leadership, make decisions, solve problems, and maintain standards of professionalism (Crawford et al., 2011). Another skill to add to this growing list is the ability to quickly learn and use new technologies proficiently. Hence, digital literacy becomes a crucial area for agricultural communicators. Digital literacy "refers to the multiplicity of literacies associated with the use of digital technologies…[including] hardware and software used for educational, social, and/or entertainment purposes in schools and home" (Ng, 2012; p. 1066).

While the need to be digitally proficient is increasing, Edgar, Johnson, and Cox (2012) found that over a 10-year period faculty in the college of agriculture at the University of Arkansas required students to complete only a limited number of ICT-related tasks in each course. Meanwhile, students have grown to realize the importance of digital skills beyond solely utilizing new learning technologies in the context of an online course (Hall, Nix, & Baker, 2013). In the field of AESC, graduates should not only have digital literacy skills, but also be able to develop projects across communication delivery platforms. Digital convergence requires that science communicators research and relay key messages through a variety of media including print, photography, video, graphics, web, and social media (Ibrus, 2016; Wirtz, 1999).

Taking rapidly changing and converging communication technologies and digital literacy demands into account, it is imperative AESC programs identify innovative pedagogical and instructional design approaches to prepare graduates who can exhibit problem-solving and technology adaptability to "think AND act globally" across communication contexts and platforms (Irani & Doerfert, 2013; p 11). Project-based learning (PjBL) could be an opportunity to engage undergraduates in developing real-world digital projects while developing and applying digital literacy skills. This research aligns with Priority Four of the American Association for Agricultural Education (AAAE) National Research Agenda (2016) which calls for further examination of how PjBL could become more "relevant and contemporary" in agriculture and natural resource education programs (Roberts, Harder, & Brashears, 2016, p. 38).

Conceptual Framework

The Buck Institute (BIE) (2016) defines PjBL as a teaching method that encourages students to use critical thinking skills in an effort to answer questions and solve real-world problems. Larmer and Mergendoller's (2015) PjBL model identifies that meaningful learning begins with a complex problem or question that challenges the learner. Solving the problem or answering the questions must require the learner to engage in inquiry. According to Larmer & Mergendoller (2015), the project should provide authentic real-world experiences and be designed to allow the learner to maintain ownership, while determining the processes that will be used for completion. Reflection throughout the entire project helps the learner to recognize personal knowledge gain and to apply knowledge to future experiences. Critique and revision helps the learner to continually improve their project, which will be turned into a tangible product that will be used by the public.

Figure 1. Essential Project-Based Learning Design Elements (Larmer & Mergendoller, 2015)

The course examined was designed following the PjBL framework. Learners were to respond to the driving question of: How can we, as science communicators, develop a project informing public online audiences about Nebraska Extension? Learners were then given voice and choice in topic selection, design, and development of their photo essay projects, with the instructor serving as an expert and facilitator to help guide learning.

Additionally, learners in this study were asked how they could use a new mobile video application for digital, visual storytelling about Nebraska Extension. This component of the study centered on better understanding AESC students' processes for developing digital literacy skills and deploying new technologies. The research was guided by the International Society for Technology in Education (ISTE; 2007) standards for students including: 1) creativity and innovation, 2) communication and collaboration, 3) research and information fluency, 4) critical

thinking, problem solving, and decision making, 5) digital citizenship, and 6) technology operations and concepts.

Purpose and Research Questions

The purpose of this study was to explore a PjBL instructional design and teaching model for multimedia skill development in an AESC undergraduate program at the University of Nebraska-Lincoln. Underpinning this model was the desire to help students develop 21st century digital literacy skills. Therefore, this study sought to: 1) explore students' perceptions and experiences of navigating a PjBL course focused on digital photography and Extension engagement and 2) better understand students' perceptions and experiences related to learning a multimedia video application (learning and employing a subset of digital literacy skills). Research questions for this study included:

1. What are undergraduate AESC students' experiences in a new digital photography course based on a PjBL instructional design and teaching approach?
    a. What do they perceive as positive and challenging aspects of learning in this format?
2. How can Extension be implemented as a real-world context in PjBL design for an AESC digital photography course? And what might students learn about Extension?
3. How do AESC students go about learning and using a new mobile video application?
4. What are AESC students' perceptions of their final project outcomes in an AESC digital photography course?

Methods

The context for this study was a course titled "Digital Photography and Visual Communication Strategies for Agriculture and the Environment". The course was offered as part of an AESC undergraduate degree program and was developed/taught by the lead researcher. The course aimed to follow a PjBL design to help students learn basic digital photography skills, as well as develop photo essay projects covering an Extension-related topic of each student's choice. Twelve students enrolled in the course in the fall of 2015. Six students consented and participated after the Institutional Review Board approved the study. Pseudonyms are used for anonymity.

Table 1

Participants

Pseudonym	Class	Gender
Alexandra	Sophomore	Female
Christina	Sophomore	Female
Haley	Junior	Female
Jared	Junior	Male

Lucy	Junior	Female
Megan	Junior	Female

Data was collected through 45-minute individual semi-structured interviews conducted by the lead researcher. The potential exists that having the lead researcher conduct the interviews may have biased participant responses. Qualitative researchers often play many roles and wear different hats in the data collection and analysis process, and a dilemma faced in conducting interviews is whether or not to have an "insider" or "outsider" conduct the interviews, with both having the potential to influence participant responses in different ways (Hesse-Biber, 2017). In this study, the decision was made to conduct interviews with an insider, the course instructor and lead researcher, to establish familiarity and trust with participants through the shared experience of participating in the PjBL designed course, as well as potentially improve and strengthen the lead researcher's PjBL pedagogical approach. The research team members then separately open-coded interview transcripts for emergent categories and came together to identify themes (Saldaña, 2016). During a second round of axial coding, the data was reviewed and coded for categories that emerged from open-coding (Saldaña, 2016). Researchers established confirmability by coding independently, comparing codes, and reaching consensus about final themes found in the data (Hesse-Biber, 2017). Researcher bias is also always existent in qualitative work. However, to mitigate biases, multiple data sources were collected for triangulation and researchers coded data separately and then, compared codes to arrive at themes. To further enhance trustworthiness, member checking was used throughout the interview process (Lincoln & Guba, 1985). Additionally, the lack of participation of half of the students in the course could be considered a limitation to this study.

Results

Themes from participant interview transcripts include: 1) PjBL facilitation balance and tension of learner voice and choice in a PjBL design, 2) PjBL design for photography content learning and Extension contextual learning, 3) Undergraduate mobile technology adoption - active vs. passive application, 4) and Learner critique and pride of final projects. Table 2 briefly highlights each theme, sub-themes, and provides a sample learner quote as supporting evidence:

Table 2

Research Questions, Themes, Sub-themes, and Interview Evidence

Research Question	Theme	Sub-Theme	Learner Interview Quote
1	PjBL facilitation	Learner voice and choice – freedom	Lucy: "I'm doing the 4-H Youth and Development sector, and I chose it just because, basically it led me to where I am today. Without 4-H, I wouldn't have been an ag major…so that's really what I wanted to

			get across in my video, just to show how much it has impacted my life…"
		Learner voice and choice – structure	Christina: "I think if we had a set plan where our photos have to be done by a certain date, and we have to talk to these people by a certain date, it might run smoother. It might be a little hard because everyone would be stressing out about the deadlines, but I think in the long run, it would be easier because we have that panic toward the end."
2	PjBL content and context	Photography skill development	Lucy: "...knowing how to work the camera and knowing the different parts of it. Because for me, I needed to learn those basic skills. I didn't know any of them."
		Extension context	Jared: "I personally learned Extension and a lot of people just automatically think of 4-H, and those sorts of things, but [Extension educator] hardly talked about 4-H at all, expect a couple of events. So, looking at Extension from a broader overview, what they do."
3	Mobile technology adoption	Active application	Lucy: "I watched tutorials and stuff, and it [the app] definitely has more features than I thought it did, after looking at all the tutorial videos."
		Passive application	Megan: "I guess the fact that it was so simple. It didn't have complex things, like the shifting of the picture. I couldn't figure out how to make it not do that."
4	Final projects	Learner critique	Haley: "I really like the pictures that I took. I like how they turned out, and I think they're a great representation of where I come from and that area and what not. What I don't like is that I don't have much experience with video, and I don't like how my voice sounds. So, I don't like recording my voice and listening to it."
		Learner satisfaction	Alexandra: "I was very worried about how to start it, how to wrap it up, and so, going with the approach of introducing Extension and

wrapping up with Extension. I kind of liked that. So, I don't know, I was kind of impressed with myself because I didn't think I would be able to do it."

Discussion and Implications

Results indicate that there was tension and instructional challenges for facilitating a PjBL course in AESC. Some students were successful and thrived in having the freedom of voice and choice (Larmer & Mergendoller, 2015) in their learning. Contrastingly, other students struggled to identify topics and establish contacts with Extension educators. The PjBL model appeared to be effective, as all students in the course successfully completed photo essay projects about Extension areas. However, there is a need to scaffold learning more clearly so that learners do not feel overwhelmed with the immensity of working through real-world constraints. The results also support prior findings (Loizzo & Lillard, 2015) that Extension is an effective context for PjBL science communication, as all learners described expanding their views of Extension to include more than 4-H. As for digital literacy skill development, a large portion of students struggled to learn how to effectively use the mobile video application. Many students jumped directly into button-pushing within the app, while only two students mentioned taking the time to watch instructional tutorials about how to use the technology. It appears it could be beneficial to build in lessons and discussion in PjBL courses utilizing new technologies with direct explanation of strategies for learning new technologies.

This research is a beginning step in exploring PjBL for undergraduate AESC. Results indicate PjBL is an effective approach for engaging students in real-world contexts such as Extension, and allowing students to take control of their learning for deeper understanding of agricultural and environmental issues, communication and digital skills development, and development of projects for real-world audiences. The PjBL approach has the potential to be implemented in multiple agricultural education and communication courses.

Future Research

Recommendations for future research include examining a PjBL approach across multiple AESC courses with additional real-world project contexts such as developing videos and podcasts with agricultural and natural resource scientists about critical issues impacting the public. There is also a need to better define digital literacy competencies and standards across AESC curricula in order for undergraduates to develop skills for successfully securing careers in the technology-rich and constantly changing field of science communication.

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Pictures Worth a Thousand Words: Data Visualization in Food, Agricultural, and Environmental Scholarly Publications

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Introduction

Visual communication is one of humanity's oldest and most enduring forms of sharing news and ideas. From prehistoric cave paintings to modern-day digital graphics, visual communication has evolved to meet the needs of disparate cultures and eras, allowing individuals to disseminate information without relying on written or spoken language. In today's increasingly image-based society, visual communication—or, more accurately, *effective* visual communication—is more important than ever.

Data visualization is a multi- and interdisciplinary field that offers a wide array of opportunities for scholarly research and practical application in both bench and social scientific disciplines. Data visualization is the use of images to represent and/or explain quantitative information. Data visualizations have proven valuable in the communications field as a sort of visual shorthand for researchers, science reporters, and technical writers as they "support scientific thinking, educate students, and convey science informally to the public" (Stephens, 2014, p. 1). As Mogoş (2012) notes,

> Images are inextricable from the daily practices of science, knowledge representation, and dissemination. Diagrams, maps, graphs, tables, drawings, illustrations, photographs, simulations, and computer visualizations are used in everyday scientific work and publications. Furthermore, scientific images are increasingly traveling outside the laboratories and entering news magazines, courtrooms, and media. (p. 14)

Conceptual Framework

With a strong focus on the persuasive power of imagery, visual communication scholarship encompasses a number of research areas, including framing, agenda-setting, visual rhetoric, and cognition. Cognitive theory, broadly defined as the study of *knowing*, examines how individuals process information. Williams (2005) regards cognition as the amalgamation of dual mental processes: rational and intuitive. Rational intelligence is analytical; intuitive intelligence, emotional (p. 195). When processing images, Williams asserts, individuals rely first on the more instinctual intuitive cognition, triggering emotional responses and processes before the brain can rationally discern meaning.

Data visualizations have been a key part of scientific publishing since the days of Galileo (Hidalgo & Almossawi, 2014), acting as shorthand to improve the clarity and memorability of even complex concepts. Previous research suggests that data visualizations work because of the pictorial superiority effect. The pictorial superiority effect (Nelson, Reed, & Walling, 1976; Snodgrass & Asiaghi, 1977) postulates that individuals better remember concepts represented by images than those in written form. More recent research on the pictorial superiority effect suggests that visual communication is a more effective tool than text for sharing high-level

scientific information, such as the risks and benefits of medical treatment, especially among audiences who prefer to communicate through images (Tait, Voepel-Lewis, Brennan-Martinez, McGonegal, & Levine, 2012; Hawley et al., 2008).

Purpose and Objectives

The purpose of this study was to investigate the use of data visualizations—here operationalized as any figures (excluding tables) used to describe, supplement, or summarize information contained in a scholarly work—in high-impact scientific journals in food, agricultural, and environmental sciences (FAES). Two research questions were posed:

RQ1: How frequently do data visualizations appear in articles in high-impact FAES journals?
RQ2: What types of data visualizations do FAES scholars use?

This study pertains to Priority 1 of the 2016-2020 AAAE National Research Agenda in its focus on public and policymaker understanding of industry research and practice. In response to Research Question 1: "What methods, models, and programs are effective for informing public opinions about agricultural and natural resources issues?" (Enns, Martin, & Spielmaker, 2016, p. 13), we posit that augmenting visual communication among scholars may improve knowledge outcomes among scientific and lay audiences alike.

Methods

Population and Sample

This study is a quantitative content analysis of data visualizations in scientific journals. A 2013 impact-factor report from Thomson Reuters ("Top Peer Reviewed Journals," 2013) was used to identify the top 20 FAES journals (Table 1). Online content for each was found on the [University] library website or via Google Scholar. Five articles published from 1980-present were selected from each journal (*N*=100). Depending on the search capabilities of each online journal, articles were either purposively sampled by using the "most cited" feature, or sampled by selecting articles at random from the dates of interest.

Table 1.

Top 20 Food, Agriculture, and Environment Journals Ranked by Impact Factor

Journal Title	Avg. Impact Factor
Annual Review of Nutrition	8.70
Molecular Nutrition & Food Research	4.45
Critical Reviews in Food Science and Nutrition	4.34
Nutrition Research Reviews	4.31
Advances in Agronomy	4.21
Journal of Nutrition	4.10
Nutrition Reviews	3.99
Trends in Food Science & Technology	3.81
Proceedings of the Nutrition Society	3.67
Annual Review of Food Science and Technology	3.60

Food Chemistry	3.41
Food Microbiology	3.27
Journal Title	**Avg. Impact Factor**
International Journal of Behavioral Nutrition and Physical Activity	3.20
Comprehensive Reviews in Food Science and Food Safety	3.20
British Journal of Nutrition	3.17
Food and Bioprocesses Technology	3.17
International Journal of Food Microbiology	3.16
Food Hydrocolloids	3.10
Rice	3.00

Data Analysis

The resulting articles (*N*=100) were downloaded in PDF format for analysis. Identifying information (title, author, publication year, issue and volume, and number of citations) was recorded in a Microsoft Excel spreadsheet. Each article was examined for the appearance of data visualizations, and each visualization was screen-captured and added to the spreadsheet with a brief description and a category. Frequencies were calculated for each journal and category in Microsoft Excel.

Findings

RQ1: Frequency of Data Visualizations in High-Impact FAES Journal Articles

The 100 articles examined yielded a total of 184 data visualizations, excluding tables. The articles averaged approximately 2 data visualizations (μ=1.86, SD=1.12). Ninety of the articles contained at least one visual element; eight articles contained tables only, and two articles contained neither tables nor data visualizations.

RQ2: Types of Data Visualizations Used by FAES Scholars

The 184 data visualizations were categorized by type (Table 2). Four primary data visualization groupings emerged: diagrams, which were defined as computer-generated models of structures and relationships (*Figure 1*); art, which included drawings, maps, and photographs (*Figure 2*); statistical graphs, such as line graphs and scatter plots (*Figure 3*); and mathematical charts, including pie charts (*Figure 4*).

Table 2.

Types of Data Visualizations and Their Frequencies

Visualization Type	Frequency	Percentage
Diagram	41	22.28
Art	25	13.59
Graph	71	38.59
Chart	47	25.54
Total	184	100.00

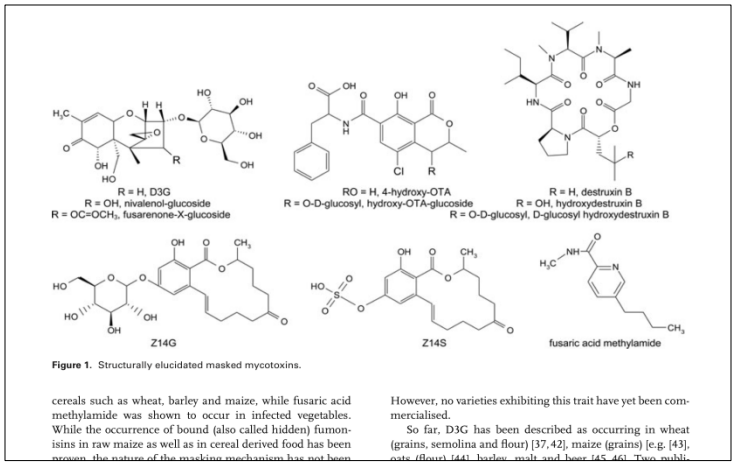

Figure 1. An example of diagrams used in *Molecular Nutrition & Food Research.*

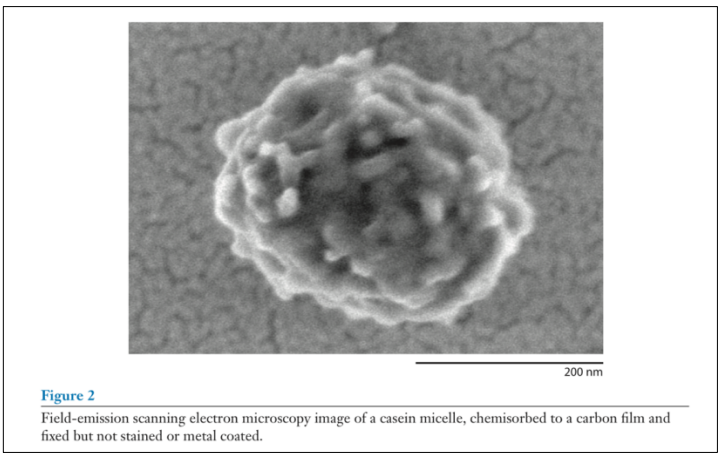

Figure 2. An example of art—in this case, a photograph—used as a data visualization in the *Annual Review of Food Science and Technology*.

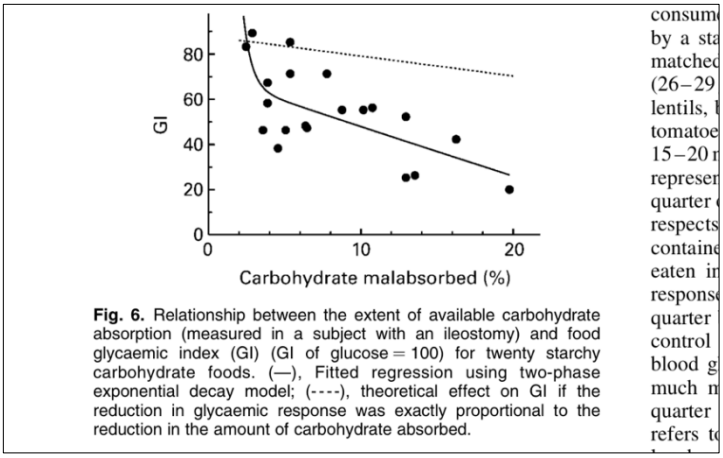

Figure 3. An example of a graph—here, a scatter plot—used as a data visualization in *Nutrition Research Reviews*.

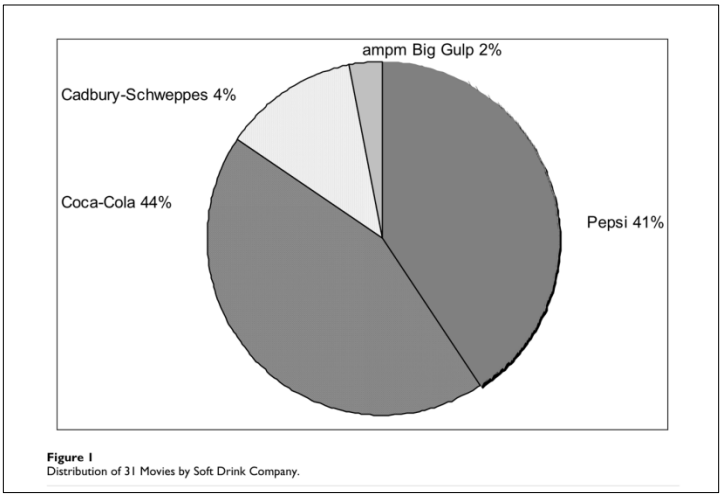

Figure 4. An example of a pie chart used as a data visualization in the *International Journal of Behavioral Nutrition and Physical Activity.*

Discussion

The vast majority of the articles examined for the purposes of this study contained data visualizations of some kind. This finding supports the notion that scientists, like other communicators, rely at least in part on the pictorial superiority effect to trigger reader cognition and improve comprehension of their work. A very small but positive correlation (r=.23) was found between year of publication (spanning 1984 to 2016) and number of data visualizations per article, indicating that the use of visualizations has remained relatively steady in the past three decades. Contemporary research (Otten, Cheng, & Drewnowski, 2015; Healy & Moody, 2014; Wu, Faris, & Ma, 2013) suggests that the use of data visualizations, especially nontraditional imagery like 3D models and interactive graphics, in a variety of scientific fields will only increase in the future.

The majority of the visualizations used were traditional graphs and charts, which accounted for almost two-thirds of the images found. The preponderance of charts and graphs indicates that the articles analyzed were not intended for consumption by lay audiences, given that these types of scientific visualizations are less comprehensible to individuals who lack specific training in relevant fields (Carpenter & Shaw, 1998). This becomes problematic when we consider the growing gap between FAE scientists and consumers: Making scientific research more palatable for journalists and other information gatekeepers could go a long way to increasing public awareness of FAES research (Otten, Cheng, & Drewnowski, 2015).

Given the results of this study, we recommend that FAES scientists explore new and innovative ways to visualize their research results. We also suggest future research to investigate the possible relationship between scientific data visualization and mass media coverage of FAES issues.

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Classroom Literacy Practices and Factors of Influence

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Introduction

Common Core State Standards (CCSS) have placed an increased emphasis on college and career readiness by focusing on disciplinary literacy (Buehl, 2011; Coleman & Pimentel, 2012; Lesley, 2014). Agricultural education is facing increased accountability due to CCSS and high stakes testing. Besides preparing students for college, Career and Technical Education (CTE) also helps prepare student for the workforce, and reading is needed to be successful in the workplace (O'Brien & Steward, 1990). To continue to prepare college and career ready students, agricultural education must incorporate literacy skills instruction into the classroom.

Disciplinary literacy and content area literacy differ from general literacy. Content area literacy focuses on general practices to improve reading in all content areas, while disciplinary literacy uses the unique reading and writing styles, and vocabulary of each area (Shanahan & Shanahan, 2008). Each content area has an individual purpose for reading and writing and distinctive vocabulary students are expected to use (Adams & Pegg, 2012; Moje, 1996; Moje, 2008; Park & Osborne, 2005; Park & Osborne, 2007; Rutherford, 2009). It is important each content area teacher focus on teaching their students the necessary skills to be literate within the discipline.

Agricultural education is a unique content area that contains elements of science education and CTE. "CTE students read to solve problems, make decisions, find information, explore issues, provide context for concepts, prepare for careers, and many other reasons," (Park, 2011, p. 12). Whereas science task students to find evidence within the reading to support or refute a claim (Buehl, 2011). These multiple philosophical approaches to agricultural education make it difficult to completely align solely science education or CTE research. Agricultural education requires its own literacy research.

Conceptual Framework

A substantive theory was developed to identify and define the relationships among variables of interest. Below provides a brief synopsis of each area.

Professional Training Factors

Agriculture teachers lack confidence in their ability to effective use literacy strategies in the classroom (Park & Osborne, 2006a; Park & Osborne 2007b; Santamaria et al., 2010) while only 39.2% have completed coursework related to content area reading (Park & Osborne, 2007b). Collaboration with the English/Language Arts (ELA) department is a factor in supporting teachers who implement literacy strategies. When those groups of teachers collaborate, they are more likely to develop strategies that will benefit all students (Brozo, Moorman, Meyer, & Stewart, 2013). Assessment of student reading (Park & Osborne, 2005; Park & Osborne, 2006a) and writing (Baker, et al., 2008; Hand & Prain, 2002) has historically been of concern for content area teachers.

Personal Literacy Preferences

A teacher's personal literacy preferences impact classroom literacy practices. Teachers who either identified as non-readers (Park & Osborne, 2006a) or who had low personal value of reading (Park & Osborne, 2007) where less likely to implement readings and reading strategies. Whereas teachers who personally valued reading were likely to view it as a tool and use more frequently (Park & Osborne, 2007). A majority of agriculture teachers believe reading is important, but a smaller percentage where likely to implement it in their classrooms (Park & Osborne, 2006a). Students are actively influenced by (Park & Osborne, 2007; Phelps, 2005) and adopt teacher attitudes regarding literacy (Adams & Pegg, 2012; Moje, 1996; Park & Osborne, 2006a).

Professional Literacy Attitudes

Lesley (2014) found pre-service teachers were opposed to literacy skills instruction in the content area, or believed reading instruction should not at occur at all at the secondary level (Hall, 2005). Another common belief was literacy skills instruction should fall on elementary and middle school teachers (Shanahan & Shanahan, 2008). However, it must be noted again each discipline has its own unique expectations for communication (Adams & Pegg, 2012) and students do not transfer the literacy skills in they learn in one content area to another (Moje, 1996). The amount of time perceived to properly incorporate literacy skills instruction has also been identified as an obstacle.

Purpose & Objectives:

The purpose of the study was to determine what barriers to literacy skill incorporation exist among agricultural education teachers, and what must be done to support and develop classroom teachers' competency in this area. Specifically, the following objectives were studied:

1. Describe the professional training factors, personal literacy preferences, and professional literacy attitudes of current agriculture teachers and frequency of literacy practices in agriculture classrooms
2. Describe the frequency of current literacy practices in agriculture classrooms
3. Determine if relationships exist between classroom literacy practices and professional factors, personal preferences, and professional attitudes

Methods

Currently, there are 10,874 agriculture teachers employed in the U.S. (Foster, Lawver, & Smith, 2014). Due to the large popular, a smaller more accessible frame was selected: members in the National Association of Agricultural Educators (NAAE) (N = 6,487). A sample (n = 364) was randomly selected, determined by Krejcie & Morgan (1970). The average participant was male (50.5%), 39.33 years old (SD = 11.68), and has taught for 13.41 years (SD = 10.43). The vast majority were traditionally certified (91.1%). Participants represented 35 states. Since not all agriculture teachers are members of NAAE, the findings should only be applied to NAAE members.

A researcher-developed questionnaire was submitted to a panel of experts ($N = 5$) for content and face validity. A pilot test of NAAE members ($N = 22$) was conducted to establish reliability. Multiple question constructs had Cronbach's alpha scores ranging from .74-.83. The test-retest method yielded coefficients of stability ranging from .72-1.0. The questionnaire was administered via Qualtrics. An initial email and five follow-ups yielded an initial response rate of 20.8% ($n = 82$). To control for non-response error, a group non-responders were randomly selected and contacted via telephone, twelve agreed to participate in the study (Miller & Smith, 1983). Due to the disproportionate sample sizes between respondents and non-respondents, a Mann-Whitney U test was utilized. It was determined there was no statistical difference between non-responders and responders. The researchers combined the two groups for a final response rate of 25.8% ($n = 94$).

Findings

Due to space restraint, refer to Tables 1 & 2 for the findings of Objectives 1 and 2, focusing on the descriptive nature of the study.

Table 1

Frequencies and Percentages for Professional Training Factor Variables (n = 94)

Professional Training Factor	Yes *n* (%)	No *n* (%)
College Coursework	79 (84.0)	15 (16.0)
Professional Development Within School District	62 (66.0)	32 (34.0)
Professional Development Outside School District	49 (52.1)	45 (47.9)
Previous Collaboration with ELA Department On Literacy Strategies	62 (66.0)	32 (34.0)
Previous Collaboration with ELA Department On FFA Activities	65 (69.1)	29 (30.9)
District Has a Stated Literacy Initiative	55 (58.9)	94 (41.1)

Note. ELA= English/Language Arts

Table 2

Descriptive Statistics for Personal Literacy Preference, Confidence and Professional Attribute Variables (n = 94)

Variable	*M*	*SD*
Personal Literacy Preferences		
Identify As a Reader[1]	3.98	1.42
General Attitude Regarding Literacy[1]	4.12	.92
Confidence		
Ability To Assess Student Literacy Skills[2]	3.13	.81
Professional Attitudes		
Literacy Skill Instruction Belongs In All Classrooms[1]	4.29	.70
Literacy Skill Instruction Supports Agriculture Content[1]	4.61	.63
Literacy Skill Incorporation Takes Too Much Time[1]	3.15	1.08
Willingness To Collaborate With ELA Department[1]	3.51	1.04

[1] 1= strongly disagree, 5 = strongly agree
[2] 1 = not confident, 5= very confident
Note. ELA= English/Language Arts

Table 3

Frequencies of Literacy Activities (n = 94)

	Frequency (Percent)							
Item	Never	Less than once month	Once a month	2-3 Times a month	Once a week	2-3 Times a week	Daily	Total
Take Notes or Outline Content	___	3 (3.2)	2 (2.2)	11 (11.8)	23 (24.7)	34 (36.6)	20 (21.5)	93 (100)
Use Graphic Organizers or Worksheet	1 (1.1)	5 (5.4)	9 (9.7)	18 (19.4)	35 (37.6)	21 (22.6)	4 (4.3)	93 (100)
Student Created Presentations	___	17 (18.3)	20 (21.5)	34 (36.6)	21 (22.6)	1 (1.1)	___	93 (100)
Summarize Content	___	6 (6.5)	17 (18.3)	18 (19.4)	22 (23.7)	19 (20.4)	11 (11.8)	93 (100)
"Traditional" Writing Assignments	3 (3.2)	40 (43.0)	32 (34.4)	13 (14.0)	4 (4.3)	1 (1.1)	___	93 (100)
Use of PowerPoint	___	5 (5.5)	2 (2.2)	13 (14.3)	19 (20.9)	40 (44.0)	12 (13.2)	91 (100)

Use of Magazine, Journal, or Newspaper Articles	___	20 (22.0)	23 (25.3)	24 (26.4)	18 (19.8)	5 (5.5)	1 (1.1)	91 (100)
Use of Informational Publications	3 (3.3)	35 (38.5)	18 (19.8)	22 (24.2)	10 (11.0)	3 (3.3)	___	91 (100)
Student Internet Usage	1 (1.1)	3 (3.3)	9 (9.9)	10 (11.0)	20 (22.0)	26 (28.6)	22 (24.2)	91 (100)

The third objective sound to determine if relationships existed between professional training, personal preferences, professional attitudes and classroom literacy practices. A logistic regression was calculated for each literacy practice while accounting for districts with a stated literacy initiative which literature indicated may be a potential influencer. Only two practices: traditional writing assignments and the use of PowerPoint had statistically significant influencers (see Tables 4 & 5). The model for traditional writing assignments was significant ($p = .05$) accounting for 47.8% of the variance, with only teacher confidence in their ability to assess literacy skills as the only significant predictor. The model for the use of PowerPoint was determined to be statistically significant ($p = .01$), accounting for 30.7% of the variance with only the belief that literacy skills supports agriculture content instruction as a significant predictor.

Table 4
Logistic Regression Analysis of Traditional Writing Assignments

Variable	β	SE	Wald test	p
Constant	-19.84	9.87	4.03	0.04
Stated Literacy Initiative	0.65	1.40	0.22	0.64
Assessment Ability	2.95	1.49	3.93	0.05
Literacy Belongs in All Classrooms	2.14	1.52	1.98	0.16
Identify as a Reader	1.14	0.85	1.78	0.18
Incorporating Literacy Skills Takes Too Much Time	0.69	0.64	1.46	0.23
Previous Collaboration with ELA	0.33	0.62	0.28	0.60
Literacy Supports Ag Ed Content	-1.27	1.05	1.46	0.23
General Attitude Towards Literacy	-1.59	0.92	2.96	0.09

Note. ELA = English Language Arts
Nagelkerke's $R^2 = .48$

Table 5
Logistic Regression Analysis of PowerPoint Usage

Variable	β	SE	Wald test	*P*
Constant	1.41	3.09	0.21	0.65
Stated Literacy Initiative	-0.52	0.64	0.66	0.42
Literacy Supports Ag Ed Content	1.53	0.63	5.87	0.02
Incorporating Literacy Skills Takes Too Much Time	0.45	0.29	2.37	0.12
Assessment Confidence	0.27	0.41	0.42	0.52
General Attitude Toward Literacy	-0.04	0.37	0.01	0.92
Identify as a Reader	-0.38	0.23	2.84	0.09
Previous Collaboration with ELA	-0.43	0.37	1.34	0.25
Literacy Belongs in All Classrooms	-1.32	0.72	3.38	0.07

Note. ELA = English Language Arts
Nagelkerke's R^2 = .31

Conclusions and Recommendations

Again, due to word constraints, the focus of this section will be on the relational, third objective. The third objective sought to determine if relationships existed between classroom literacy practices and professional factors, personal preferences, and professional attitudes. It was concluded that two literacy practices traditional writing assignments and PowerPoint usage had influencer. A teacher's comfort in assessing students' literacy skills influenced whether or not they used traditional writing assignments, which was consistent with previous research (Cantrell, Burns, & Callaway, 2009). Professional development should be offered to help in-service teachers become more comfortable in assessing student literacy skills. Literacy related coursework for pre-service teachers should focus on helping pre-service teachers develop skills and confidence needed to assess literacy skills. The use of PowerPoint in classroom was influenced by the belief literacy skills supported agriculture content. It has yet to be determined agriculture teachers use PowerPoints because they believe literacy skills are support agriculture content or if they believe literacy skills are important because they use PowerPoints. However, no other literacy practices had significant predictors.

This area of inquiry would benefit from additional research. Due to the variety of philosophical approaches to agricultural education, it would be beneficial to establish what in-service teachers believe disciplinary literacy looks like in the field. Exploring how in-service teachers form professional attitudes and if they change over time is another possible area of study. An additional area warranting study is if and how professional development can influence teachers' attitudes. Pre-service teachers should also be studied to determine their professional attitudes regarding literacy and how they are formed.

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LONGITUDINAL TRENDS IN THE IMPORTANCE OF AGRICULTURAL MECHANICS SKILLS

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Introduction

Today's employers are seeking employees with 21st century skills (National Research Council, 2012), and agricultural education plays a crucial role in incorporating and developing these skills (National Research Council, 2009). Agricultural education has proven to be a powerful tool in helping students apply Science, Technology, Engineering, and Mathematics (STEM) skills into real-world situations (Ricketts, Duncan, & Peake, 2006; Shultz, Anderson, Shultz, & Paulsen, 2014). Buriak (1992) discovered concerns that agricultural mechanics was not a viable methods for delivering 21st century skills and STEM content. Contrary to the concern noted by Buriak, Miller (1991) posited that agricultural mechanics "is a scientific based curriculum which provides the ideal setting to apply selected principles of physics, chemistry, and mathematics" (p. 4).

Despite a lack of post-secondary agricultural mechanics training received by teachers, and uncertainty regarding teachers' perceptions of their own competence to teach the subject, agricultural mechanics remains popular among secondary programs and their students (Herren, 2015). Students enrolled in agricultural mechanics courses can explore a vast array of skills which are needed in many careers related to agriculture among other skills which will prove valuable over a lifetime (Shultz, et al., 2014). Regardless of the variety of skills to which students are exposed to during their secondary education, if skills are not learned in preparation for a progressive and rapidly changing future, their learning may be for naught (Davis & Jayaratne, 2015). In order to effectively prepare today's students for gainful employment, educational programs must look towards the future.

Conceptual Framework

The conceptual framework used in this study was derived from Roberts and Ball (2009) and can be seen below in Figure 1. As described in this model, agricultural education programs deliver content through a combination of social and cognitive constructivism. Through this epistemology, curriculum can be delivered to meet the individual needs of students, whether they remain in the agricultural workforce or not. Roberts and Ball (2009) posited that agricultural education teachers reinforce learning through hands-on interactions resulting in two outcomes: a skilled agricultural workforce, and successful lifelong learners that are agriculturally literate citizens. At the very root of this model is the idea that agricultural education teachers use industry-validated curricula.

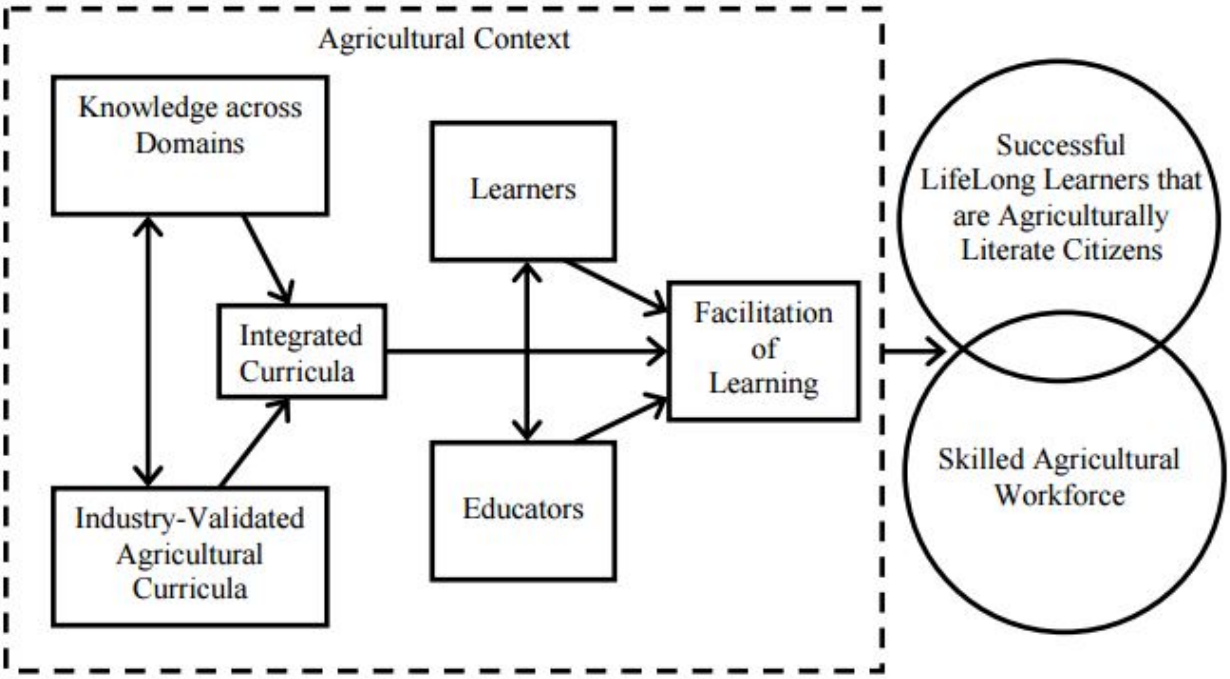

Figure 1. Conceptual model for agricultural subject matter as a content and context for teaching. (Roberts & Ball, 2009, p. 87)

Purpose and Objectives

The purpose of this study was to describe trends regarding the importance of secondary agricultural mechanics skills. This research aligns with the American Association for Agricultural Education National Research Agenda (Roberts, Harder, & Brashears, 2016) Research Priority 3 which calls to determine the competencies needed for a viable agriculture workforce. The objectives for this study were as follows:

1. Determine the change in the depth of agricultural mechanics skills taught in the U.S. in 1994 and in Iowa in 2016.
2. Determine the change in perceived importance of agricultural mechanics skills in the U.S. in 2004 and in Iowa in 2026.
3. Analyze the difference in past U.S. secondary agricultural education teachers' predictions about the future importance of secondary agricultural mechanics skills and the depth agricultural mechanics skills are currently being taught in Iowa.

Methods

This descriptive, non-experimental, quantitative study used a longitudinal approach to describe the perceptions of secondary agricultural education teachers regarding the importance of secondary agricultural mechanics skills. Our data and that collected by Laird (1994) were used to compare data collected over a 22 year span. Laird (1994) utilized a sample survey technique with secondary agricultural education teachers across the United States (n = 253). We used Laird's survey to collect data from secondary agricultural education teachers in Iowa (n = 64).

Laird's (1994) instrument included 60 skills appropriate for inclusion in secondary agricultural mechanics curricula. One skill identified by Laird (1994), Oxy-Acetylene Welding and Cutting, could not be included in this study because we divided Oxy-Acetylene Welding, and Oxy-Acetylene Cutting into two separate skills. The instruments designed by Laird (1994) consisted of nine constructs.

The instrument was revalidated in 2015 by a panel of eight experts who were agricultural education faculty members with backgrounds in agricultural mechanics at different institutions across the United States. Fink (1995) indicated that 10 people are typically needed to field test an instrument. In order to confirm the reliability of the instrument, another pilot study was conducted in 2016 using ten secondary agricultural education teachers from an adjoining state ($n = 10$). Following the pilot study, reliability was calculated using Cronbach's alpha ($\alpha = 0.92$) which was determined to be highly reliable (Ary, Jacobs, Razevieh, & Sorensen, 2006).

The researchers asked respondents to evaluate a set of agricultural mechanics skills using a nine-point summated double-matrix rating scale. The double-matrix allowed respondents to answer twice; first rating the depth at which they currently teach each skill (1 = *no depth*, 3 = *little depth*, 5 = *some depth*, 7 = *much depth*, 9 = *utmost depth*), and secondly rating the importance they perceive each skill to have in secondary agricultural education in 2026 (1 = *not important*, 3 = *of little importance*, 5 = *somewhat important*, 7 = *important*, 9 = *very* important). As a result, data collected showed the depth secondary agricultural mechanics skills were taught in 1994, the importance teachers believed those skills would have in 2004 (Laird, 1994), and the depth those skills were taught in 2016 as well as the importance of those skills in 2026.

Results

The first objective of this study was to determine the change in the depth of agricultural mechanics skills taught from 1994 to 2016. Table 1 shows each construct's grand mean scores from Laird (1994) and from this study. Table 1 indicates that all constructs are taught in less depth than what they were taught in 1994. Computers and Problem Solving ($\Delta M = -0.52$) showed the least change in mean scores while others ($\Delta M = -2.46$) showed the greatest change in mean scores.

Table 1

Construct Grand Mean Scores for the Current Depth Agricultural Mechanics Skills were Taught in the U.S. in 1994 and in Iowa *in 2016*

Construct	1994		2016			
	M	*SD*	*n*	*M*	*SD*	*Δ M*
Computers and Problem Solving	3.73	1.90	62	3.21	1.48	-0.52
Metal Processing and Metalworking	4.46	1.69	63	3.57	1.72	-0.89
Carpentry and Woodworking	5.81	2.16	63	4.90	2.21	-0.91
Safety	6.62	1.73	62	5.70	2.03	-0.92
Farm Structures	3.95	1.87	63	2.99	1.73	-0.96
Soil and Water Management	3.44	2.09	60	2.38	1.37	-1.06
Electrical Power	4.42	2.22	63	3.32	2.05	-1.10

Farm Power and Machinery	3.87	1.90	62	2.59	1.64	-1.28
Others	5.36	1.85	62	2.90	0.74	-2.46

(1 = *no depth*, 3 = *little depth*, 5 = *some depth*, 7 = *much depth*, 9 = *utmost depth*)

The second objective of this study was to determine the change in perceived importance of agricultural mechanics skills in the U.S. in 2004 and in [STAE] in 2026. Table 2 shows each construct's grand mean scores from Laird (1994) and from this study. The data in Table 2 indicates that the Farm Structures, and Soil and Water Management constructs saw the greatest positive change in mean scores (ΔM = 0.40).

Table 2
Construct Grand Mean Scores for the Perceptions of the Importance of Secondary Agricultural Mechanics Skills Ten Years into the Future from Teachers Across the United States in 1994 (*N ranges from 224 to 240*) *and in* Iowa *in 2016*

Construct	2004			2026		
	M	*SD*	*n*	*M*	*SD*	*Δ M*
Farm Structures	5.29	1.90	61	5.69	1.81	0.40
Soil and Water Management	4.72	2.20	58	5.12	2.01	0.40
Farm Power and Machinery	5.31	1.94	60	5.57	1.99	0.26
Computers and Problem Solving	5.85	2.06	60	6.07	1.79	0.22
Electrical Power	5.90	2.15	61	6.05	2.04	0.15
Carpentry and Woodworking	6.44	1.95	61	6.44	1.83	0.00
Metal Processing and Metalworking	5.59	1.72	61	5.59	1.85	0.00
Safety	7.78	1.40	61	7.75	1.38	-0.03
Others	6.16	1.75	60	3.83	0.72	-2.33

(1 = *not important*, 3 = *of little importance*, 5 = *somewhat important*, 7 = *important*, 9 = *very* important)

The third objective of this study compared perceptions regarding the future importance of secondary agricultural mechanics skills from teachers in 1994 with the current depth those skills are currently being taught. Table 3 shows each construct's grand mean scores from Laird (1994) and from this study. All constructs in Table 3 have seen a negative change in mean scores.

Table 3.
Construct Grand Mean Scores for the Perceptions of the Importance of Secondary Agricultural Mechanics Skills Ten Years into the Future from Teachers Across the United States in 1994 (*N ranges from 224 to 240*) *and the Current Depth Those Skills were Taught in* Iowa *in 2016*

Construct	2004			2016		
	M	*SD*	*n*	*M*	*SD*	*Δ M*
Carpentry and Woodworking	6.44	1.95	63	4.90	2.21	-1.54
Metal Processing and Metalworking	5.59	1.72	63	3.57	1.72	-2.02
Safety	7.78	1.40	62	5.70	2.03	-2.08
Farm Structures	5.29	1.90	63	2.99	1.73	-2.30
Soil and Water Management	4.72	2.20	60	2.38	1.37	-2.34
Electrical Power	5.90	2.15	63	3.32	2.05	-2.58
Computers and Problem Solving	5.85	2.06	62	3.21	1.48	-2.64

Farm Power and Machinery	5.31	1.94	62	2.59	1.64	-2.72
Others	6.16	1.75	62	2.90	0.74	-3.26

(1 = *no depth*, 3 = *little depth*, 5 = *some depth*, 7 = *much depth*, 9 = *utmost depth*)
(1 = *not important*, 3 = *of little importance*, 5 = *somewhat important*, 7 = *important*, 9 = *very* important)

Conclusions, Implications, and Recommendations

The first objective of this study identified trends in the depth agricultural mechanics skills were taught at the secondary level. The two skills with the highest mean change between the depths taught in the U.S. in 1994 and in Iowa in 2016 were Metric System and Robotics. Based on these findings, agricultural education teachers are making efforts to include technological advancements and opportunities for STEM integration into their curriculum. This finding supports Stubbs and Myers (2015) who reported agricultural education teachers are making an effort to integrate STEM based content.

The second objective of this study was to determine future trends in secondary agricultural mechanics skills. Table 2 shows that seven of the nine constructs were rated as having a higher future importance by Iowa teachers in 2016 than the ratings received in 1994. It would seem that current teachers are optimistic about the important role agricultural mechanics will play in their programs. This corresponds with the suggestion made by Davis and Jayaratne (2015) that it is important for students to be prepared with new century skills to "be competitive in the globalizing work place" (p. 54).

Objective three sought to compare perceptions regarding the future importance of secondary agricultural mechanics skills from teachers in 1994 to the current depth those same skills are being taught. Interestingly, all nine constructs saw a negative change in mean scores between the predicted importance to teach the skills in 2004 and the depth those skills were taught in 2016. This leads researchers to conclude that secondary agricultural mechanics is taught in less depth overall in 2016 than what was predicted by teachers in 1994.

It should be noted that teachers' perceptions of the future importance of agricultural mechanics skills has increased overall, yet the depth they are teaching these skills has decreased. Alarmingly, this shows that the gap between what should be taught and what is being taught is widening. We can conclude that teachers are struggling to teach industry-validated content because the depth being taught has diminished over the past 22 years. According to the conceptual framework guiding this study, teachers should be working with industry to prepare a curriculum which prepares students to be lifelong learners who are successful in the workforce (Roberts & Ball, 2009). While teachers are not able to teach all agricultural mechanics skills in a depth that fully prepares students for college or careers, at a minimum students are being exposed to those career pathways which can lead to a student driven search for deeper content learning.

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Instructional Level of the Agricultural Teacher Education SAE Competencies According to Agricultural Teacher Educators

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Introduction and Conceptual Framework

Faculty in university agricultural teacher education programs bear the responsibility of preparing future teachers to lead effective school-based agricultural education (SBAE) programs (Roberts & Dyer, 2004). As part of agriculture teacher education, "SBAE preservice programs should work to promote authentic experiences for preservice teachers to develop, implement, maintain, sustain, evaluate, supervise, and communicate an SAE program" (Rubenstein, Thoron, & Estepp, 2014, p. 81). To meet these goals, pre-service agriculture teachers are prepared using a combination of coursework, early field experience (EFE) and student-teaching. However, the curricular structure of individual programs varies widely across agricultural teacher education programs (McLean & Camp, 2000).

In teacher preparation programs, the components of an effective SBAE program are commonly conceptualized using the SBAE model and consist of contextual, inquiry-based learning through classroom and laboratory interaction, leadership engagement through the National FFA Organization (FFA), and planned and supervised, experience-based learning through Supervised Agricultural Experience (SAE) (Talbert, Vaughn, Croom & Lee, 2014). The SAE component, which is the focus of this study, has evolved over time from vocational training in production agriculture to include a broader variety of SAE types. Currently, the National Council for Agricultural Education ([NCAE], 2015) identifies the types of SAE as exploratory, placement/internship, ownership/entrepreneurship, research, school-based enterprise, and service learning.

The NCAE (2015) has determined "Each portion of the title 'Supervised Agricultural Experience' is significant in describing what is expected of all teachers and students of agricultural education" (p. 1). Agriculture teachers should provide supervision on-site when possible, but also through other methods such as computer technology, written reports, and group meetings to assist students in planning and conducting their SAE (NCAE, 2015). Contextually, the SAE is based in agriculture and should form a linkage between agriculture, food, and natural resources (AFNR) instruction, the students' interests, and career exploration (NCAE, 2015).

SAE is often thought of as the primary experiential learning component of the SBAE model (Baker, Robinson, & Kolb, 2012; Barrick & Hughes, 1993; Bird, Martin, & Simonsen, 2013). However, participation in an experience alone is not necessarily a quality learning experience (Dewey, 1938). Connecting the experience to critical thinking and applying knowledge to new experiences is the core of experiential learning theory (Dewey, 1938; Kolb, 2015). "The process of experiential learning can be described as a four-stage cycle involving four adaptive learning modes – concrete experience, reflective observation, abstract conceptualization, and active experimentation" (Kolb, 2015, p.66). Knowledge is continually constructed by learners as they progress through the four dialectically opposed adaptive learning

modes in this cycle that becomes a spiral as new experiences build on past experience (Kolb, 2015).

Agriculture teachers need to understand the process of experiential learning to effectively use it within their programs (Baker, et al., 2012; Roberts 2006). Within agricultural teacher education, the experiential learning process is incorporated into the curriculum to provide preservice teachers with experiences that are meant to link theory to practice (Miller & Wilson, 2010).

Agriculture teachers have an impact on the implementation and success of SAE programs (Dyer & Osborne, 1995; Philipps, Osborn, Dyer & Ball, 2008; Retallick, 2010; Rubenstein, Thoron & Estepp, 2014; Swortzel, 1996). However, "There is a paradox between the value teachers place on SAE and the manner in which SAE is being implemented" (Wilson & Moore, 2007, p. 89). Based on Locke's (1991) motivational schema, Wilson and Moore (2007) suggested that agriculture teachers are not implementing SAE because of a lack of rewards and perceived barriers. Perceived barriers limit the implementation of SAE even though agriculture teachers consider SAE programs to be valuable (Retallick, 2010; Wilson & Moore, 2007).

A guiding philosophy as well as competencies for teacher preparation in SAE have been developed by the American Association for Agricultural Education ([AAAE], 2013a; 2013b). Using the AAAE-SAE teacher preparation competencies as well as incorporating authentic experiences in agricultural teacher education could increase SAE implementation and participation in SBAE (Rubenstein, et al., 2014). The need exists for a national study to identify how and to what extent the AAAE-SAE teacher preparation competencies are currently incorporated within agricultural teacher education programs in the United States.

Purpose

The purpose of this study was to identify the level of instruction occurring in agriculture teacher education programs in the United States for each of the *Competencies for Agriculture Teacher Preparation in SAE* (AAAE, 2013b).

Methods

The population for this study was all agriculture teacher education programs in the United States. Ninety-five agricultural teacher education programs were identified using the *AAAE Directory of University Faculty in Agricultural Education* (Dyer, 2003), AAAE Agricultural Education Directory online, NAAE Teach Ag website, and university websites.

As part of a larger study, a survey instrument was developed following the Tailored Design Method for Internet Surveys (Dillman, Smyth, & Christian, 2014). The content validity of the survey instrument was evaluated by a panel consisting of SAE experts (n=5). A separate panel of SAE experts (n=4) evaluated face validity. After the survey instrument was revised and IRB approval was received, an invitation email containing a link to the survey was sent to representatives of each agricultural teacher education program. Following the invitation three reminder emails were sent to non-responders.

Participants were asked to rate their institution's level of instruction for each *Competencies for Agriculture Teacher Preparation in SAE* (AAAE, 2013b) statement using a five-point ordinal scale that was adapted from the *West Virginia State Community and Technical College General Education Core-Audit Grid* (Scroggins, 2004). The ordinal scale levels were described 0 = Not at All, 1 = Introduced, 2 = Emphasized, 3 = Reinforced, and 4 = Applied.

The response rate for the larger study was 78.95%. Institutions that indicated that they did not have current students or recent graduates (n = 5) or that did not teach SAE within their curriculum (n = 2) were removed leaving 68 usable responses for a usable response rate of 71.58%. Early and late responders were compared to control for nonresponse error. A wave of late responders could not be identified, so late responders were defined operationally as the later 50% of responders (Lindner, Murphy, & Briers, 2001). An independent samples t-test showed no statistically significant ($p > 0.05$) difference between early and late responders. Results were analyzed with IBM SPSS 23 statistical software and descriptive statistics were reported.

Findings

The programs that responded represented 1862 land grant institutions (n=34), regional/state institutions (n=28), 1890 land grant institutions (n=3), and private institutions (n=3). Among the 17 objectives associated with the 7 SAE teacher preparation competencies, 4 statements were most frequently rated as "Introduced" (*Mode* = 1), 9 statements were most frequently rated as "Emphasized" (*Mode* = 2), and 4 statements were most frequently rated as "Applied" (*Mode* = 4).

The statement "conduct an SAE supervisory visit and enlist the assistance of others in SAE supervision" (*Mdn* = 3, *M* = 2.89, *SD* = 1.252) in Competency 4 was the highest rated objective statement among all of the *Competencies for Agricultural Teacher Preparation in SAE*. Additionally, the mode for this statement was 4 (*Mode* = 4) indicating that the most common response to this statement was applied.

The second highest rated statement was "Define, by example, the four recognized SAE types (i.e. entrepreneurship, placement, research and experimentation, and exploratory)" (*Mdn* = 3, *Mode* = 2, *M* = 2.70, *SD* = 1.094) from Competency 1. It should be noted in regard to this statement in Competency 1, the NCAE has added the categories of school-based enterprise and service learning as recognized types of SAE (NCAE, 2015) and that the recognized SAE types are currently different than the types recognized when these data were collected.

The lowest rated item was for the statement "design a strategy to compare and contrast student progress toward selected college and/or career readiness and prepare a summary report of findings to appropriate entities on a four-year time period" (*Mdn* = 1, Mode = 1, M = 1.58, *SD* = 1.345) found in Competency 6.

There were 4 items with a mode of 4 indicating that "applied" was the most frequent level of instruction for these competency items. These items were "Formulate a record keeping strategy to document student SAE outcomes based upon the concept of career pathway progression" from Competency 3, "Conduct an SAE supervisory visit and enlist the assistance of others in SAE supervision" from Competency 4 as well as "Design a curriculum unit in which

students are introduced to the basic elements of record keeping as they relate to enterprise development and management" and "Adapt an SAE record keeping format appropriate for an enterprise in each of the four SAE types recognized by The National Council for Agricultural Education" from Competency 5.

Conclusions, Implications, and Recommendations

It can be concluded that, although many (n = 39, 57.35%) of the institutions that participated in this study included all of the *Competencies for Teacher Preparation in SAE* (AAAE, 2013b) within their agriculture teacher education curriculum, there was a broad range in the level of instruction reported by individual programs. Interestingly, each of the statements that specifically mentioned record keeping had a mode of 4 (*Mode* = 4) indicating that most agriculture teacher education programs teach record keeping using a real-world or problem-solving method at the applied level. However, these record keeping statements each had medians that indicated the distribution of responses was centered in the "Emphasized" (*Mdn* = 2) response. The modes of 4 and medians of 2 indicate a wide range of responses revealing differences in how record keeping is taught among individual institutions.

The majority of the SAE teacher preparation competencies being rated as introduced and emphasized may contribute to how SAE is implemented in practice by agriculture teachers. If teacher education in SAE is approached in an introduced or emphasized manner, preservice teachers may develop a theoretical or conceptual knowledge and "know the politically correct answer" (Wilson & Moore, 2007, p. 89) but not be able to link theory to practice (Miller & Wilson, 2010). Additionally, agriculture teachers may lack the experience and the tools to overcome barriers to the implementation of SAE (Retallick, 2010; Wilson & Moore, 2007).

Considering that SAE is only one area and that there are many requirements that must be included within teacher education, it may not be practical to teach each SAE agricultural teacher preparation competency using a real-world or problem-solving method. It may be more practical, given the time limitations in teacher education, to target specific objectives to teach with applied methods within the curriculum that will help teachers to implement SAE programs. Research should be conducted to determine how and to what extent each of the AAAE preservice SAE competencies could be taught at an applied level to best prepare agriculture teachers to implement SAE programs. In addition, time for faculty to prepare new content to teach SAE may be an issue. In an effort to provide assistance to agriculture teacher educators, curriculum has been designed to teach these SAE competencies and is available free of charge (Barrick, et al., 2015). This curriculum may be used to supplement or replace current SAE curriculum content to help ensure that agriculture teachers are adequately prepared in each SAE competency.

The findings from this study provide a snapshot of one moment-in-time and serve as a starting point to begin a conversation about how SAE should be taught in agricultural teacher education. Using applied methods to teach the SAE competencies in the preservice curriculum may reduce the difficulty of implementing SAE programs in SBAE. Considering that SAE is often conceptualized as the primary experiential learning component of the SBAE model (Baker, et al., 2012), it is recommended that agriculture teacher educators follow Kolb's (2015) experiential learning process. Purposefully incorporating experience and reflection through applied problem-solving or real-world experiences within agricultural teacher preparation could

help preservice teachers move beyond a conceptual knowledge of the SAE competencies and develop a skillset to overcome barriers to the implementation and management of SAE.

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State FFA Constitution Membership Language Regarding Private and Homeschool Students

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Introduction

The youth organization in agriculture, known as FFA (aka, Future Farmers of America), was founded on the principle of developing leadership and interpersonal skills through an intracurricular model for secondary students enrolled in Agricultural Education (FFA History, 2015). Leadership is important to society because in a democracy, there is a continual need for the development of new leaders (Ricketts, Bruce, & Ewing, 2008). Additionally, in a global economy, leadership skills are a competitive advantage when seeking employment, as employers desire hiring leaders (Job Outlook 2013, 2012). In response to the evolving nature of agriculture and demographics in the 21st century, school-based Agricultural Education (SBAE) and therefore FFA programs are broadening their content foci to appeal to a more diverse student population and increase enrollment (Conroy & Kelsey, 2000; Frick, Kahler, & Miller, 1991; Kahler, 1988; Newcomb, McCracken, Warmbrod, & Whittington, 2004; Powell, Agnew, & Trexler, 2008). Traditionally, FFA membership has been exclusively accessible to students enrolled in public schools that offer SBAE programs and maintain an FFA chapter charter (Croom, 2008; Talbert, Vaughn, & Croom, 2005). National FFA has stated in its research agenda for 2013-2018 that the top priority for the organization is accessibility and inclusiveness of FFA and that it is "imperative that barriers be removed in order to engage all young people enrolled in agricultural education in the National FFA Organization's mission of developing premier leadership, personal growth, and career success" (Crutchfield, 2013, p. 1). Expanding program access is important because previous research has shown that FFA achieves its self-proclaimed leadership development principle and can be a valuable program for adolescent development, even if those benefits are self-perceived leadership development (Rutherford, Townsend, Briers, Cummins, & Conrad, 2002) or as broad as satisfying the needs of program participants (Reis & Kahler, 1997), such as providing a sense of belonging (Croom & Flowers, 2001). One key to expanding FFA program access is having a clearly defined and interpreted membership policy. However, no studies were found that summarized and analyzed state-level FFA membership language and how that language varies by state FFA constitution.

Conceptual Framework

In 1950 and 1998, the U.S. Congress granted the FFA a Federal Charter based on Public Laws 81-740 and 105-225, respectively (National FFA Organization, 2015). These public laws state that FFA is an integral part of public instruction in agriculture and the federal charter "provides the foundation that makes FFA an integral part of the 3-Component Model of School-Based Agricultural Education" (National FFA Organization, n.d., n.p.). According to the National FFA Constitution (2012), a student (grades 7-12) must be enrolled in a secondary agricultural education program to be eligible as an active member in the FFA. The National FFA Constitution states, "to become an active member and retain membership, a student must: While in school, be enrolled in at least one agricultural education course during the school year and/or

follow a planned course of study; either course must include a supervised agricultural experience program, the objective of which is preparation for an agricultural career" (p. 3). Moreover, a state FFA constitution cannot conflict with the National FFA Constitution to be considered in good standing with the National FFA Organization, and "the National FFA Board of Directors shall have the power to suspend the charter of any state association which violates the National FFA Constitution and Bylaws" (National FFA Organization, 2012, p. 2). As each state FFA association navigates inclusiveness and accessibility to increase membership, there is tension in how the policy language of the National FFA Constitution is interpreted.

Purpose

The purpose of this study was to describe policy language of state FFA constitutions regarding active FFA membership and specifically program access to private and homeschool students.

Methods & Procedures

A qualitative policy analysis using evaluation coding (Saldaña, 2013) examined 49 out of 50 possible state FFA constitutions for their language regarding membership. One state was omitted due to a lack of response to requests for their FFA constitution. This is attributed to that state not having any full-time state-level FFA staff. An iterative process was implemented using three phases: (1) collecting all possible state FFA constitutions and conducting a preliminary analysis of the membership language they contain grouping together states with similar or identical language; (2) development of a rubric based upon the differences observed within state FFA constitutions and assigning relative values to the potential inclusiveness of membership language; and (3) document analysis going back to all state FFA constitutions and analyzing and interpreting the potential inclusiveness of membership language for each state. State FFA constitutions were analyzed for membership requirement language and three categories emerged: (1) Required enrollment in SBAE course and SAE, (2) required enrollment in SBAE course or SAE, and (3) either of the previous statements with a clause allowing for private or homeschool chapters and/or members. Reflexivity of the researcher resulted in disclosure of biases and interpretations that were monitored throughout the study. Upon completion of the evaluative data analysis and interpretation process, different state FFA constitution language regarding membership resulted in multiple potential paths for program participation. Credibility, dependability, and confirmability were established using iterative questioning, negative case analysis, frequent debriefing sessions, peer scrutiny of the research project, direct quotes from documents, detailed and transparent operational field notes, triangulation, admission of researcher's beliefs and assumptions, recognition of limitations, audit trail, and reflexive journaling (Shenton, 2004).

Results

The policy analysis of state FFA constitutions resulted in two distinct categories of potential program access based upon membership requirements, as well as two clauses that explicitly expand potential program access to non-traditional FFA audiences. The first type of FFA membership requirement language observed states that in order to have membership in a chapter, the member must be enrolled in at least one approved Agricultural Education course each year

and maintain a supervised agricultural experience. This wording was identified as being the least potentially inclusive. Ten states (HI, IN, KY, MO, NV, SC, SD, UT, VT, WA) have this or a similar wording of membership language in their state FFA constitution.

The second type of membership requirement language observed states that in order to have membership in an FFA chapter, the member must be enrolled in at least one Agricultural Education course each year **and/or** follow a planned course of study with either including a supervised agricultural experience. This wording was determined to be more inclusive due to the "planned course of study" phrase, which gives more lenience to local FFA advisors allowing them to determine the course of study that qualifies potential members. Thirty-nine states (AL, AK, AZ, AR, CA, CO, DE, FL, GA, ID, IL, IA, KS, LA, ME, MD, MA, MI, MN, MS, MT, NE, NH, NJ, NM, NY, NC, ND, OH, OK, OR, PA, RI, TN, TX, VA, WV, WI, WY) have this or a similar wording of membership language in their state FFA constitution.

The first membership clause for non-public school students observed in state FFA constitutions allows private schools to form FFA chapters and gives potential FFA program access to private school students. Five states (AL, AK, NC, OR, TX) either explicitly state in their state FFA constitution that private school chapters are allowed, or have a means of providing membership access to private school students. Alabama allows FFA chapters in private schools provided that the teacher is a state certified Agricultural Education teacher. Alaska includes secondary agricultural and natural resource programs at both charter and private schools as qualifying students for FFA membership. North Carolina does not explicitly mention private school chapters in its state FFA constitution, but there are clearly stated requirements that allow private school chapters to be chartered (Forrest, 2001). Oregon allows private schools to charter FFA chapters provided that they meet and maintain program approval with state officials and renew that status every three years. Texas explicitly mentions charter and private school students as potential members in its state FFA constitution.

The second membership clause for non-public school students observed in state FFA constitutions provides homeschooled students with a potential program participation pathway. Three states (AK, LA, NC) explicitly mention homeschooled students in their state FFA constitution. Alaska allows homeschool FFA chapters to be formed and there exists one such chapter in the state with multiple sub-chapters (Massey, 2015). Louisiana added a clause to their state FFA constitution in 2011 that mentions homeschooled students, stated to be an attempt to increase enrollment. What is mentioned in the clause is a year-long partnership between the homeschool parent and the Agricultural Education teacher, and does not currently provide the opportunity to form homeschool FFA chapters. North Carolina has the most robust program to provide program access to homeschool students, allowing for the charter of homeschool FFA chapters, but does not include a clause defining membership requirements for homeschool students in their state FFA constitution. Rather, North Carolina maintains this information on their state FFA website.

Implications

The results from this membership policy analysis show that there may be ambiguity regarding what activities are required to qualify a student for FFA membership and how inclusive membership language is in state FFA constitutions. Subtle variations of wording occur among the first grouping of state FFA constitutions (least potentially inclusive language) including in Indiana, where the FFA "member must be enrolled in at least one **approved** course each year

and maintain a supervised agricultural experience." Kentucky also has a subtle difference that states the FFA "member must be enrolled in at least one agricultural education class each year and attend that class when it is taught." The Indiana FFA membership language could be interpreted that the supervised agricultural experience *is* the approved course that qualifies a student for FFA membership, thus not requiring the student to physically attend a course in the FFA chapter's home school. In contrast, the Kentucky FFA membership language appears to explicitly state that the qualifying course must be attended, thereby requiring the student to be physically in the public school of the FFA chapter.

This ambiguity also appears in the second grouping of state FFA constitutions (most potentially inclusive language) including in Tennessee, where "any student regularly enrolled in agriculture education is entitled to become an active member upon receiving a majority vote of the members present at any chapter meeting." The Tennessee FFA membership language could be interpreted such that a student could join *any* FFA chapter, so long as they meet the enrollment requirement at *some* school and are voted into membership status by the current FFA members in that chapter. Wisconsin has a different wording that states the FFA "member must be enrolled in at least one agriculture education course during the school year and/or follow a planned course of study for an agricultural occupation (including a supervised agricultural experience program)." The Wisconsin FFA membership language more explicitly states the implied membership pathway from the Indiana FFA membership language, that a supervised agricultural experience *could* count as an approved course of study qualifying the student for FFA chapter membership.

Increasing potential FFA program access and membership moving forward should warrant a reexamination of current FFA membership language in state FFA constitutions. Clarity in interpretation of FFA membership would help potential FFA members and local Agricultural Education teachers acting as FFA advisors have a clearer understanding of various pathways to meet active FFA membership requirements. If specific curricular requirements are met, FFA membership access should be provided. However, a majority of current FFA members may not be meeting all requirements of being an agriculture student. Previous research shows that supervised agricultural experiences (SAE) are an underutilized component of the three-circle model of Agricultural Education (Lewis, Rayfield, & Moore, 2012; Talbert & Balschweid, 2004), yet there are more than a few states that have completion of an SAE as a requirement for FFA membership. State FFA constitutions and their membership language are the public face for FFA program access, and there appears to be a need for reform. The first step in empowering local Agricultural Education teachers acting as FFA chapter advisors to grow their programs and expand access to non-public school students is to provide them with easily interpretable FFA membership language.

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A Motivational View of Preparing Successful Career Development Event Teams

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Introduction

The ability to prepare Career Development Events (CDEs) teams has been noted as a trademark of effective school based agriculture (SBAE) teachers (Roberts & Dyer, 2004). Since CDEs are a combination of learning and competition, teachers need to employ motivational strategies while preparing them. Previous research indicates teachers utilize the following to motivate students to participate in CDEs: tradition/success of the chapter, providing opportunities to compete and have fun, developing life skills, recruiting members who show potential, and making CDEs an integral part of the curriculum (Russell, Robinson, & Kelsey, 2009).

Related to specific CDE preparation strategies, research indicates SBAE teachers utilize social support and situational consideration (Falk, Masser, & Palmer, 2014), expectations, goals, support, and a positive environment (Voight, Talbert, McKinley, & Brady, 2013), as well as alertness, friendship, intentness, competitive greatness, cooperation, and initiative (Bowling & Torres, 2010). Although research exists, which explores some of the preparation strategies, little is known about what motivational strategies are utilized. By identifying the motivational strategies utilized a linkage can be created, which better connects the authentic wisdom of teacher practice to theoretically and empirically tested principles, thereby developing a map of motivation, which works in an authentic teaching context for CDEs.

Conceptual Framework/Philosophical Assumptions

Motivation is a phenomenon which can be applied to numerous areas of social science including education. Contemporary theories of motivation utilized within education share many common themes (Schunk, Meece, & Pintrich, 2014). The common themes of motivation help to frame the notion that motivation underlines human behavior (Schunk et al., 2014). The shared themes and the influence motivational processes have on human behavior served as the conceptual framework for this study. Additionally, a constructivist philosophical approach was utilized to allow for complete emergence of the CDE preparation motivational strategies and the associated motivational theories. Further, the constructivist approach positioned the researchers within the context of the study and allowed for meaning to emerge from the participants.

Purpose

The purpose of this study was to identify the motivational strategies utilized when preparing CDE teams. Additionally, this study sought to identify the underlined motivational theories and outcomes which align with the motivational strategies. This investigation was driven by the following question:

> What motivational strategies, underlying motivational theories, and potential student outcomes are present within CDE preparation?

Methods

This study utilized a qualitative intrinsic case design (see figure 1; Stake, 1995). One SBAE teacher and 12 students who comprised two CDE teams were purposively sampled and served as the bounded system due to the teachers' previous exemplary track record of winning multiple state and national CDEs. Data were collected through 50 interviews and 36 hours of CDE practice field observations. Through the analysis process the strategies and subsequent motivational theories were allowed to emerge from the case. The constant comparative method was utilized (Creswell, 2013) for data analysis, which included: open codes, categories, and themes. The central question guided the open coding. Trustworthiness was upheld through triangulation, comparison of emerging themes and subthemes, peer debriefing, and maintaining an audit trail (Lincoln & Guba, 1985).

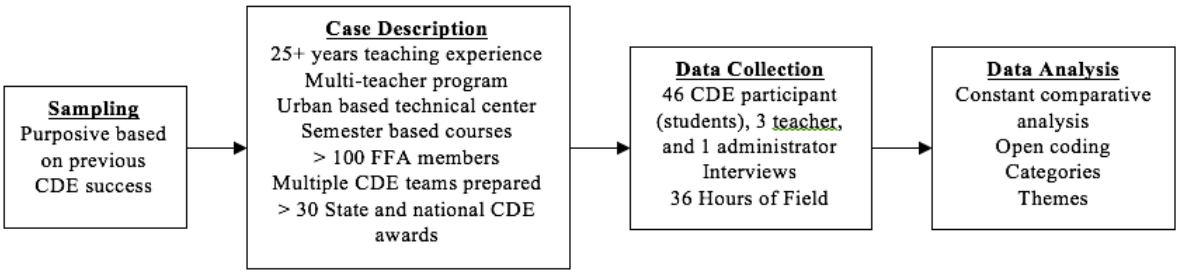

Figure 1. Analytical Framework

Findings

Within this case several motivational strategies emerged and were aligned with motivational theories. The findings are reported by the emerging theories: Self-Determination Theory (SDT), Expectancy-Value Theory (EVT), goal setting, and goal orientation. Additionally, a model was developed to display the connection of theories, strategies, and potential outcomes.

Self-Determination Theory

SDT is comprised of the psychological needs of relatedness, competence, and autonomy (Ryan & Deci, 2002). The need for autonomy was met through the teacher shifting the locus of control. During the early parts of the CDE preparation process the teacher was the primary control focus as the expert who had to deliver information. As the students learned the content and became experts, the teacher relinquished his control and the students selected the content and the ways it would be studied for subsequent practices. Competence was met through the development of confidence within the CDE area. Allen stated, "It's practical skills that you can use a lot later on in life." Furthermore, multiple students indicated they could apply this knowledge to future career areas, and that inherent knowledge made them feel like more competent future professionals. Additionally, the teacher constantly connected knowledge from the formal curriculum in their classes to the CDE content to engage their prior knowledge and increase competence. Throughout the CDE practices the teacher developed relatedness by asking the students about their day and engaging in personal conversations with them. Additionally, the

teacher would openly discuss the importance of team cohesiveness and praised the team for it. Further, the students developed friendships while on the teams, "...I didn't really care that I didn't make the team necessarily because I got a lot of great experience just hanging out with my friends." Lastly, students also felt being on a CDE team gave them social acceptance such as having a place where they felt "at home" or "fit in."

SDT also focuses on the locus of motivation within the self-determination continuum (see figure 2; Ryan & Deci, 2002). The teacher utilized external rewards (external regulation) to motivate students such as: (a) jackets if the team won state, (b) food/drink for correct answers or good practices, (c) scholarships, and (d) a trip to the national competition. The teacher also utilized others to motivate students (introjected regulation). At the beginning of the CDE season the teacher recruited 6 to 8 individuals for each team but only four can compete. The number of team members increased the competition among the team and increased the students' motivation to study and practice. The teacher also used peer teaching when preparing teams. This created a team atmosphere where competition not only thrived among the team members but also created a collective form of competition that allowed them to push one another. Stacy said, "… and since you have competition within your own team too, you want to go to practice and kind of prove yourself." Additionally, the teacher utilized externally driven emotional rewards (introjected regulation) such as a fun and caring environment, humor, and sarcasm. Identified regulation was not directly present through the preparation process, however it was visible in the data due to the CDEs congruence with the students' self-schemas. The skills students developed connected to future career self-schemas. Cory stated, "… like it's not just playing with a chicken, there are life lessons you can learn and career opportunities you can get out of it." This can be considered integrated regulation because the CDE content, environment, and skills directly aligned with the students' values and goals. Lastly, students were motivated intrinsically by the competitive nature and their interest in CDEs. The teacher also discussed the importance of competition with the teams and would tell them, "Competition will make you better." Amy stated, "I just want that competition." Within the preparation process the teacher identified the need to connect the students to the CDEs and develop their interest in it. Allen said, "This stuff interests me. Stuff outside of school, I'd probably be doing this anyway if I wasn't at practice."

		Extrinsic Motivation				
	Amotivation	External Regulation	Introjected Regulation	Identified Regulation	Integrated Regulation	Intrinsic Motivation
Locus	N/A	External	External	Slight Internal	Internal	Internal
Level of Self-Determined	No Regulation	Least Self Determined	Slightly Self Determined	More Self Determined	Completely Self Determined	Completely Self Determined

Figure 2. Self-Determination Continuum

Expectancy-Value Theory

EVT is an achievement theory, which states individuals choose activities based on their expectations for success and task value (Wigfield & Eccles, 2002). To begin the CDE preparation process, the teacher expressed his expectations for the students. He also encouraged the students to develop their own expectations. Additionally, before practices started the teacher

sought out students who he believed would be successful and placed them on particular teams. Cory stated, "It makes you feel pretty special whenever one of the teachers comes up to you and asks you if you want to be a part of the team because they know your ability or your potential to do well." Through this purposeful recruitment students were sought out who valued and enjoyed the CDE content and also valued competition to a degree. The teacher sought out students who were pushed by competition but were not so driven by it that they only focused on winning and not learning. This value of the content and competition helped to motivate and increase the students' expectations for success.

Goal Setting

Goal setting theory is being motivated through setting goals (Locke, 1996; Weinberg, 2010). When preparing CDE teams the teacher had students develop goals related to their expected level of success. In the beginning, the teacher had students write down individual and team goals. During the goal writing process, the teacher expressed the importance of having a written copy of their goals. Throughout the CDE preparation process if students were not meeting their goals, the teacher would have the students revisit them. As a result, students would either, reassess their goals if they were not willing to put in the study time or they would keep their current goals and increase their performance.

Mastery Goal Orientation

Mastery goal orientation focuses on learning, task mastery, skill development, competence, and acceptance of challenges (Ames, 1992). Through the teacher's utilization of higher order questioning the students focused more on the thinking and learning process rather than winning. During practices, the teacher would constantly ask the students to explain why the answers they provided were correct. This process helped to develop the students' understanding of CDE concepts and increased their learning. Additionally, the teacher would also structure his teaching based on the students' leave of mastery orientation, "[I] push them as hard as they want to be pushed." Furthermore, the students accepted and encouraged the academic challenges of the CDE competition, "... just the experience of a challenge, if you can beat everyone else, how good your skills are. You see if you learned enough." Beyond the challenge of the competitions, the students viewed the jackets they could receive for winning not as a symbol of victory but a symbol of their knowledge and skill development. Allen stated, "It [jacket] just shows your knowledge and your accomplishments."

Conclusions/Implications/Recommendations

It was concluded the teacher utilized a range of motivational strategies when preparing CDE teams. It was also concluded the motivational strategies utilized were connected to and overlapped multiple motivational theories (see figure 3). The teacher utilized strategies, which connected to SDT, EVT, goal setting, and mastery goal orientation. Each of the strategies specifically met the motivational needs of students to increase their performance. To begin, the needs of SDT were met so the other strategies and theories could flourish (Ryan & Deci, 2002). Next, expectations for success were developed within the students and written goals were developed (Wigfield & Eccles, 2002). By setting written goals at the beginning of the

preparation process this established ideals for the students to strive for and thus helped the other theories be successful (Locke, 1996; Weinberg, 2010). Lastly, the teacher used the remaining strategies and theories based off of the situation and the students' motivational needs.

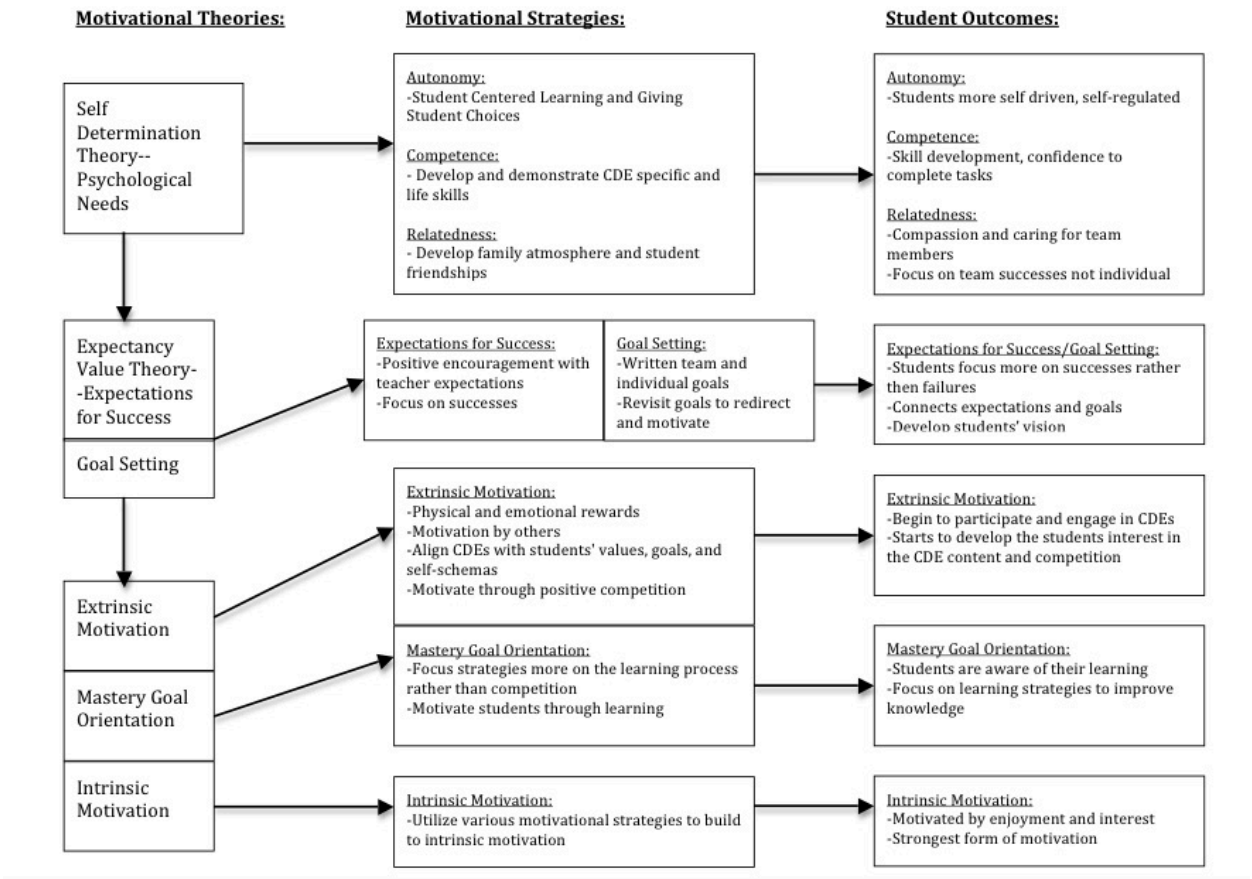

Figure 3. CDE Motivational Strategies Model

Theories are developed through scholarly research and it is undeniable that educational strategies are deeply rooted in theory. Rarely though are these theories in the forefront of the teachers' minds when they utilize their strategies. Thus, a disconnect is developed between the practices and the research trying to influence them. SBAE teachers and CDE preparation are not immune to this disconnect. By developing a model of motivational strategies and theories related to CDE preparation, teachers can better see where their current strategies lie and what gaps exist. Although the theory to practice gap cannot be fully closed, this model helps to bridge the CDE motivational practices closer to research supported theories.

It is recommended teachers develop motivational strategies, which mirror the model presented. By utilizing these strategies teachers can work towards the students being intrinsically motivated and truly participating for the interest in CDEs. Professional development workshops should be developed to foster the use of CDE specific motivational strategies. Further research is needed to better codify the specific motivational strategies utilized. These investigations need to focus both on the teachers' strategies but also the influence they have on students.

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