Research Conference Proceedings

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Kansas State University

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Michigan State University
East Lansing, Michigan

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Review Process for the North Central Research Conference

The AAAE North Central members express their sincere gratitude to AAAE colleagues who served as reviewers for research abstracts submitted for the 2019 North Central Research Conference. A total of 34 research abstracts were submitted. The AAAE Protocol Guidelines for Conference Paper Selection were used in the paper review and selection process. Twenty-one abstracts were selected for presentation at the 2019 North Central Conference held in East Lansing, Michigan.

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Jonathan Ulmer
Hui-Hui Wang
Shannon Washburn
Troy White

Distinguished Abstract Session (Kellogg Center, Friday 8:00AM – 9:30AM)

Lincoln Room
Discussant: Dr. Thomas Paulson
Facilitator: Yu Lun Wu

Teacher Retention: A Relational Perspective
Eric M. Moser, Michigan State University
Aaron J. McKim, Michigan State University

Metacognition of Pre-service Teachers: A Phenomenology of Reflection-in-Action
Aaron J. Giorgi, The Ohio State University
Dr. Amanda M. Bowling, The Ohio State University
Dr. Caryn M. Filson, The Ohio State University

Prescribed Pedagogical Outcomes Versus Real-World Challenges: A Content Analysis of Kansas AFNR Course Competency Profiles
Zachary Callaghan, Kansas State University
Dr. Gaea Hock, Kansas State University

NC-AAAE Research Session 1 (Kellogg Center, Friday 9:45AM – 11:00AM)

Lincoln Room
Discussant: Dr. Anil Kumar Chaudhary
Facilitator: Aaron Giorgi

Success and Longevity Factors of North Dakota Agricultural Educators
Jenny Vandehoven, Medina High School, ND
Adam A. Marx, North Dakota State University

Motivational Beliefs of School Based Agricultural Education Teachers through Career Stages
Amanda Bowling, The Ohio State University
Amber Rice, University of Arizona
Kevin W. Curry, Pennsylvania State University
Adam A. Marx, North Dakota State University

Shared Motivational Beliefs of School Based Agricultural Education Teachers
Amanda Bowling, The Ohio State University
Amber Rice, University of Arizona
Kevin W. Curry, Pennsylvania State University
Adam A. Marx, North Dakota State University

Heritage Room
Discussant: Dr. Seburn Pense
Facilitator: Katie Daugherty

Secondary Agriculture Teachers' Knowledge, Beliefs and Teaching Practices of Climate Change
Bryanna Nelson, Purdue University
Dr. Hui-Hui Wang, Purdue University
Dr. Devarati Bhattacharya, University of Nebraska—Lincoln

Reaching Science Literacy through School-based Agricultural Education
Rosalind Cowan, The Pennsylvania State University
Dr. Kevin Curry, Jr., The Pennsylvania State University

Making the Jump: What Motivates Agricultural Education Instructors to Engage Students in Agriscience Research SAEs?
Brooke L. Thiel, North Dakota State University
Adam A. Marx, North Dakota State University

Room 103A/B
Discussant: Dr. Jessica Blythe
Facilitator: Melanie Bloom

Kansas Ag Teachers' Perceptions of Diversity & Inclusion in Agricultural Education
Laura E. Miller, Kansas State University
Dr. Gaea Hock, Kansas State University
Dr. Jon Ulmer, Kansas State University
Dr. Jason Ellis, Kansas State University

The Shortage of Licensed Secondary Agriculture Instructors in Illinois: An Examination of the Impact on Secondary Agricultural Education Program Quality
Howard K. Heavner, Southern Illinois University
Seburn L. Pense, Southern Illinois University
Logan O. Park, Southern Illinois University

Teacher Perceptions of the Impact and Challenges of Middle School Agricultural Education Experiences in Kansas
Anna Williamson, Kansas State University
Dr. Gaea Hock, Kansas State University
Dr. Jon Ulmer, Kansas State University
Dr. Lori Goodson, Kansas State University

NC-AAAE Research Session 2 (Kellogg Center, Saturday 8:30AM – 9:45AM)

Lincoln Room
Discussant: Dr. Daniel Foster
Facilitator: Madison Quinn

Women Agvocates' Approaches to Using Instagram
Emily Warnimont, The Ohio State University
Annie R. Specht, The Ohio State University

How Gender Plays a Role in Explaining Differences in Water Conservation Practices of Urban Homeowners?
Anil Kumar Chaudhary, The Pennsylvania State University
Elsie Assan, The Pennsylvania State University
Laura A. Warner, University of Florida

The Contributions of George Washington Owens to the Development of Agricultural Education Opportunities for African Americans
Zachary Callaghan, Kansas State University
Dr. Gaea Hock, Kansas State University

Heritage Room
Discussant: Dr. John Tummons
Facilitator: Jason Hughes

Agricultural Education Teachers Knowledge and Perceptions of Service-Learning
Trenton Smedley, Kansas State University
Dr. Jonathan D. Ulmer, Kansas State University

An Examination of the Curriculum for Agricultural Science Education (CASE) Certified Educators Perceptions of the Curriculums
Lauren Devine, West Virginia University
Jessica M. Blythe, West Virginia University

Agricultural Teacher Perceptions of Facilitating Inquiry-Based Instruction Following a Yearlong Professional Development Experience
Matthew Kreifels, University of Nebraska-Lincoln
Nathan Conner, University of Nebraska-Lincoln
Bryan Reiling, University of Nebraska-Lincoln
Christopher Stripling, University of Tennessee
Mark Balschweid, University of Nebraska-Lincoln

Room 103 A/B
Discussant: Dr. Mark Zidon
Facilitator: Kindra Carr

Perceived Teaching Professional Development Needs and Self-Efficacy for Faculty at Non-Land-Grant Colleges of Agriculture
Lucas Maxwell, Illinois State University
Will Bird, University of Tennessee at Martin
Anna Ball, University of Illinois, Urbana-Champaign

Engaging Virtual Volunteers in Agricultural Teacher Education: The Volunteers' Perspective
Tiffany Morey, The Pennsylvania State University
Becky Haddad, Oregon State University
Daniel Foster, The Pennsylvania State University

The Dualism of Interdisciplinarity: A Model for Research and Practice
Aaron J. McKim, Michigan State University

Teacher Retention: A Relational Perspective

Eric M. Moser, Michigan State University
Aaron J. McKim, Michigan State University

Introduction

Teacher retention is one of the most common, and important, topics of study within school-based agricultural education (SBAE). Inability to retain teachers results in instability, program closures, and reduced opportunities for students (Lawver, Foster, & Smith, 2018; Rinke, 2007). Studies in SBAE seeking predictors of teacher retention have focused on common, overarching themes, such as self-efficacy (Blackburn, Bunch, & Haynes, 2017; McKim & Velez, 2017, 2015). A fresh perspective on teacher retention within SBAE, one that explores new predictors, could uncover promising avenues for research and practice. Informed by research on the importance of connectivity to professional resilience and retention (Coldwell, 2017; Dutton & Heaphy, 2003; Hope, 1999; Rinke, 2007), the current study provides a new approach by exploring the relationship between SBAE teacher connectivity and career commitment.

Literature Review

The literature review is organized into a discussion of existing research on connectivity, career commitment, and the relationship between connectivity and career commitment.

Connectivity

Within an analysis of organizations, Dutton and Heaphy (2003) found the level of connections workers perceived to be a predictor of job satisfaction and organizational success. Authors unpacked the concept of connections, suggesting quality connections include: (a) higher emotional carrying capacity, (b) resilience, and (c) a high degree of connectivity. Within education, the connections teachers develop create support systems within the school, improving school culture and emotional support (Rinke, 2007; Sass, Seal, & Martin, 2011). Professional development (Coldwell, 2017) and teacher mentoring programs (Ingersoll & Strong, 2011; Ingersoll & Kralik, 2004; Hope, 1999) have been identified as methods to build high-quality connections and relationships.

Career Commitment

Given the shortage of teachers, career commitment is a commonly studied construct throughout education. Hong (2010) identified numerous psychological factors relating to teacher career commitment, including: self-efficacy, knowledge, beliefs, and emotions. Within SBAE, self-efficacy is the most commonly analyzed psychological element studied in relation to career commitment, with evidence suggesting increased self-efficacy relates to increased career commitment (Blackburn & Robinson 2008; McKim & Velez, 2016, 2015). A less common, but growing, area of study within SBAE teacher career commitment is work-family balance, with results indicating work-family balance is a significant predictor of teacher retention (Blackburn, Bunch & Haynes, 2017; Sorensen & McKim, 2014).

Relationship between Connectivity and Career Commitment

Analyzing the factors associated with teacher retention in SBAE (e.g., self-efficacy, work-family balance), reveals a common element. Connectivity is a critical component to social persuasion (i.e., feedback from others regarding abilities), which is a building block to self-efficacy

(Bandura, 1986). Additionally, connectivity plays an essential role in creating a positive or negative culture within work or family domains, which directly relates to spillover (i.e., work and family intersections, either positive or negative), an element of work-family balance (Sorensen & McKim, 2014). Therefore, it is reasonable to assume connectivity is an important element of career commitment.

Theoretical Framework

The current study, which attends to four connectivity elements among SBAE teachers and career commitment, was informed by the Relational Theory of Working (RTW). The RTW "provides a framework for understanding ways in which working is embedded in external and internal relational contexts" (Blustein, 2011, p. 1). The RTW emerged in response to a growing body of vocational literature which viewed employees as completely independent - existing within a relationship vacuum. In contrast, relational theories identified relationships as an essential element of human life, noting individual growth occurs via connection (Jordan, 2008). While existing research within the field of education supports relationships being an important element of career commitment (Doney, 2013; Korte & Simonsen, 2018; LeCornu, 2009; Sass et al., 2010), this postulation has not been explicitly investigated in SBAE. Further, research associating relationships with career commitment among teachers has not analyzed the diversity of relationships managed by teachers (e.g., in-school, disciplinary, community, and curricular).

Purpose and Objectives

The current study seeks to evaluate perceptions of four elements of connectivity and career commitment among a national sample of SBAE teachers as well as model the relationship between connectivity and career commitment. The knowledge gained through this work is expected to expand current understandings regarding the nature, scope, and value of connectivity within the SBAE teacher role. The current study was guided by three research objectives: (a) describe SBAE teacher perceptions of connectivity within the areas of community, curriculum, school, and other SBAE teachers, (b) describe SBAE teacher perceptions of career commitment, and (c) model the relationship between perceptions of connectivity and career commitment.

Methods

All school-based agricultural educators during the 2018-2019 school year served as the population for the study. A simple random sample of 750 teachers was obtained from the National FFA Organization. Frame error reduced the sample by 45 respondents, resulting in a final frame of 705 teachers. Data collection, using an online survey, was conducted in March and April of 2019. In total, 213 useable responses were received, yielding a usable response rate of 30.21% (n = 213). Non-response bias was analyzed by comparing on-time respondents (i.e., teachers responding within the first three points of contact; n = 207) to late-respondents (i.e., teachers responding after the final point of contact; n = 30) using an independent samples t-test. No statistically significant differences were identified (p-values ranged from .381 to .778), suggesting non-response bias was not an issue (Lindner, Murphy, & Briers, 2001; Miller & Smith, 1983).

Instrumentation

The current study includes five constructs of interest, (a) community connectivity, (b) curricular connectivity, (c) school connectivity, (d) SBAE teacher connectivity, and (e) career commitment.

Responses for each item within the constructs were measured on a seven-point scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree)*. The researcher-developed, community connectivity construct was comprised of five questions designed to measure connection between the teacher and the community in which their program resides. The research-developed, curricular connectivity construct was made up of seven questions measuring the connection respondents had to their agriculture, food, and natural resources curriculum. The researcher-developed, school connectivity construct included seven items designed to measure connection to non-SBAE teachers and administrators within the school in which respondents taught. The research-developed, SBAE teacher connectivity construct included seven items measuring connection to peer SBAE teachers, including any other SBAE teacher(s) within the school in which they taught or SBAE teachers outside the school in which they taught. The career commitment scale (developed by Sorensen & McKim, 2014) included eight items designed to measure commitment to remain as a SBAE teacher.

Validity and Reliability

A panel of experts, including four faculty in SBAE with expertise in social science research, were used to evaluate face and content validity. Feedback from the panel of experts was used to expand the content coverage of connectivity items. *Post hoc* reliability assessments suggested that each of the five constructs (i.e., Cronbach's alpha for community connectivity = .89, curricular connectivity= .72, school connectivity = .81, SBAE teacher connectivity = .89, and career commitment = .92) were reliable (Fraenkel & Wallen, 2000; Nunnally & Bernstein, 1994).

Data Analysis

The first and second research objectives, in which perceptions of connectivity and career commitment were sought, were accomplished by averaging responses to obtain a single construct score. For the third research objective, in which career commitment was modeled by perceptions of connectivity, a multiple linear regression was completed. To run this analysis, data were first checked for the assumptions of multiple linear regression (i.e., linearity, multivariate normality, absence of multicollinearity, homoscedasticity), with no violations found. Then, the four connectivity constructs were included in the model simultaneously as independent variables predicting career commitment, the dependent variable.

Description of Respondents

On average, respondents had 12.46 (*SD* = 10.51) years of teaching experience. The majority of respondents (75.10%) completed an undergraduate or graduate degree in agriculture education. The largest proportion of respondents (50.80%) reported a Bachelor's Degree as their highest level of education, followed by Master's (47.70%), Associates (1.0%), and Ph.D. (0.50%). On average, respondents had 129.08 (*SD* = 123.38) non-duplicated students enrolled in their SBAE program during the 2018-2019 school year.

Findings

The highest rated element of connectivity (see Table 1) was within the curricular construct (*M* = 5.45, *SD* = 0.82). The lowest perception of connectivity was identified among non-SBAE colleagues within the school (*M* = 4.50, *SD* = 1.21). On average, respondents rated their career commitment a 4.61 (*SD* = 1.52), which placed the average response between the "Neither Agree

nor Disagree" and "Somewhat Agree" response options on statements associated with career commitment.

Table 1
Perceptions of Connectivity and Career Commitment

Constructs	*n*	Minimum	Maximum	Mean	Standard Deviation
Curricular Connectivity	205	2.71	7.00	5.45	0.82
SBAE Teacher Connectivity	208	1.43	7.00	5.11	1.24
Community Connectivity	198	1.00	7.00	5.06	1.30
Career Commitment	211	1.00	7.00	4.61	1.52
School Connectivity	179	1.17	7.00	4.50	1.21

Note. Responses for each item within the five constructs were measured on a seven-point scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). Number of responses for each construct varies due to missing data.

Results associated with research objective three indicate the model was statistically significant (F-value = 5.65; p-value = <.001; see Table 2). In total, the four independent variables predicted 12% of the variance in career commitment (R = .34; R^2 = .12). Within the final model, two of the predictors were statistically significant. The strongest predictor of career commitment was school connectivity (β = .19; p-value = .022) followed by SBAE teacher connectivity (β = .16; p-value = .046).

Table 2
Model of Career Commitment

	Dependent Variable: Career Commitment					
Predictors	Zero-order correlation (r)	p-value	B	SEB	β	p-value
Community Connectivity	.21	.004	0.06	0.09	.06	.501
Curricular Connectivity	.20	.005	0.15	0.15	.07	.351
School Connectivity	.28	<.001	0.23	0.10	.19	.022
SBAE Teacher Connectivity	.24	<.001	0.19	0.09	.16	.046

Note. n = 174, R = .34, R^2 = .12, F-value = 5.65, p-value = <.001. Items scaled from 1 (*strongly disagree*) to 7 (*strongly agree*).

Discussion and Conclusions

The findings of this study highlight the importance of connectivity to the career commitment of SBAE teachers. Findings support the theoretical framework for this study, the Relational Theory of Working (Blustein, 2011), as well as related studies on high-quality connections (Dutton & Heaphy, 2003), suggesting relationships are a critical variable needing consideration in efforts to study and/or support teacher career commitment. However, this work is not free from limitations. Limitations to this study include (a) using self-perceived career commitment rather than a longitudinal analysis of career decisions and (b) an incomplete analysis of connectivity (e.g., missing connection to students, FFA).

School connectivity was found to be the strongest predictor of career commitment; however, respondents felt the least connected in this area. This lack of connectedness can create feelings of isolation within the teacher's own school district (Sass et al., 2011), which can also lead to a relational gap between teachers and administrators. Weak peer and administrative support have been found to have a large influence on the decision of teachers to leave the profession (Hong, 2010; Hope, 1999; Sass et al., 2011). The importance of connections within the school is supported by the theoretical framework, which identified relationships in the workplace as essential (Jordan, 2008).

In addition to school connectivity, connections with other SBAE teachers was a significant predictor of career commitment. Conversely to school connectivity, respondents reported having a comparatively strong connection with other SBAE teachers. The findings support existing research in SBAE suggesting social relationships and connections with other SBAE teachers increase career commitment, with self-efficacy acting as a mediating variable (Korte & Simonsen, 2018).

Recommendations

As the lowest rated element of connectivity and strongest predictor of career commitment, there is a clear need to help SBAE teachers develop connections within their schools. Educational research has identified ways to increase the connections and support teachers experience within their school through mentoring programs and interdisciplinary lesson planning (Ingersoll & Strong, 2011; Ingersoll & Kralik, 2004). Mentoring programs allow for novice teachers to gain confidence in their teaching abilities and connect with other teachers by providing a mentor to help guide and support their work in the classroom (Ingersoll & Strong, 2011). Interdisciplinary lesson planning, in which an SBAE teacher works with other academic area teachers to develop and/or teach a lesson, is another opportunity to forge connections within the school. Research modeling mentoring participation, interdisciplinary collaborations, and career commitment is needed as a next step to inform interventions attending to the connectedness and career commitment of SBAE teachers.

References

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory.* Englewood Cliffs, NJ: Prentice-Hall.

Blackburn, J. J., & Robinson, J. S. (2008). Assessing teacher self-efficacy and job satisfaction of early career agriculture teachers in Kentucky. *Journal of Agricultural Education, 49(3),* 1-11. doi:10.5032/jae.2008.03001

Blackburn, J. J., Bunch, J. C., & Haynes, J. C. (2017). Assessing the relationship of teacher self-efficacy, job satisfaction, and perception of work-life balance of Louisiana agriculture teachers. *Journal of Agricultural Education, 58*(1), 14-35. doi:10.5032/jae.2017.01014

Blustein, D. L. (2011). A relational theory of working. *Journal of Vocational Behavior, 79*(2011), 1-17. https://doi.org/10.1016/j.jvb.2010.10.004

Coldwell, M. (2017). Exploring the influence of professional development on teacher careers: A path model approach. *Teaching and Teacher Education, 61*(1), 189-198. doi:10.1016/j.tate.2016.10.015

Doney, P. A. (2013). Fostering resilience: A necessary skill for teacher retention. *Journal of Science Teacher Education, 24*(4), 645-664. doi:10.1007/s10972-012-9324-x

Dutton, J. E., & Heaphy, E. D. (2003). The power of high-quality connections. In K. S. Cameron, J. E. Dutton, & R. E. Quinn (Eds.), *Positive organizational scholarship* (pp. 263–278). San Francisco: Berret-Koehler.

Fraenkel, J. R., & Wallen, N. E. (2000). *How to design and evaluate research in education.* New York, NY: McGraw-Hill.

Hong, J. Y. (2010). Pre-service and beginning teachers' professional identity and its relation to dropping out of the profession. *Teaching and Teacher Education, 26*(1), 1530-1543.

Hope, W. C. (1999). Principals' orientation and induction activities as factors in teacher retention. *The Clearing House, 73*(1), 54-56. doi:10.1080/00098659909599641

Ingersoll, R., & Kralik, J. M. (2004). *The impact of mentoring on teacher retention: What the research says.* Denver, CO: Education Commission of the States.

Jordan, J. V. (2008). Recent developments in relational-cultural theory. *Women & Therapy, 31*(2-4), 1-4. doi:10.1080/02703140802145540

Korte, D. S., & Simonsen, J. C. (2018). Influence of social support on teacher self-efficacy in novice agricultural education teachers. *Journal of Agricultural Education, 59*(3), 100-123. doi:10.5032/jae.2018.03100

Lawver, R. G., Foster, D. D, & Smith, A. R. (2018). *Status of the U. S. supply and demand for teachers of agricultural education, 2014-2016.* Retrieved from http://aaaeonline.org/Teacher-Supply-and-Demand.

LeCornu, R. (2009). Building resilience in pre-service teachers. *Teaching and Teacher Education, 25*, 717-723. doi:10.1016/j.tate.2008.11.016

Lindner, J. R., Murphy, T. H., & Briers, G. E. (2001). Handling nonresponse in social science research. *Journal of Agricultural Education, 42*(4), 43-53. doi:10.5032/jae.2001.04043

McKim, A. J., & Velez, J. J. (2015). Exploring the relationship between self-efficacy and career commitment among early career agriculture teachers. *Journal of Agricultural Education*, *56*(1), 127-140. doi:10.5032/jae.2015.01127

McKim, A. J., & Velez, J. J. (2016). An evaluation of the self-efficacy theory in agricultural education. *Journal of Agricultural Education*, 57(1), 73-90. doi:10.5032/jae.2016.01073

McKim, A. J., & Velez, J. J. (2017). Developing self-efficacy: Exploring preservice coursework, student teaching, and professional development experiences. *Journal of Agricultural Education, 58*(1), 172-185. doi: 10.5032/jae.2017.01172

Miller, L. E., & Smith, K. L. (1983). Handling non-response issues. *Journal of Extension, 21*(5), 45-50.

Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric theory* (3rd ed.). New York, NY: McGraw-Hill.

Rinke, C. R. (2007). Understanding teachers' careers: Linking professional life to professional path. *Educational Research Review, 3(1),* 1-13.

Sass, D. A., Seal, A. K., Martin, N. K. (2010). Predicting teacher retention using stress and support variables. *Journal of Educational Administration, 49*(2), 200-215. doi:10.1108/09578231111116734

Sorensen, T. J., McKim, A. J. (2014). Perceived work-life balance ability, job satisfaction, and professional commitment among agriculture teachers. *Journal of Agricultural Education, 55*(4), 116-132. doi:10.5032/jae.2014.04116

Metacognition of Pre-service Teachers: A Phenomenology of Reflection-in-Action

Aaron J. Giorgi
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Dr. Caryn M. Filson
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Introduction

Agriscience teacher education programs should intentionally and judiciously engage pre-service teachers in developing pedagogical skillsets that (a) overcome inaccurate preconceptions, (b) increase efficient self-reflective practices, and (c) empower management of the "problem of complexity" (Barrick & Garton, 2010; Hammerness, Darling-Hammond, & Bransford, 2005). Literature suggests that a "metacognitive approach to instruction" (p. 366) that empowers pre-service teachers to take control of their development and manage the novelty of the teaching environment supports this type development (Hammerness et al., 2005). Teacher education programs that use a metacognitive approach should enable pre-service teachers to learn from their practice of teaching (Darling-Hammond & Bransford, 2005).

As part of the developmental process, the pre-service teachers are asked to participate in *reflection-on-action* (Schon, 1983) as a retrospective process to assess their own teaching decisions and development as opposed to the suggested variety of settings. An alternative to after-the-fact reflection would be utilizing peer observations in a *reflection-in-action* process during micro-teaching observations. Using *reflection-in-action* through peer observation can foster reflective practices, pedagogical decision-making, and discourse around best teaching practices (Hammersley-Fletcher, & Orsmond, 2005). However, Kennedy (1999) describes a barrier for novice teachers at the intersection of internal reflection and subsequently making quality teaching choices as a problem of enactment. Imparting wisdom alone cannot overcome the problem of enactment, rather quality experiences with support for reflection offer a better solution (also called "case-based," see Williams, 1992; Hammerness et al., 2005).

It has been noted that unstructured internal reflections by novice teachers can result in pedagogical dissonance and internal discourses that can lead to a diluted application of teaching theory (Barnes & Smargorinsky, 2016). Findings from Clark and Paulsen's (2016) analysis of student teacher reflective blogs support the notion of Barnes and Smargorinsky's (2016) potential dilution effective of unstructured reflection, further suggesting that applying structure to reflection could increase the depth of critical thinking, thus lead to greater impact of reflective practices.

Philosophical Perspective

We were guided by a pragmatist epistemology, which sought to address the complexity teacher preparation programs face as they prepare future teachers and the complexity pre-service teachers face as they begin to engage with all aspects of teaching.

Purpose and Research Questions

The purpose of this study was to explore pre-service teachers' metacognitive processes during *reflection-in-action*. The guiding research question was, what is it like for pre-service teachers to reflect *during* teaching observations?

Methods

To explore the perceived lived experience of pre-service teachers reflecting in action we utilized a qualitative phenomenological approach (Moustakas, 1994). The *reflection-in-action* activity consisted of a peer observation during a senior-level teaching methods course. During the observation, the student verbally reflected with an Agriscience Education faculty member. We are previous agriscience teachers who taught middle and high school agriculture in urban, suburban, and rural schools. We are also professors and teaching assistants within an agriscience teacher preparation program. We acknowledged these biases and bracketed ourselves to allow for emergence of the phenomenon.

Participants

Collective case study methodology was utilized to purposively sample participants (Stake, 1994). A senior-level teaching methods course at a large, midwestern, land grant university served as the sampling bounded system with 15 pre-service teachers enrolled in the course (n = 15).

Data Collection

Pre-service teachers participated in a *reflection-in-action* activity, where they observed a peer teaching from an observation room with one-way mirror allowing view of the entire classroom. Pre-service teachers individually reflected on a peer-taught lesson and on their own perceptions. Throughout the *reflection-in-action* activity, a faculty member utilized a think aloud protocol (Van Someren, Barnard, & Sandberg, 1994) to facilitate the reflection process through open ended and prompting questions that honed in on the pre-service teachers' metacognitive processes, understanding of the teaching-learning process, and their evaluation of effective teaching methods. The reflection activities were audio recorded and transcribed. Additionally, field notes were taken by a researcher during the reflections. Other rich sources of data included pre-service teacher lesson plans with written reflections, post-experience written debriefs, and teaching videos (Giorgi, 1985).

Data Analysis

We used a three step analysis of the data. This coding process involved: (1) a careful read through of all data collected in the study to reduce the chances of selectivity; (2) the generation of explanatory themes from the collected data, which were simplified by the existence of the identified phenomena; and (3) the application of the themes to the research questions of the study (Moustakas, 1994),. We triangulated data during the three-stage analysis and utilized a variety of other validation strategies to uphold trustworthiness (Lincoln and Guba, 1985).

Results and Implications

The emergent insights into the phenomenon of pre-service teachers' metacognitive processes during a *reflection-in-action* activity offer unique perspectives to learn from. Two main themes emerged representing pre-service teacher metacognitive processes and reflection: (a) "Narrow Focus," and (b) "Linear, Functional Teaching." Additionally, minor insight can be gained into how students tackle the complex nature of teaching, and their perceptions on enacting quality pedagogical strategies.

Theme 1: Narrow Focus

The teaching environment is a complex, multifaceted system of personal and physical variables. Through the analysis, it emerged that pre-service teachers were not able to analyze and reflect on

the holistic teaching environment. The pre-service teachers displayed a narrow focus of the teaching environment, where they reflected on a single event/strategy or a few tangible components of the teaching environment.

Anna's focus was on the physical and planned teaching structures. She began her reflection with the structure of the lesson introduction, "When he goes to tie the bell ringer into his lesson later on, he's going to have to tie it back twice, which I think might get a little awkward." Anna's reflections also included discussions of the physical structures of the classroom:

> I personally do not like the table group setups, especially for a lesson like this… [students] get off-track a lot easier with their laughter and their comments and what [student]'s doing right now.

Another view of the narrow focus of pre-service reflections was that of Lane, who's focus during his reflection was the student engagement experiences he witnessed. One of Lane's initial comments was, "They're engaged. They're definitely engaged, but I don't know if they're going for exactly what he's looking for. Except for [student]. [student]'s on the phone." When the facilitator probed deeper, Lane continued to reflect on student actions he perceived as indicators of engagement:

> [Prompted] … Okay, so he's kind of drawing in like ... Well, I don't know if drawing in, but like giving them something to actually look at and to feel and touch and engage ... bring them back into engaging, putting some of that learning on them slightly.

During Emily's reflection, assessment became her narrow focus.

> Yes, it's a type of formative assessment, but it's also a check for you that, from slide to slide they got what you wanted them to get out of the slide, and if they didn't then you can go back and be like okay, we need to re-do whatever just happened.

Her comments continued to reflect on assessment as both a teaching tool and a learning tool.

> That's on the teacher for not keeping them engaged in the lesson. He wrote the definition there, either they didn't write it down, or they didn't understand as he was presenting it to them. He gave them the definition, so if they can't regurgitate the six words that was in the definition that would definitely be on him.

Megan's focus during reflection was on meaningfulness of student actions, [Prompted]…"Yeah. I think if they would have a deeper reason for counting, they wouldn't have been throwing or tossing them around. They're spending a lot of time to count the petals." Her comments further reflected on the value and meaningfulness for students:

> The students have essentially just tore apart a flower. They learned all the parts yesterday, but the premise for this lesson wasn't to identify the parts. There was no labeling once they tore it apart. The hypothesis might be used later, but if they didn't know why they were forming a hypothesis, it's probably not a very strong or structured one to use later.

The narrow focus of reflections may be a representation of pre-service teacher readiness to perceive the wider teaching environment.

Theme 2: Linear, Functional Teaching

It emerged that the pre-service teachers possessed a linear and functional view of teaching through their verbal metacognitive processing. Pre-service teachers were espousing a step-wise

process of teaching actions and student behavior outcomes. A linear processing was represented by the pre-service teachers reflecting on orders, steps, or stages to the teaching experiences they were witnesseing. As they pre-service teachers began to organize their reflections in this linear process, they also began to attribute causal relationships between the different behaviors. These reflections began to take shape where behaviors were the inputs leading to or perpetuating outcomes.

Emily represented functional reflections through her comments attributing blame to teachers, "That's on the teacher for not keeping them engaged in the lesson." While Amy offered an alternative view, "I think she's reacting. I think mostly all of us are reacting, not being proactive." Additionally, Megan began to draw perspective from the complexity of the teaching environment, representing that the function of many variables influences the outcomes:

> I think that is a combination. I don't think it's much in the behavior issue. These students are acting up that poorly, they just, they don't have clear instruction and content that they want to participate in. Partial planning, not enough structure. Students don't know what specifically to be doing, and content problems as well.

Analyzed comments have a feeling of pre-service teachers' reflection on the linear or steps of interactions leading to casual relationships between the behaviors of teachers and students. Jamie reflected on the functional nature of teaching from his perceptions of teacher prompting:

> Every time she asks all the students, and what they thought, to bring their knowledge into it, before just answering it… A lot of [students] ... Well, some look like they became more engaged, but others are starting to ... It's kind of switching kind of who wasn't and who was.

Megan also viewed the teacher as the stage-setter for further student behaviors:

> There's a lack of structure, which I think you need when you have materials in front of you that you can actively interact with. It's not clear how they're supposed to dissect the flower or what it should look like.

Jessica reflected similarly, offering potential teaching amendments that may influence a more favorable student behavior outcome, "make them more concise and clear with the directions, because I think she kind of drew it out longer, saying more words than she had to for what they're doing."

This linear and functional teaching theme also had a lens of student behavior management. Offering Kyle's and Sara's commented as representations of this reflective view, they espouse teacher actions perpetuate student behaviors or "mis"-behaviors. Kyle commented:

> So, she's really focusing on where maybe two of the problems are versus the entire room and not focusing on the students as a whole… A lot of students are just sitting there, so not much movement, or they're not really doing much. That table over there, [student] looks pretty distracted and [student] is kinda interacting with him, because [student] rolled over to him. So, they're still not necessarily exactly focused on the task and/or the video.

Sara's comments also reflect on the impact of current teacher behaviors on future student behaviors. She reflected:

> Instead of continuing to answer the question "what are we doing?" She should say-tell them to listen to their friends or you should have heard that earlier, ask a friend, figure it out. Because she's reinforcing that behavior that "I don't have to listen because you're gonna tell me what it is over and over again".

Jessica's reflections represented the thematic tomes of linear step-wise or stage-like teaching, as well as, offering the functional behavior causations. She continuously reflected on the progress made by the teacher she was viewing. She commented: "I don't know. It just seems like they haven't really gotten anywhere yet…It doesn't seem like they've really gotten anywhere yet. This is what, her first or second slide after her objective slide?" That reflection was followed up by:

> Well first, I think they need to all quiet down, because you can tell that they're not even paying attention, as they all laugh. They're not engaged with the lesson at all. Then number two, they need to pay attention to each other's questions because they could very well have the same question."

When taken together, these two comments epitomize the linear, functional reflective processes pre-service teachers were engaging in during the observation.

The utilization of an innovative *reflection-in-action* activity supported pre-service teacher's ability to verbally process teaching situations and describe potential amendments to instruction to increase potential effectiveness.

Discussion

Pre-service teacher responses elucidated the narrow focus of perception influencing the metacognitive reflections during the peer observations. Literature describes the teaching environment as a multifaceted system that requires moment by moment flexibility (Hammerness et al., 2005). Pre-service teachers with a narrow focus do not yet perceive the complexity of the multifaceted system. Pre-service teacher responses represented their perception of how teacher and student behaviors interact and are functions of each other. These logical process assertions could be ascribed as preliminary decision-making skills for pre-service teachers beginning to think like a teacher and lead to teacher enactment. Enactment is the process when teachers leverage *thinking like a teacher* into quality effective teaching choices (Kennedy, 1999).

Responses also demonstrated the power of *reflection-in-action* for pre-service teachers growth as they could verbally discuss the complexity in a low-stakes, safe learning environment. Pre-service teachers gained a new understanding of the complexity of teaching without being an active participant in laboratory lessons. Utilizing a peer observation based, *reflection-in-action* activity can directly engage pre-service teachers in a quality, supported reflection experience to learn from the teaching practices and build a metacognitive process to think and act like a teacher (Darling-Hammond & Bransford, 2005; Williams, 1992).

Recommendations

It is recommended that pre-service education programs integrate a facilitated peer obersvation, *reflection-in-action* to support development of metacognitive processes in undergraduate students. For programs that are not equipped with an attached observation room, the *reflection-in-action* can easily be replicated through utilization of video conferencing technologies. Additionally, the laboratory lesson could be video recorded and viewed by the pre-service teacher and faculty member at a later time. It is recommended that faculty develop supports to assist pre-service grappling with the complexity of teaching, and to overcome the barriers to

enacting teaching decisions. Future research should continue to investigate the impact *reflection-in-action* has on pre-service teacher development. Specifically, investigate the development of reflective practices, pedagogical decision-making, and usage of quality teaching theories in decision-making.

Roberts and Kitchel (2010) describe the value of building a coherent scope and sequence for teacher education programs. Responses from the *reflection-in-action* peer observation activity demonstrated varying levels for pre-service teachers relating materials taught throughout the program to the in situ experience they were reflecting on. The teacher education program can use this information to assess the level of coherence of their pre-service teachers and make plans to better articulate theory and practice across the scope of their courses.

References

Barnes, M. E., & Smagorinsky, P. (2016). What English/language arts teacher candidates learn during coursework and practica: a study of three teacher education programs. *Journal of Teacher Education, 67*(4), 338-355. doi: 10.1177/0022487116653661

Barrick, R. K., & Garton, B. L. (2010) Frameworks for agriculture teacher preparation. In Torres, R. M., Kitchel, T., Ball, A. L. (Editors). *Preparing and advancing teachers in agricultural education* (pp. 30-41). Columbus, OH: Curriculum Materials Services.

Clark, T. K., Paulsen, T. H. (2016a). Analyzing student teacher critical thinking through blogs in an electronic Community of Practice. *Journal of Agricultural Education, 57*(2), 75-92. doi: 10.5032/aje.2016.02075

Darling-Hammond, L., Bransford, J. (Editors). (2005). *Preparing teachers for a changing world; What teachers should learn and be able to do.* San Francisco, CA: Jossey Bass.

Giorgi, A. (Ed.). (1985). *Phenomenological and psychological research.* Pittsburg, PA: Duquesne University Press.

Hammerness, K., Darling-Hammond, L., Bransford, J. (Editors). (2005). How teachers learn and develop. In L. Darling-Hammond, & J. Bransford (Eds.). *Preparing teachers for a changing world; What teachers should learn and be able to do.* San Francisco, CA: Jossey Bass.

Hammersley-Fletcher, L., & Orsmond, P. (2005). Reflecting on reflective practices within peer observation. *Studies in Higher Education, 30*(2), 213-224. doi: 10.1080/03075070500043358

Kennedy, M. (1999). The role of preservice teacher education. In L. Darling-Hammond and G. Sykes (Eds.). *Teaching as the learning professions: Handbook of policy and practices* (pp. 54-85). San Francisco, CA: Jossey Bass.

Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry* (Vol. 75). Sage.

Moustakas, C. (1994). *Phenomenological research methods.* Thousand Oaks, CA: Sage Publications Inc.

National Council for Accreditation of Teacher Education (2008). *Professional Standards for the Accreditation of Teacher Preparation Institutions.* Washington, D.C.: National Council for Accreditation of Teacher Education.

Roberts, T. G., & Kitchel, T. (2010). Designing professional knowledge curriculum and instruction. In Torres, R. M., Kitchel, T., Ball, A. L. (Editors). *Preparing and advancing teachers in agricultural education* (pp.100-111). Columbus, OH: Curriculum Materials Services.

Schon, D. A. (1983). *The reflective practitioner: How professionals think in action.* New York, NY: Basic Books.

Stake, R. E. (1994). Case studies. In N. K. Denzin, & Y. S. Lincoln (Eds.), *Handbook of qualitative research.* Thousand Oaks, CA: Sage.

Van Someren, M. W., Barnard, Y. F., & Sandberg, J. A. C. (1994). *The think aloud method: A practical guide to modelling cognitive processes.* London: Academic Press.

Williams, S. M. (1992). Putting case-based instruction into context: Examples from legal and medical education. *The Journal of the Learning Sciences, 2*(4), 367-427.

Prescribed Pedagogical Outcomes Versus Real-World Challenges: A Content Analysis of Kansas AFNR Course Competency Profiles

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Introduction

Agricultural content and context in U.S. secondary agricultural education classrooms provide an integrated curriculum with two identified outcomes: a skilled agricultural labor pool and agriculturally literate contributors to a democratic society (Roberts & Ball, 2009). Developing competent workers in the broad field of agriculture through school-based agricultural education may be an increasingly harder outcome to achieve with current practices. Shifting workforce demands and complex challenges facing agricultural systems have brought forth a need for agricultural educators to "prepare a sufficient scientific and professional workforce that understands the multidisciplinary nature of agriculture and is diverse, globally competent, and possesses 21st century skills (Stripling & Ricketts, 2016)."

To meet the nutritional demands of a growing human population, agriculture, which is responsible for approximately 70 percent of all worldwide water withdrawals annually, will need to adapt to offset the current and future issues of global water scarcity (Mancosu, Snyder, Kyriakakis, & Spano, 2015). Evidence suggests that secondary agriculture, food, and natural resource (AFNR) educators can incorporate water scarcity into their pedagogical practices to combat these issues. McKim, Fornbush, and McKendree (2018) identified specific ways AFNR educators can integrate sustainable water management topics into their curriculum, which "empowers them to contribute to water scarcity solutions" (p.167).

In Kansas, the principle issues surrounding water scarcity are the rapid depletion of the Ogallala aquifer and sedimentation of state reservoirs (Kansas Water Office, 2015). The Kansas Water Office (2015) estimates, if no changes are made to current practices within the next 50 years, the Ogallala, which is one of the largest aquifers in the world and lies under portions of eight states, will be 70 percent depleted. They also add that 40 percent of the capacity in state reservoirs will be filled with sediment. This provides complex challenges for Kansas, where over 40 percent of the economy is agriculturally based (Kansas Department of Agriculture, 2018) and more than 2.5 million acres of cropland are irrigated (U.S. Department of Agriculture, 2019).

In order to bridge the issues of water scarcity in Kansas and possible solutions that lie within secondary agricultural education, this study examined two resources. One is the *Long-Term Vision of the Future of Water Supply in Kansas* (Kansas Water Office, 2015), which lays out water-related problems in the state and provides strategic themes that attempt to identify solutions to overcome those challenges. The other resource is the Kansas AFNR Course Competency Profiles. These course profiles identify learning outcomes, or competencies, that students should obtain as a result of taking a specific AFNR course.

Conceptual Framework

Krippendorff (2013) provides a prescriptive conceptual framework to "guide the conceptualization and design of practical content analytic research" (Krippendorff, 2013, p.35). There are six conceptual components that content analysis studies should include: a body of text to be analyzed, a research question where an answer is sought out by examining the body of text, a researcher-determined context to make sense of the text, operational understanding of the context, inferences related to the research questions, and validating evidence to justify the analysis. The framework for content analysis is depicted in Figure 1.

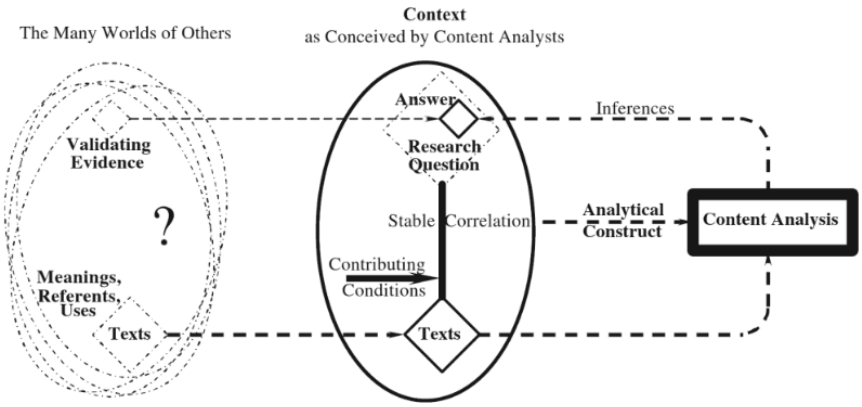

Figure 1. "A Framework for Content Analysis" (Krippendorff, 2013, p.36)

The body of text used were the 36 course competencies and the context was the Long-Term Vision for the Future of Water Supply in Kansas (Kansas Water Office, 2015) (i.e. the Kansas Water Vision). Written by a team of several state agencies, this document addresses issues related to water resources in the state. There are four main themes included in the vision document: *Water Conservation*, *Water Management*, *Technologies and Crop Varieties*, and *Additional Sources of Supply*.

Purpose and Research Objectives

This study addresses needs outlined in Research Priorities three and seven of the *2016-2020 American Association for Agricultural Education National Research Agenda*. The challenges of water and strengthening communities are part of what make priority three, *Sufficient Scientific and Professional Workforce that Addresses the Challenges of the 21st Century*, "a problem of focus in every sector of the agricultural industry and for all aspects of agricultural education (Stripling & Ricketts, 2016, p.30)." Challenges onset by global population growth, such as enhanced natural resource management, have brought forth research priority seven, *Addressing Complex Problems.* Priority seven of the research agenda cites "the significant impact of human behavior on climate change has resulted in shifts in the global hydrological cycle [which, when] coupled with the excessive use of ground water and the deterioration of water quality, provide significant issues for our global communities with respect to our most precious resource (Andenoro, Baker, Stedman, & Weeks, 2016, p.57)." This complex problem is especially profound in Kansas, where reservoir sedimentation and depletion of the Ogallala aquifer are pressing issues (Kansas Water Office, 2015).

The purpose of this study was to address the need of developing an educated workforce that can solve complex water-related issues of this century. The following objectives guided this study:

1) Determine which Kansas AFNR courses and pathways prescribe water-related outcomes.
2) Identify the specific Kansas AFNR course competencies that are connected to the *Kansas Water Vision*.
3) Determine the extent to which course competencies are related to the *Kansas Water Vision* themes.

Methodology

This study utilized quantitative content analysis methods, as identified by Krippendorff (2013), to investigate the research objectives. To study the relationships between the *Kansas Water Vision* and the state's prescribed learning outcomes, or course competencies, for agricultural education courses, we downloaded the most recent version of all 36 Kansas AFNR Course Competency Profiles from the Agriculture, Food & Natural Resources page of the Kansas Department of Education's website (Kansas State Department of Education, 2019a). Once downloaded, general attributing information was recorded prior to the documents being analyzed. This information included the course title, revision date, and the designated course code.

Researchers then developed a codebook adapted from a previous water-related study (Dobelbower, 2018). The codebook provided proper protocols and pertinent information for coders to designate categories to each sample, or individual course competency. Two sections formed the codebook: general attributes, which included the previously listed information, and coder categories. The "Category" section asked coders to code each individual course competency with either a "0" for "No Connection to the Kansas Water Vision," or a "1" for "Some Connection to the Kansas Water Vision," or a "2" for "Strong Connection to the Kansas Water Vision." To determine the level of connection to the *Kansas Water Vision*, category classifications were added to the codebook and include descriptions of each of the four strategic themes of the *Vision* (Kansas Water Office, 2015, p.14). The four themes are *Water Conservation, Water Management, Technologies and Crop Varieties,* and *Additional Sources of Supply*. Coders consisted of two undergraduate researchers and a university faculty member. To establish intercoder reliability, coders met and adjusted the codebook to reduce variations in coder interpretations. After coding was complete, researchers analyzed the data.

Findings/Results

Research objective one sought to determine which AFNR courses and pathways prescribe water-related outcomes. Of the three courses in the Agribusiness Systems pathway, two in the Food Products & Processing Systems pathway, and eight in the Power, Structural & Technical Systems pathway, none had any water-related learning competencies (N=966, n=0). Coders reported less than 1% of competencies (N=311, *n*=2) in the Animal Science pathway, specifically from the Animal Science and Advanced Animal Science courses, were water related. The Applications in Agricultural Biotechnology course, in the Biotechnology in Agriculture pathway, had one water-related competency and accounted for 1% of the total competencies (N=86, *n*=1) in that pathway. The water competencies of the two courses in the Natural Resources and Environmental Systems pathway, Natural Resource Management and

Environmental Resources & Wildlife Science, accounted for 27% (N=86, *n*=23) of the total. The Floriculture and Greenhouse Management, Crop & Range Management, Horticulture, Applications in Horticulture, and Plant & Soil Science courses of the Plant Systems pathway are reported to have 8% (N=358, *n*=28) of their competencies be water-related. The Agriculture Explorations, Plant & Animal Science, Advanced Plant & Animal Science, Research in Agriculture, Ag Leadership/Communications, Introduction to Agriculture, and Agricultural Science courses were included in the Comprehensive Agriculture pathway. In this pathway, 6% (N=539, *n*=35) of competencies were water related. All courses and their corresponding number of competencies are reported in Table 2.

The second research objective aimed to identify the specific Kansas AFNR course competencies that are connected to the *Kansas Water Vision*. Of the 2,346 total course competencies, 89 had some connection or a strong connection to the *Kansas Water Vision*. Due to space constraints, only one example of a water-related competency from the course with the most water-related competencies from each pathway is reported in Table 1.

Table 1
Courses with the Most Water-Related Competencies from Each Pathway and Examples

Pathway and Course Name	Water-Related Competency Example
Animal Science: *Animal Science*[1]	Evaluate the effects of animal agriculture on the environment.
Biotechnology in Agriculture: *Applications in Agricultural Biotechnology*	Design and perform an assay to detect target microorganisms in food, water, or the environment.
Comprehensive Agriculture: *Ag Leadership/Communications*[1]	Research, examine and discuss issues and trends that impact local, state, national, and global agriculture.
Natural Resources and Enviro. Systems: *Natural Resource Management*	Relate the function of watersheds to natural resources.
Plant Systems: *Plant & Soil Science*	Describe how water holding capacity, available water, and wilting points, permeability, leaching are affected by soil texture and nutrient availability.

Note: [1]Courses that tied with another for number of competencies

Table 2

Kansas AFNR Pathways and Courses with their Water-Related Outcomes

Pathway and Course Name	Total Competencies	Water-Related Competencies	Percent of Total
	N	*n*	%
Agribusiness Systems:			
Agribusiness	34	0	0%
Applications in Agribusiness	44	0	0%
Ag Entrepreneurship	107	0	0%
Animal Science:			
Animal Health/Vet Tech	45	0	0%
Equine Science	64	0	0%
Adv Animal Science	107	1	1%
Small Animal Care	57	0	0%
Animal Science	38	1	3%
Biotechnology in Agriculture:			
Applications in Agricultural Biotechnology	48	1	2%
Agricultural Biotechnology	38	0	0%
Comprehensive Agriculture:			
Ag Explorations	48	4	4%
Adv. Plant & Animal Science	46	8	8%
Plant & Animal Science	43	3	3%
Research in Ag	41	2	2%
Ag Leadership/Communications	97	8	8%
Introduction to Agriculture	83	7	7%
Agricultural Science	47	3	3%
Adv Ag Internship	70	0	0%
Ag Internship	64	0	0%
Food Products and Processing Systems:			
Food Science II	57	0	0%
Ag Food Science	46	0	0%
Natural Resources and Environmental Systems:			
Natural Resource Management	43	13	13%
Environmental Resources & Wildlife Science	43	10	10%
Plant Systems:			
Floriculture & Greenhouse Management	70	5	5%
Applications in Horticulture	56	3	3%
Crop & Range Management	90	7	7%
Plant & Soil Science	69	8	8%
Horticulture	73	5	5%
Power, Structural & Technical Systems:			
Agricultural Mechanics	88	0	0%
Adv Agricultural Mechanics	67	0	0%
Ag Structures	105	0	0%
Agricultural Power	69	0	0%
Small Gas Engines	103	0	0%
Agricultural Fabrication	54	0	0%
Ag Welding II	125	0	0%
Ag Welding	67	0	0%

Research on objective three investigated the extent to which course competencies are related to the *Kansas Water Vision* themes. Of the 2,346 total course competencies, 4% (*n*=89) were related to themes of the water vision document. Of those 89 competencies, 27% (*n*=24) had a "strong connection" to the document. This accounted for 1% of the total competencies. Additionally, 73% (*n*=65) of the 89 water-related competencies, or 3% of total competencies, had "some connection" to the document. Examples of a "strong connection" are "Determine the hydraulic conductivity for soil and how the results influence irrigation practices" and "Perform a water quality test." Competencies with "some connection" included "Develop a plan of action to improve the environment," and "Develop a watering schedule for a greenhouse."

Conclusions

Of the 36 courses included in this content analysis, 17 contained at least one water related competency (47%). Of the eight pathways, three are not incorporating water-related competencies (Agribusiness, Food Products and Processing, and Power, Structural and Technical). Of the pathways that do offer these learning outcomes, they still only account for a small percentage of their total number of competencies. Moreso, the level to which these outcomes are connected to water scarcity issues in Kansas, as outlined by the state's water vision, is miniscule, as only 27% are strongly connected.

The Natural Resources & Environmental Systems pathways reported the most water-related competencies by far but, according to the Kansas State Department of Education (2019b), only ten schools in Kansas offer this pathway (compared to 179 for the Comprehensive Agriculture Science pathway and 205 total high school agriculture programs).

The validating evidence, a conceptual component of content analysis research, to support these results include the current needs and trends outlined in this paper's introduction. The need for more skilled workers and agriculturally literate citizens (Roberts & Ball, 2009), calls for agriculture to adapt to offset current and future issues regarding global water scarcity (Mancosu, et al., 2015), and the current climate of water issues in Kansas as outlined by the Kansas Water Office (Kansas Water Office, 2015) implies a possible lack of water education in the state of Kansas. In addition, the *Kansas Water Vision* includes an *Education and Public Outreach* supplement (Kansas Water Office, 2015) that further outlines the need for water-related education. Key action item areas relating to agricultural education in this supplement include; "Increase awareness and knowledge of Kansas youth on water-related issues, provide opportunities for Kansans of all ages to increase their awareness of local water issues," and "develop partnerships between industry, community and education institutions that will promote and train for water-related careers" (Kansas Water Office, 2015, pp.69-77). Some outcomes related to water scarcity concepts in Kansas are already being taught in Kansas agricultural education classrooms, but AFNR educators could be in a position to further meet the increased need for water education.

Recommendations/Implications

The findings of the study indicate a more rigorous review of Kansas AFNR Course Competency Profiles is warranted. When the teachers come together to work on the profiles, they may not push themselves to think about the grand challenges facing the agriculture industry, the state of Kansas, or global agriculture. Work needs to be done to include key state agencies, industries,

and scientists to help teachers know what they should be teaching to prepare their students for future success.

The majority of courses could have some type of water related competency built in without distracting from the goals of the curriculum. Many agriculture and water focused institutions, such as the Irrigation Association and National Agriculture in the Classroom Organization, already provide curriculum and lesson plans focused on water scarcity topics. Also, it is recommended that a course specifically concentrated on water related competencies be developed. It could include content regarding natural resource management, conservation, irrigation practices and technology, policy, and water-related careers.

It may be important to highlight that some work has already been started to enhance the water-related education youth receive in Kansas. Hock, Callaghan, and Pinkston (2019) have reported the longitudinal impact of the Kansas Youth Water Advocates training program for secondary agricultural education students. This model of informal agricultural education has produced a positive impact on the participants' knowledge and ability to advocate for Kansas water issues. More work should be done to produce similar results in secondary agriculture classrooms.

Recommendations for future research include identifying teachers' perceived ability to teach the water-related competencies, student achievement and career interest, and impact of changes on water practices in the state. It is also recommended that another content analysis of the state agricultural education competencies be conducted to identify key interdisciplinary challenges facing the industry (i.e. global agriculture production, nutritional needs, rural sustainability and vitality).

References

Andenoro, A.C., Baker, M., Stedman, N.L.P. & Weeks, P.P.. (2016). Research Priority 7: Analyzing Complex Problems (pp. 57). In G.T. Roberts, A. Harder, & M.T. Brashears, *American Association for Agricultural Education National Research Agenda: 2016-2020*. Gainesville, FL: Department of Agricultural Education and Communication.

Hock, G., Callaghan, Z., & Pinkston, K. (2019, May). *Assessing the Longitudinal Impact of a Specialized Youth Training Program.* Poster session presented at the National American Association for Agricultural Education Conference, Des Moines, IA.

Dobelbower, S. (2018). *Framing the Future of the Ogallala: A Comparative Content Analysis of Agricultural and Mainstream Media Publications*. (Master's thesis). Texas Tech University, Lubbock, TX. Retrieved from https://ttu-ir.tdl.org/handle/2346/82072.

Kansas Department of Agriculture. (2018). *Kansas Agriculture's Economic Impact Report* [Data set]. Retrieved from https://agriculture.ks.gov/docs/default-source/ag-marketing/ag-contribution-2018-with-retail-ethanol-combined-update-final.pdf?sfvrsn=2ffa84c1_4

Kansas State Department of Education. (2019a). *Agriculture, Food & Natural Resources*. Retrieved from https://www.ksde.org/Agency/Division-of-Learning-Services/Career-Standards-and-Assessment-Services/Content-Area-A-E/Agriculture-Food-Natural-Resources-CTE-Career-Cluster

Kansas State Department of Education. (2019b). *2018-19 Pathway and Courses List by Pathway Name*. Retrieved from https://www.ksde.org/Agency/Division-of-Learning-Services/Career-Standards-and-Assessment-Services/CSAS-Home/Career-Technical-Education-CTE/Career-Clusters-Pathways

Kansas Water Office. (2015, January). *A Long-Term Vision for the Future of Water Supply in Kansas*. Retrieved from https://www.kwo.ks.gov/docs/default-source/water-vision-water-plan/vision/rpt-vision-call-to-action-sectiona2d9e11da40b6667970cff000032a16e.pdf?sfvrsn=c6d28714_0

Krippendorff, K. (2013). *Content Analysis: An Introduction to its Methodology* (3rd ed.). Thousand Oaks, CA: Sage. (Original work published 1980)

Mancosu, N., Snyder, R. L., Kyriakakis, G., & Spano, D. (2015). Water scarcity and future challenges for food production. *Water*, 7, 975-992. doi:10.3390/w7030975

McKim, A.J., Fornbush, M., & McKendree, R.B. (2018). Sustainable Water Management Within Agriculture, Food, and Natural Resources Education. *Journal of Agricultural Education*, 59(2), 166-178 https://doi.org/10.5032/jae.2018.02166

Roberts, T.G., & Ball, A.L. (2009). Secondary Agricultural Science as Content and Context for Teaching. *Journal of Agricultural Education*, 50(1), 81-91. http:/jae-online.org

Stripling, C.T., & Ricketts, J.C. (2016). Research Priority 3: Sufficient scientific and professional workforce that addresses the challenges of the 21st Century (pp. 30). In G.T. Roberts, A. Harder, & M.T. Brashears, *American Association for Agricultural Education National Research Agenda: 2016-2020*. Gainesville, FL: Department of Agricultural Education and Communication.

U.S. Department of Agriculture, National Agricultural Statistics Service. (2019). *2017 Census of Agriculture (Chapter 1, Table 10 - Irrigation)* [Data set]. Retrieved from https://www.nass.usda.gov/Quick_Stats/CDQT/chapter/1/table/10/state/KS

Success and Longevity Factors of North Dakota Agricultural Educators

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Introduction and Literature Review

Retention of agricultural educators is a problem that is being faced by administration, state staff, agriculture education associations, and schools around the state. Having an understanding of why agriculture teachers remain in the classroom is beneficial to facing the problem of retention (Crutchfield, Ritz, & Burris, 2013; Clemons & Lindner, 2017; Clemons & Lindner, 2019). Teachers have reported reasons why they have left the profession including: work/life balance, poor professional development, poor teacher preparation programs, burnout, rising expectations, growing learning demand, retirement and more (Adams, King, & King, 1996; Clark, Kelsey, & Brown, 2014; Crutchfield, Ritz, & Burris, 2013; DeLay & Washburn, 2013; Conneely & Uy, 2009; Ingersoll, 2001; Reynolds & Wang, 2005; Zhang & Zeller, 2016). There is an alarming low retention rate of agriculture educators in [State] and nationwide. Marx, Smith, Smalley, and Miller (2017) pointed out the fact that there have been concerning teacher shortages since the early 1900s. Retention of educators in a career provides continuity of a program as well as has beneficial effects on the education of the students who are taught by these educators. Teachers are leaving the profession early on in their careers. Anywhere between 40% and 50% of teachers will leave the classroom within their first five years (Zhang & Zeller, 2016). Much of this previous research provides input as to why teachers leave the profession, but there is not an abundance of research dealing with why agriculture educators remain in the profession.

Theoretical Framework

The Social Cognitive Career Theory (SCCT) (Lent, Brown, & Hackett, 1994) was utilized to frame this study. Although SCCT is frequently aligned most directly with adolescent career choice, the theory is useful to describe a cyclical process of career retention. The primary principles of work experiences which develop self-efficacy and goals related to work apply with the choice to stay. This manifests through that efficacy and the goals guiding professional action and performance assessment in the career. That act of assessment leads a person toward growth (new learning experiences) within the profession and subsequent efficacy and goals. Throughout this process, Lent et al. (1994) posit there are person and contextual influences which mediate those goals and actions. For the purposes of this work, we choose to focus on the contextual aspects, career interest aspect, and choice actions through the self-reporting of factors which influence staying in the Agricultural Education profession.

Purpose

The purpose of this study is to investigate the characteristics for longevity of current North Dakota agricultural education teachers. The research questions which guided this study are:

1. What are the characteristics of the employer and school district which impact why the educator is remaining in the classroom?
2. How does the educator's involvement in the FFA impact why they choose to remain in the classroom?

Methods

This study utilized a descriptive survey research approach. A questionnaire was distributed digitally via Qualtrics which was derived from Clemons and Lindner's (2017) work in teacher retention. There are a total of fourteen questions to investigate of the participant's demographics. The survey instrument was developed by faculty at Auburn University (Clemons & Lindner, 2017) and consisted of three categories: Characteristics of Climate and Culture of the Employer, Professional Development as an FFA Advisor, Personal Characteristics of Self, Family, and Peers. The survey contains 80 statements developed through prior research that was related to teacher matriculation, per-service teacher perceptions and attitudes of agricultural education, participant interviews, pilot groups, and pilot testing. The Auburn faculty ran two pilot tests in the summer of 2017 to evaluate validity and reliability. Face and content validity were established by a national panel of experts, the Chronbach's alpha for each area is: Employer: .855, Advisor/FFA: .892, Personal: .723.

The instrument was distributed utilizing a state teacher's email list and included only those teachers who had three or more years of teaching experience in [State] which included 82 (N) teachers in total. Three reminders were sent to the selected frame. At the conclusion of data collection 49 (*n)* teachers provided fully useable responses for a response rate of 59.7%. Characteristics of those respondents are found in Table 1.

Table 1
Demographics of Ag Teachers (n=49)

Characteristic	***n***	**%**
Gender		
Male	27	55.1
Female	21	42.9
Prefer not to say	1	2.0
Age (years)		
21-24	3	6.1
25-34	16	32.7
35-44	14	28.6
45-54	12	24.5
55-64	4	8.2
Highest Degree Obtained		
Undergraduate	35	72.9
Master's Degree	13	27.1
Teacher Preparation		
Undergraduate teach education program	45	81.8
Substitute teaching which lead to position	1	1.8
Teaching experience (Years)		
3-10	20	42.5
11-20	15	31.9
21-40	12	25.5

Findings

The results from two sections of the instrument are reported herein which aligns with the research questions. Results of objective one describing school factors are found in Table 2. Freedom to determine curriculum, feeling secure in the place of employment, having supportive administration, excellent employee benefits including health, vision, dental and retirements are among the top seven contributing factors (of 22 items) affecting the job satisfaction of [State] secondary agriculture instructors.

Table 2
Top Characteristics of School Climate and Culture (n = 49)

Item#	*Description*	*Mean*	*SD*
15	The freedom to determine my own curriculum is an important factor of my remaining in the classroom.	4.48	0.58
7	Feeling secure in my employment at my school is an important factor of my remaining in the classroom.	4.36	0.69
8	Reliable administrative support is an important factor of my remaining in the classroom.	4.28	1.05
5	Employee benefits (health insurance, dental, vision, etc.) are an important factor of my remaining in the classroom.	4.22	0.81
6	Employer contribution to my retirement is an important factor of my remaining in the classroom	4.08	0.80
12	Feeling like I am an important contributor to the vision and values of the school is an important factor of my remaining in the classroom.	4.06	0.84
9	The social climate of my school is an important factor of my remaining in the classroom.	4.02	0.91

Table 3 displays the employer characteristics from Table 2 divided out and analyzed by teacher experience levels. Curriculum control is more important with those with fewer years of experience. As educators advance to later career, 21-40 years of experience, extended contract and being an important factor in the vision and values of the school is more important to educators remaining in the classroom than health and retirement benefits.

Table 3
Employer Characteristic factors by Experience Level

3-10 year teachers (n=20)			11-20 year teachers (n=15)			21-40 year teachers(n=12)		
Item#	Mean	SD	Item#	Mean	SD	Item#	Mean	SD
15	4.60	0.59	7	4.40	0.63	7	4.42	0.66
7	4.30	0.80	15	4.40	0.63	8	4.42	0.90
5	4.25	0.78	5	4.40	0.73	15	4.42	0.51
6	4.20	0.52	8	4.20	1.01	12	4.25	0.86
8	4.15	1.22	6	4.13	0.91	3	4.17	0.93

In describing objective two, friendships which are developed among agriculture educators is a top factor teachers remain in the classroom and profession as shown in Table 4. The top three reasons in the category for staying in the classroom all deal with collaborating and working with

colleagues within the profession. Assisting students within the FFA Organization as well as the teachers past FFA experiences also play a role in teacher longevity.

Table 4
Factors of FFA Advising (n=49)

Item#	*Description*	*Mean*	*SD*
20	The friendships I have developed with other advisors is a factor of my remaining in teaching.	4.24	1.02
2	Developing peer friendships with other FFA advisors is an important factor of my remaining in the classroom.	4.20	1.01
17	Collaborating with other FFA Advisors is an important factor of my remaining in the classroom.	4.18	0.98
5	Assisting students to attain their individual goals is an important factor of my remaining in the classroom.	4.12	0.71
1	My past experience with FFA is a factor of my remaining in the classroom.	3.92	1.02
13	Developing my program and attaining professional goals for the chapter is an important factor of my remaining in the classroom.	3.86	0.80
19	Learning to manage my time as an FFA advisor is an important factor of my remaining in the classroom.	3.68	0.84

By teacher experience level in Table 5, there is not a substantive difference between early career teachers and more experienced educators. It is noted that early and middle career educators rely more on that collaboration between other educators than the veteran teachers. Middle career teachers rated developing their programs and meeting goals for their programs more highly than early career and veteran teachers.

Table 5
FFA Characteristic factors by Experience Level

3-10 year teachers (n=20)			**11-20 year teachers (n=15)**			**21-40 year teachers(n=12)**		
Item#	**Mean**	**SD**	**Item#**	**Mean**	**SD**	**Item#**	**Mean**	**SD**
17	4.65	0.67	2	4.07	0.88	5	4.33	0.49
20	4.65	0.74	20	3.87	1.12	1	4.33	0.88
5	4.30	0.73	17	3.80	1.14	2	4.25	1.13
2	4.25	1.11	5	3.73	0.70	21	4.25	0.45
1	4.20	0.89	13	3.53	0.83	20	4.17	1.11

Conclusion and Recommendations

Many mediating factors play into a teacher's decision to stay in the profession. As evidenced by these findings, the contextual factors Lent et al. (1994) proposed appear to find their way into the full process of stay-ability. Interpretation of this study needs limited to the subject state and the responding sample. From this work we can reasonably conclude that a supportive administration and feeling secure in the workplace is among the top reasons for success in remaining in the profession and current work environment. This finding is strongly supported by other research (Castillo & Cano, 1999; Walker, Garton, & Kitchel, 2004). Benefits provided through the

employer also impact the teacher longevity of the subject agriculture teachers. Teachers can influence all of these characteristics by having appropriate conversations with administration, state Career and Technical Education staff, advisory boards, and school boards. Having this conversation can lead to educators knowing the expectation of their administration which can lead to job satisfaction (Clemons & Lindner, 2017). Developing positive relationships between state staff, school administration including school board, the advisory committee, and the teacher could have some added benefits to the agricultural education program. Teachers may not have a direct choice in what administration decides as far as negotiations and other decisions however, they can provide input and express their concerns.

The freedom to create curriculum and teach what they feel is viable information within their classroom is extremely important. Educators need to ensure they, administration, and state staff are on the same page with curriculum choices. Educators should be in contact with their state staff, and ask for them to advocate for the educator when it comes to extended contracts and stipends for continuing education or meaningful professional development. Meaningful professional development allows educators to take quality curriculum materials back to their classroom as well as provide them with motivational material. Additionally, these opportunities can provide the collaboration that an agriculture education teacher seeks (Myers, Dyer, & Washburn, 2005; Hord, 2008). Meaningful professional development for mid-career agriculture educators in an effort to increase motivation and retention rates may be an important focus. Mid-career teachers have the lowest commitment to teaching as supported by Smalley & Smith, programs such as eXellence in Leadership for Retention (XLR8) could help educators get over that hurdle (2017).

The purpose of objective two was to determine the role of FFA involvement as an advisor on teacher longevity and success. Participants rated the relationships with other agriculture teachers and collaborating with each other as highly important to the success and longevity of their careers. Agriculture educators should find the time at these FFA events and collaborate with other agriculture educators while students are participating in these events. These opportunities could bring about new friendships as well as providing educators with ideas for their classroom and opportunities to see what other educators are doing within their programs as well. Beyond this, student successes are important to teacher longevity, and teachers see students succeed in all facets of the FFA Organization. Clemons and Lindner (2019) reported that participants of their study noted assisting students in achieving their goals had the highest impact on retention. Students who work hard to achieve their goals with the help of their advisor brings a sense of value to the teacher (Clemons & Lindner, 2019). Further research could be conducted to discover effective ways for collaboration among agriculture educators. Additional examination of what student success looks like and how that success impacts the career decisions of the agriculture teacher/FFA advisor. While the present study gave us a glimpse into aspects which influence practicing teachers, it should be noted that discussions with attrited teachers would certainly prove valuable toward the development of quality and sustained programming for current and upcoming teachers.

References

Adams, G. A., King, L. A., & King, D. W. (1996). Relationships of job and family involvement, family social support, and work-family conflict with job and life satisfaction. *Journal of Applied Psychology, 81*(4), 411-420. doi:10.1037//0021-9010.81.4.411

Castillo, J. X., & Cano, J. (1999). A Comparative Analysis of Ohio Agriculture Teachers Level Of Job Satisfaction. *Journal of Agricultural Education, 40*(4), 67-79. doi:10.5032/jae.1999.04067

Clark, M. S., Kelsey, K. D., & Brown, N. R. (2014). The Thornless Rose: A Phenomenological Look at Decisions Career Teachers Make to Remain in the Profession. *Journal of Agricultural Education, 55*(3), 43-56. doi:10.5032/jae.2014.03043

Clemons, C.A., & Lindner, J.R. (2017). Teaching for a lifetime. National teacher success and longevity study. National Association of Agricultural Educators National Conference. December 7, 2017. Nashville, Tennessee

Clemons, C.A., & Lindner, J.R. (2019). Teacher Longevity and Career Satisfaction in the Secondary Agriculture Education Classroom. *Journal of Agriculture Education, 60*(1), 186-201. Doi:10.5032/jae.2019.01186

Conneely, N. & Uy, E. (2009). Teacher shortage undermines CTE. National Association of State Directors of Career Technical Education Consortium. Retrieved from https://careertech.org/sites/default/files/TeacherShortageUnderminesCTE-August2009.pdf

Crutchfield, N., Ritz, R., & Burris, S. (2013). Why Agricultural Educators Remain in the Classroom. *Journal of Agricultural Education, 54*(2), 1-14. doi:10.5032/jae.2013.02001

Delay, A., & Washburn, S. (2013). The Role of Collaboration in Secondary Agriculture Teacher Career Satisfaction and Career Retention. *Journal of Agricultural Education,* 104-120. doi:10.5032/jae.2013.04104

Hord, S. (2008). Evolution of the professional learning community. *Journal of Staff Development, 29*(3), 10-13, 66. http://search.proquest.com/docview/ 211516745?accountid=36812.

Ingersoll, R. M. (2001). Teacher Turnover and Teacher Shortages: An Organizational Analysis. *American Educational Research Journal, 38*(3), 499-534. doi:10.3102/00028312038003499

Lent, R. W., Brown, S. D., & Hackett, G. (1994). Toward a unifying social cognitive theory of career and academic interest, choice, and performance. Journal of Vocational Behavior, 45, 79-122. doi: 10.1006/jvbe.1994.1027.

Marx, A. A., Smith, A. R., Smalley, S. W., & Miller, C. (2017). Previous Experience Not Required: Contextualizing the Choice to Teach School-based Agricultural Education. *Journal of Agricultural Education, 58*(4), 126-142. doi.org/10.5032/jae.2017.04126

Myers, B. E., Dyer, J. E., & Washburn, S. G. (2005). Problems Facing Beginning Agriculture Teachers. *Journal of Agricultural Education, 46*(3), 47-55. doi:10.5032/jae.2005.03047

Reynolds, A., & Wang, L. (2005). Teacher Retention: What Role Does Professional Development School Preparation Play? *The New Educator, 1*(3), 205-229. doi:10.1080/15476880590966312

Smalley, S., & Smith, A. (2017). Professional Development Needs of Mid-Career Agriculture Teachers. *Journal of Agricultural Education, 58*(4), 282-290. doi:10.5032/jae.2017.04283

Walker, W., Garton, B., & Kitchel, T. (2004). Job Satisfaction and Retention of Secondary Agriculture Teachers. *Journal of Agricultural Education, 45*(2), 28-38. doi:10.5032/jae.2004.02028

Zhang, G. & Zeller, N. (2016). A Longitudinal Investigation of the Relationship between Teacher Preparation and Teacher Retention. *Teacher Education Quarterly.*

com.ezproxy.lib.ndsu.nodak.edu/login.aspx?direct=true&db=eue&AN=115066898&site=ehost-live&scope=site

Motivational Beliefs of School Based Agricultural Education Teachers through Career Stages

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Introduction

The literature on teacher beliefs suggests that there are marked differences between preservice, novice, and veteran teachers (Patrick & Pintrich, 2001). Scholars describe the status of educators in stages based on years of experience in the classroom. Christensen, Burke, Fessler, and Hagstrom (1983) detail the stages of teachers' careers following preservice preparation as "induction and the early years, the middle years, and the later years toward retirement. In each of their stages, they define the differing needs of professional development corresponding to the characteristics of adult learning. As an example, Masuda, Ebersole, and Barrett (2013) found that preservice, early, mid and late career teachers differed in their attitudes and willingness to engage in professional development. It stands to reason, then, teachers may also differ in their beliefs and approaches toward motivating their students to engage in their classrooms.

Overarching theories on motivation can help illustrate the ways motivation impacts key outcomes in educational environments. Expectancy-value theory, for example, posits the choices an individual makes regarding a task and how they perform are a function of their expectancies (e.g. self-efficacy) and values (e.g. utility value and cost) (Wigfield & Eccles, 2000). Similarly, self-determination theory can be applied to describe the degree to which a student is intrinsically motivated based upon their autonomy, relatedness, and competence (Ryan & Deci, 2000). Given the impact on student performance, it is important for educators to have a strong command of how to impact student motivation in order to provide the best learning environment for students. The purpose of this study was to investigate the beliefs teachers' hold regarding student's motivations.

Conceptual Framework

The conceptual framework for this study was the Sociocultural Model of Embedded Beliefs Systems (see Figure 1; Jones & Carter, 2007). The model displays the construction of science teachers' beliefs and attitudes through reciprocal interactions and cultural contexts. With no defined origin, a cyclical process is implied where beliefs, epistemologies, and attitudes are formed, modified, and influence instructional practices.

Teacher beliefs are influenced by the teachers' perceived efficacy, social norms, and environmental constraints. Self-efficacy is the belief of one's ability to execute a task to achieve a desired attainment (Bandura, 1997) and has been determined to be a key component of one's belief system which influences instructional decisions, practices utilized, and motivation (Jones & Leagon, 2014). Self-efficacy can be influenced by prior experiences, successes, failures, and feedback received (Jones & Leagon, 2014). Teacher beliefs and thus instructional practices are also influenced by social norms and the expectations placed on teachers by others (Jones & Carter, 2007). Available resources, time constraints, and accessible funding are types of environmental constraints which could influence teacher beliefs and attitudes (Jones & Carter,

2007). Epistemologies provide a lens for which teachers develop and assess their instructional practices (Jones & Carter, 2007). The beliefs of teaching and learning are primarily affected by the teachers' own educational experiences or apprenticeship of observation (Eick & Reed, 2002; Jones & Carter, 2007).

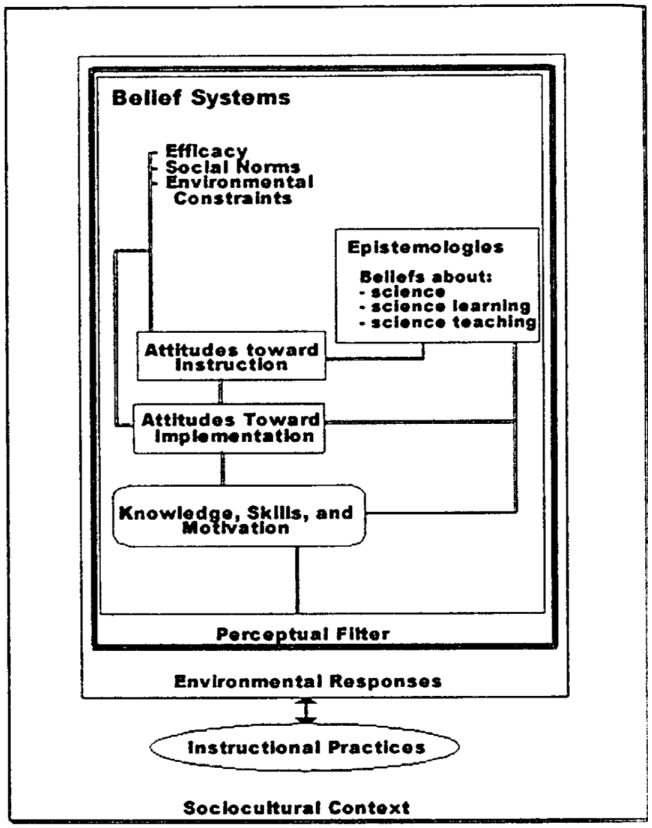

Figure 1. Sociocultural model of Embedded Beliefs Systems

While beliefs and attitudes are connected within one's decision making, it is important to outline both concepts for the purpose of this study. Thus, beliefs are viewed as "predispositions to action", whereas attitudes are "a set of interrelated predispositions to action organized around an object or situation" (Rokeach, 1972, p. 113). The cyclical process of beliefs, epistemologies, and attitudes development, is then filtered through the individuals' perspective. Environmental responses, primarily changes in student learning, further influences the development, change, and implementation of teacher beliefs (Guskey, 1986; Jones & Carter, 2007). The perceptual filter and environmental responses via a developed or altered belief or attitude will then influence the instructional practices a teacher utilizes. Lastly, the beliefs system is underlined by the sociocultural context (Jones & Carter, 2007). Thus, the teachers' instructional settings such as: the communities' socioeconomic status, country, region within a country, and cultural/religious beliefs situate the teachers' beliefs.

Purpose and Research Question

The purpose of this study was to examine the beliefs system SBAE teachers possess related to student motivation. The question which guided our inquiry was: What is the belief system held by SBAE teachers regarding student motivation during the early, mid, and late career stages?

Methods

We utilized a phenomenological approach for this study (Moustakas, 1994). The central phenomenon we investigated was agriculture teachers' beliefs regarding student motivation. We approached this study through a constructivist lens (Crotty, 1998), specifically relying on the social constructivist learning theory which highlights the role of the social process in meaning making and knowledge assimilation (Schunk, 2012). We are all former high school agriculture teachers and are all currently employed as university teacher educators in agricultural education at four universities across the United States. We have attempted to bracket those experiences to allow the true essence of the phenomenon to emerge (Creswell, 2013).

A total of 37 high school agriculture teachers employed during the 2017-2018 school year participated in this study. Teacher beliefs develop over time due to experience in the classroom (Darling-Hammond & Bransford, 2005); therefore, we included teachers with varying years of experience within three teacher career phases: early, mid, and late career (The National Association for Agricultural Educators, 2015). To establish consistency, we attached a years of experience range to each of the career phases: early career (1-7 years), mid-career (8-15 years), and late career (16+) (Fessler, & Rice, 2010). In addition to career phases, we choose teachers from four distinct regions including: Northern (North Dakota and South Dakota), Eastern (Pennsylvania), Central (Ohio) and Western (Arizona) to achieve diverse geographic representation.

We conducted a total of 12 focus groups. Three per region, divided by career experience phases. Each focus group contained between two and four participants. To attain diversity and recruit participants, a Qualtrics questionnaire was developed. We collected data during the spring and fall of 2018. All focus groups were conducted via Zoom and were audio and video recorded for transcription purposes. Audio files were uploaded to a transcription service and verbatim manuscripts were generated for each focus group. Semi-structured interview questions were developed based on relevant literature and the conceptual framework. Each focus group lasted 60-90 minutes in length. Two researchers moderated each focus group, and each researcher participated in two regionals sets of focus groups (6 focus groups in total).

Data were analyzed using the phenomenological techniques of horizontalization, identification of meaning units, and clustering of themes which culminated in the development of the true essence of the phenomenon (Moustakas, 1994). There were no regional differences identified during horizontalization, so the decision was made to sort by career stages as analysis continued. The meaning making units were clustered into themes and subthemes, removing any overlapping or repetitive statements (Moustakas, 1994). Finally, the essence of the phenomenon was constructed around the stages of locus of motivation for each career stage, resulting in the final model and subsequent descriptions. All data was managed using Nvivo 12 data management software to generate the initial codes which were compiled and confirmed by two researchers. These initial codes were sent to two others in the research team to complete the axial coding process to develop categories. This process occurred independently to establish initial categories, they then met virtually to combine and narrow to an agreed upon set of meaning making units (Moustakas,

1994). The categories were then sent to the first researchers to complete the final step, selective coding whereby themes and subthemes were developed. To ensure trustworthiness of our study a variety of strategies were employed including: worthy topic, rich rigor, sincerity, credibility, resonance, significant contribution, ethical, and meaningful coherence (Tracy, 2010).

Findings

Our analysis revealed several key differences between teachers in early, mid, and late career stages. We summarized the comparisons revealed regarding their locus of motivation, originations of their beliefs, their motivation context, and their student outcomes focus in Figure 2. With space in mind, many orienting and supporting quotes needed removed, however we feel the foundational picture is painted.

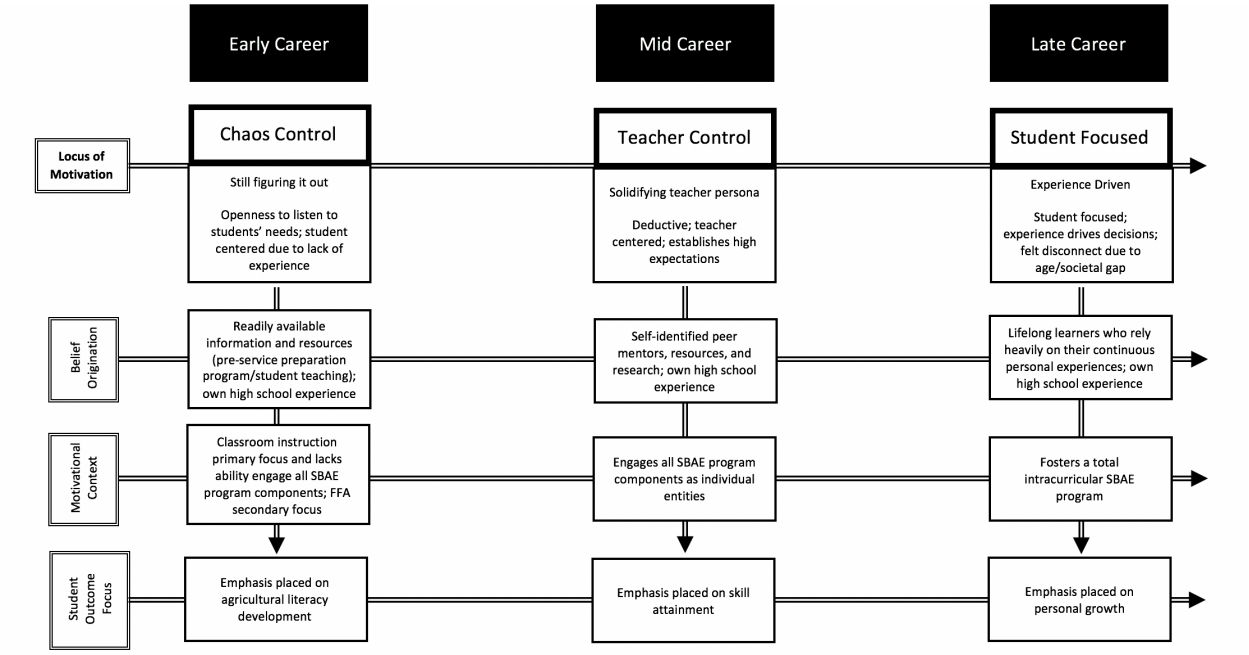

Figure 2. Teacher Beliefs on Student Motivation by Career Phases

Locus of Motivation

Participants' lived experience centered on the locus of motivation within each career stage: chaos control, teacher control, and student-focused. The teachers operated within a certain locus of motivation which dictated how they managed, directed, or delegated control and motivation.

Chaos control.

The early career stage teachers possessed a locus of motivation which focused on chaos control. Within chaos control, the teachers identified that they felt that they were still trying to determine how to motivate students within the SBAE program. Jake said, "I'm still figuring everything out. I feel like it changes on a daily basis". Positively, they never viewed the chaos through a negative lens but as motivation. Becky viewed the control more as a motivational, exploratory process where both she and her students can grow together. Further, it emerged that the early career teachers relied on using student needs, interests, and student-centered teaching strategies to motivate students.

Teacher control.
As the mid-career teachers come into themselves and solidify their teaching persona, they tended to harbor as much control as possible which centered on motivational beliefs internal to the teachers and teacher-centered strategies. The teachers viewed the motivational process, within the classroom, as a deductive process dictated by the teacher. Monica discussed how she believed that the teachers' level of enthusiasm and the presentation of the content directs student motivation. Setting high expectations also drove their motivational beliefs. These expectations aligned with the teachers' self-perception that they are hard-working, motivated individuals and their students should be, too.

Student-focused.
Student-focused and student-directed activities were at the center of the late career teachers' motivational beliefs and drove their motivational/instructional decisions. Numerous late-career teachers described themselves as being "very student-centered" (Amy), more of a guide than a sage (Lynn and Kathy), and "very student-led, student-driven" (Clark). The teachers also utilized their student-focused beliefs to help bridge the age and societal gap they experienced with connecting to their students.

Career Progression Themes
Belief origination.
Beliefs teachers expressed had specific origins which varied based on their particular career stage. Within early career focus groups, it emerged that many of their motivational beliefs originated from the most readily available information and resources from their pre-service program and student teaching experiences. The origin of the mid-career teachers' beliefs mirrored their teacher control locus of motivation, as their beliefs were rooted in resources and mentors the teachers self-identified. They discussed as their motivational beliefs continued to grow, they possessed a desire to consume new information and felt the need to regulate sources of information. This desire continued into the late-career as they were explicit about their desire to be lifelong learners who relied heavily on their personal experiences. Amber said, "If we're not taking on new challenges and learning new things, then I feel like I need to find a new job, because that's what teaching is all about".

Motivational context.
At each career stage, teachers utilized different SBAE program contexts to emphasize student motivation and focus efforts on motivational strategy development and implementation. For early-career teachers, their primary motivational context centered on classroom instruction, with FFA being secondary. The teachers also discussed a lack of ability, due to experiencing chaos control, to engage all SBAE program components and to develop intracurricular experiences for students. Mid-career teachers shifted their motivational context where they utilized all SBAE program components as individual entities, not intracurricular experiences. In contrast, the late career teachers discussed intracurricular experiences were where student motivation truly flourished and allowed the students to develop efficacy through knowledge and skill application from one program component to another.

Focus of student outcomes.
The teachers varied based on the outcomes they believed students would experience in the SBAE program. Early career teachers expressed beliefs that the primary focus of SBAE outcomes centered on developing agricultural literacy and knowledge to be more educated consumers and citizens. Mid-career teachers focused on developing students' technical skills and many framed skill development through the lens of technical skills and general skills with application beyond school. Late career teachers believed the outcomes experienced in SBAE programs advanced students' personal growth. The teachers' beliefs emerged as a collective of agricultural literacy development and general skill attainment for holistic student development.

Discussion

The ways teachers think about and perceive teaching evolves across their professional timeline (Darling-Hammond & Bransford, 2005; Patrick & Pintrich, 2001), this study supports that assertion. Along their timeline, their Locus of Motivation develops incrementally as they gain experiences as a teacher. There are periods where very little is in control and others where control is exerted in an effort to create balance. The development of these Loci is akin to the building of a house. Early career teachers are organizing and arranging all the pieces; finding the site, asking the questions, making initial materials decisions, and constantly pushing things along to keep it moving. Mid-career teachers have the foundation set with subfloors, walls, windows, and the roof in place. They are now in control of the process and can more clearly itemize their continued steps. Late career teachers have the house built and are pulling weeds in the flower beds. They are focused on maintenance and keeping things in check.

Early career teachers look to mid-career and late-career teachers for guidance and as mentors. They need to make certain to gain perspective over coveting what the mentors are presently accomplishing. The process of teacher development takes time and the chaos needs endured, at least to an extent. Capacity to more holistically engage themselves and their students in the total SBAE program expands across the career. Teachers begin knowing how to be a classroom teacher and add in the two remaining components over time.

We propose a few recommendations for practice and research from this analysis. States can intentionally focus professional development for teachers in each stage. Early career teachers need agricultural content and diverse pedagogy coaching to broaden their library and empower their belief focus on literacy in student outcomes. Mid-career teachers need to practically and philosophically dive into the 3-component model of Agricultural Education to enhance student development across the program. Late-career teachers need to be part of developing and guiding this effort as doing so will speak to their beliefs in personal growth and commitment. Early career teachers may serve as a resource for Late-career teachers in developing more contemporary ways to connect with their high school students. Further inquiry into the process of teachers' transitioning beliefs between career stages could give insight to their own expertise development. What occurs which brings the teacher out of chaos control? When do teachers feel ready to focus more intracurricularly? What shift(s) occurs for teachers to focus on skill development from a focus on literacy?

References

Christensen, J., Burke, P., Fessler, R., & Hagstrom, D. (1983). *Stages of teachers' careers: Implications for professional development.* Washington, DC: National Institute of Education (ERIC Document Reproduction Services No. ED 227 054).

Creswell, J. W. (2013). *Qualitative inquiry & research design: Choosing among five approaches*. Thousand Oaks, CA: Sage Publications.

Crotty M. (1998). *The foundations of social research: Meaning and perspective in the research process.* Thousand Oaks, CA: Sage Publications.

Darling-Hammond, L., & Bransford, J. (Eds.). (2005). *Preparing teachers for a changing world: What teachers should learn and be able to do.* San Francisco, California: Jossey-Bass.

Fessler, R., & Rice, E. (2010). Teachers career stages and professional development. In P. Peterson, E. Baker, & B. McGaw (Eds.), *International Encyclopedia of Education* (pp. 582–586). Oxford: Elsevier.

Jones, M. G., & Carter, G. (2007). Science teacher attitudes and beliefs. *Handbook of research on science education*, 1067-1104.

Masuda, A. M., Ebersole, M. M., & Barrett, D. (2013). A qualitative inquiry: Teachers' attitudes and willingness to engage in professional development experiences at different career stages. *Delta Kappa Gamma Bulletin, 79*(2), 6.

Moustakas, C. (1994). *Phenomenological research methods.* Thousand Oaks, CA: Sage Publications.

National Association of Agricultural Educators (2015). *Ag teacher's life cycle*. Retrieved from https://www.naae.org/lifecycle/

Patrick, H., & Pintrich, P. R. (2001). Conceptual change in teachers' intuitive conceptions of learning, motivation, and instruction: The role of motivational and epistemological beliefs. *Understanding and teaching the intuitive mind: Student and teacher learning*, 117-143.

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist*, *55*(1), 68.

Schunk, D. H. (2012). *Learning theories: An educational perspective*. (6th ed.). Boston, MA: Pearson.

Tracy, S. J. (2010). Qualitative quality: Eight "big-tent" criteria for excellent qualitative research. *Qualitative Inquiry, 16*(10), 837-851. doi:10.1177/1077800410383121

Wigfield, A., & Eccles, J. S. (2000). Expectancy–value theory of achievement motivation. *Contemporary educational psychology*, *25*(1), 68-81.

Shared Motivational Beliefs of School Based Agricultural Education Teachers

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Introduction

Overarching theories on motivation can help to illustrate the ways motivation impacts key outcomes in educational environments. Expectancy-value theory, for example, posits that the choices an individual makes regarding a task and how they perform are a function of their expectancies (e.g. self-efficacy) and values (e.g. utility value and cost) (Wigfield & Eccles, 2000). Similarly, self-determination theory can be applied to describe the degree to which a student is intrinsically motivated based upon their autonomy, relatedness, and competence (Ryan & Deci, 2000). Given the impact on student performance, it is important for educators to have a strong belief system and strategies to impact student motivation.

The literature on teacher beliefs suggests that there are marked differences between preservice, novice and veteran teachers (Patrick & Pintrich, 2001). However, specific to teacher beliefs about motivation, researchers have demonstrated the role of individual and group beliefs in developing school climate around motivation (Klassen et al., 2008). A teacher's personal motivation and beliefs have also been shown to be positive contributors to autonomy-supportive behavior in the classroom (Katz & Shahar, 2015). Mansfield and Violet (2010) discuss several factors that contribute to the beliefs about classroom motivation of preservice teachers; among them are prior beliefs, the alignment and conflict of ideas, and self-motivating factors. Although the literature firmly suggests that the beliefs of teachers matter, it has proved very difficult to measure. Teacher efficacy and its influence on a teachers' belief in their ability to manage a classroom, engage students, and utilize instructional strategies is the most commonly measured teacher belief (Tschannen-Moran & Hoy, 2001).

School-based agricultural education scholars have made efforts to describe the beliefs of agriculture teachers concerning a host of issues including alternative certification (Robinson & Haynes, 2011); intentions to teach SBAE (Lawver & Torres, 2011); science credit for agriculture courses (Johnson, 1996), instructional supervision (Paulsen & Martin, 2013). Collectively they demonstrate that beliefs agriculture teachers possess can have measured effects on a variety of outcomes important to the success of a SBAE program.

Conceptual Framework

The conceptual framework which informed this study was the Sociocultural Model of Embedded Beliefs Systems (see Figure 1; Jones & Carter, 2007). The model outlines the construction of science teachers' beliefs and attitudes through reciprocal interactions and cultural contexts and their influence on instructional practices. Since the beliefs of educators regarding a range of issues influences their actions as a teacher, and their experiences in the classroom can in turn influence their beliefs, this model has implications for both preservice teacher education programs and in-service professional development alike. Better understanding the beliefs agricultural education teacher possess would afford teacher education programs more awareness for the beliefs which are most ripe for impacting future practice. Likewise, insight into the

beliefs of practicing agriculture teachers and, importantly, the derivation of those beliefs, would provide valuable context for the ways to structure in-service professional development experiences.

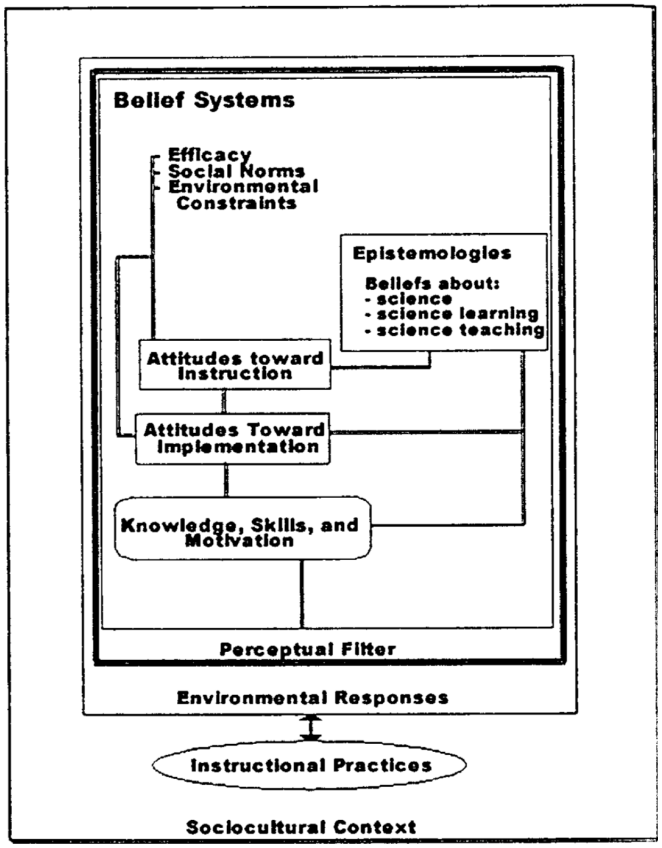

Figure 1. Sociocultural model of Embedded Beliefs Systems

Purpose and Research Questions

The purpose of this study was to examine the beliefs held by School Based Agricultural Education (SBAE) teachers related to student motivation and was guided by the research question: what student motivation beliefs are held by SBAE teachers regardless of their career stage?

Methods

We utilized a phenomenological approach for this study (Moustakas, 1994). The central phenomenon we investigated was agriculture teachers' beliefs regarding student motivation. We approached this study through a constructivist lens (Crotty, 1998), specifically relying on the social constructivist learning theory which highlights the role of the social process in meaning making and knowledge assimilation (Schunk, 2012). We are all former high school agriculture teachers and are all currently employed as university teacher educators in agricultural education at four universities across the United States. We have attempted to bracket those experiences to allow the true essence of the phenomenon to emerge (Creswell, 2013).

A total of 37 high school agriculture teachers employed during the 2017-2018 school year participated in this study. Teacher beliefs develop over time due to experience in the classroom (Darling-Hammond & Bransford, 2005); therefore, we included teachers with varying years of experience within three teacher career phases: early, mid, and late career (The National Association for Agricultural Educators, 2015). To establish consistency, we attached a years of experience range to each of the career phases: early career (1-7 years), mid-career (8-15 years), and late career (16+) (Fessler & Rice, 2010). In addition to career phases, we choose teachers from four distinct regions including: Northern (North Dakota and South Dakota), Eastern (Pennsylvania), Central (Ohio) and Western (Arizona) to achieve diverse geographic representation.

We conducted a total of 12 focus groups. Three per region, divided out by career experience phases. Each focus group contained a minimum of 2 and a maximum of 4 participants. To attain diversity and recruit participants, a Qualtrics questionnaire was developed. The survey was used strictly to determine the demographics of participants and aid the recruitment efforts for qualitative data collection. We collected data during the spring and fall of 2018. All focus groups were conducted via Zoom and were audio and video recorded for transcription purposes. Semi-structured interview questions were developed based on relevant literature and the conceptual framework. Each focus group lasted 60-90 minutes in length.

Data were analyzed using the phenomenological techniques of horizontalization, identification of meaning units, and clustering of themes which culminated in the development of the true essence of the phenomenon (Moustakas, 1994). Data were analyzed with open, axial, and selective coding techniques (Corbin & Strauss, 2015). Two members of the research team open coded the entire dataset. Next, the open codes were combined into more comprehensive categories through the process of axial coding by two different members of the research team. Finally, selective coding was performed to develop the core themes presented in the findings.

There were no regional differences identified during horizontalization, so the decision was made to sort by career stages as analysis continued. The meaning making units were clustered into themes and subthemes, removing any overlapping or repetitive statements (Moustakas, 1994). Finally, the essence of the phenomenon was constructed around the stages of locus of motivation for each career stage, resulting in the final model and subsequent descriptions. All data was managed using Nvivo 12 data management software. To ensure trustworthiness of our study a variety of strategies were employed including: worthy topic, rich rigor, sincerity, credibility, resonance, significant contribution, ethical, and meaningful coherence (Tracy, 2010).

Findings

Across the career stages four shared motivational beliefs emerged: fostering caring relationships, differentiated motivational strategies, struggles of SAE implementation and motivation, and success breeds success.

Fostering Caring Relationships

One of the primary beliefs held by all participants was the need to develop relationships within the SBAE programs. The foundation of these relationships was built upon mutual caring and understanding, “The relationships that you can build with your students. You learn to care about

them. They learn to care about you..." (Monica). The teachers then discussed how they believed these caring relationships where inherently motivating to students. Clark said, "When they come in you have to make them feel like family and that is probably the biggest thing that you can do to get them to buy in."

While it was clear that teachers believe relationships matter, the participants also articulated how their role as a SBAE teacher influenced the ways in which they could develop student relationships. The teachers identified the extra hours for FFA and SAE activities served as a critical component to better understanding their students. Additionally, the time out of the classroom allowed for more student interactions which the teachers believed fostered student relationships, motivation, and participation through socially based activities.

Differentiated Motivational Strategies

Teachers discussed their beliefs in the need to motivate students within all facets of the SBAE program. However, these beliefs were encapsulated in their presumption that no one idea, process, or strategy will motivate all students. As Jake described it, "Everything [motivation] is very different for each individual person. Sometimes they're motivated by all of those things, sometimes just one. It's just kinda like the shotgun approach." This "shotgun approach" was described by nearly every participant. Trying to determine what motivates each student was a point of intrigue and frustration for the teachers. Even as a late career teacher, Kathy, described that she was still struggling to motivate all students, "If I could figure that answer out for every one of my kids, I'd be doing great."

Struggles of SAE Implementation and Motivation

As teachers were discussing SAEs during the focus groups, a collective frustration clearly emerged between participants. Their frustrations where couched within the belief of the importance of SAEs. James said, "This [SAE] is the one that I struggle with the most because I thoroughly, thoroughly, thoroughly believe that every kid has to have SAE." Nearly all participants identified arduous and inconsistent experiences when implementing SAEs. Teachers discussed that students who had previous family/work experience or had readily available access to an experience can easily experience success. However, this does not describe the majority of their students, and this gap is what teachers connect to their inconsistent results. Further teachers lacked the ability to identify clear implementation and engagement strategies.

Teachers experienced the onerous task of motivating students to engage in SAEs. Participants discussed that the overall idea of or the predetermined perceptions students had about SAEs deterred their motivation. The teachers also identified mechanical components of SAEs which negatively impacted student motivation. Specifically, record keeping and program management were identified as motivational deterrents. Erin discussed, "I think sometimes, trying to figure out how AET [record keeping system] works itself, and keeping track of SAE's, it's deterring our kids." While teachers discussed their general frustrations with SAE motivation, some teachers discussed how they have found success in motivating students. Furthermore, these motivational strategies were primarily situated within extrinsic motivators such as money, scholarships, and awards.

Success Breeds Success

The teachers believed that experienced success or observing a peer experience success was inherently motivating to students. Richard stated, "if kids have success or they see their friends having success, then they're going to want to do it." Kathy also discussed that little successes can help to build student confidence, "baby step 'em, like little success and then, as they get a little bit more confidence then they can have a little bit more faith in themselves…" The teachers also emphasized the importance of peer relationships within building upon successes. Specifically, teachers identified that successful upperclassmen can encourage and guide underclassmen, "…making sure you get underclassmen to join in, they learn from the upperclassmen what it takes to be successful and how many hours it's going to take to put in to become a top ten finalist…" (Cindy)

Discussion

Regardless of the career stage a participant belonged to, they all shared specific beliefs regarding student motivation. These shared beliefs could be potential social norms the participants developed through the agricultural education profession (Jones & Carter, 2007). The teachers all believed that caring relationships must be developed to motivate students and that these relationships are more accessible to SBAE teachers because of FFA and SAE extended hours. This finding aligns with the need to support relatedness within Self Determination Theory (Ryan & Deci, 2000) and previous literature which found that developing relationships was the foundation of the process of supporting student motivation within SBAE programs (Bowling & Ball, 2018). While the participants were confident about the importance of relationship development, they were unsure about how to motivate all students. The teachers acknowledged that they believed that they had to use a shotgun approach and differentiate the motivational strategies that they utilized for each student. Regardless of years of teaching experience, the teachers also identified that they experienced difficulties implementing and motivating students to participate in SAEs. Lastly, participants believed that as students observed or experienced success, they were more likely to be motivated to continue and/or expand their engagement in the SBAE program. This finding aligns with supporting student competence (Ryan & Deci, 2000) and efficacy (Wigfield & Eccles, 2000).

Teacher beliefs influence their attitudes towards instructional and motivational practices and determine what practices are utilized. Thus, when teachers possess positive, efficacious beliefs they are more likely to utilize the associated strategies (Jones & Carter, 2007). The teachers were confident on the importance of relationship development and scaffolding success. Thus, it is likely they are using consistent relationship and achievement building strategies. A concern arises when beliefs are less efficacious, and the associated strategies are not solidified. The teachers expressed a lack of belief efficacy to constantly motivate all students and implement SAEs, which developed inconsistent strategies. This resulted in the shotgun approach or the potential use of every motivational strategy, for every student, every day. These motivational approaches carry major implications for SBAE teachers when considering the amount of time and effort which would be dedicated to this motivational process.

It is recommended that teachers develop SBAE programs where caring relationships can flourish and students can experience scaffolded successes. Additionally, teachers should explore more intrinsically based motivational strategies to motivate students to negate the shotgun approach.

SBAE teachers, teacher preparation programs, and the profession should explore the difficulties related to SAE motivation which emerged within this study. Future research should continue to investigate teacher beliefs about student motivation. Specifically, studies should investigate the beliefs teachers possess around and the strategies utilized to develop professional, caring relationships with students. Studies should also investigate the notion of the motivational shotgun approach to motivating students.

References

Bowling, A. M., & Ball, A. L. (2018). Conceptualizing the process for supporting students' psychological needs and motivation within School Based Agricultural Education Programs: A mixed methods study. *Proceedings of the National AAAE Research Conference,* Charleston, SC.

Corbin, J., & Strauss, A. (2015). *Basics of qualitative research: Techniques and procedures for developing grounded theory* (4th ed.). Thousand Oaks, CA: Sage Publications.

Creswell, J. W. (2013). *Qualitative inquiry & research design: Choosing among five approaches*. Thousand Oaks, CA: Sage Publications.

Crotty M. (1998). *The foundations of social research: Meaning and perspective in the research process.* Thousand Oaks, CA: Sage Publications.

Darling-Hammond, L., & Bransford, J. (Eds.). (2005). *Preparing teachers for a changing world: What teachers should learn and be able to do.* San Francisco, California: Jossey-Bass.

Fessler, R., & Rice, E. (2010). Teachers career stages and professional development. In P. Peterson, E. Baker, & B. McGaw (Eds.), *International Encyclopedia of Education* (pp. 582–586). Oxford: Elsevier.

Johnson, D. M. (1996). Science credit for agriculture: Relationship between perceived effects and teacher support. *Journal of Agricultural Education, 37(3), 9-17*. doi: 10.5032/jae.1996.03009

Jones, M. G., & Carter, G. (2007). Science teacher attitudes and beliefs. *Handbook of research on science education*, 1067-1104.

Katz, I., & Shahar, B. H. (2015). What makes a motivating teacher? Teachers' motivation and beliefs as predictors of their autonomy-supportive style. *School Psychology International, 36*(6), 575-588.

Klassen, R. M., Chong, W. H., Huan, V. S., Wong, I., Kates, A., & Hannok, W. (2008). Motivation beliefs of secondary school teachers in Canada and Singapore: A mixed methods study. *Teaching and Teacher Education*, *24*(7), 1919-1934.

Lawver, R., & Torres, R. (2011). Determinants of pre-service students' choice to teach secondary agricultural education. *Journal of Agricultural Education. 52. 61-71*. doi: 10.5032/jae.2011.01061.

Mansfield, C. F., & Volet, S. E. (2010). Developing beliefs about classroom motivation: Journeys of preservice teachers. *Teaching and Teacher Education, 26*(7), 1404-1415.

Moustakas, C. (1994). *Phenomenological research methods.* Thousand Oaks, CA: Sage Publications.

National Association of Agricultural Educators (2015). *Ag teacher's life cycle*. Retrieved from https://www.naae.org/lifecycle/

Patrick, H., & Pintrich, P. R. (2001). Conceptual change in teachers' intuitive conceptions of learning, motivation, and instruction: The role of motivational and epistemological

beliefs. *Understanding and teaching the intuitive mind: Student and teacher learning*, 117-143.

Paulsen, T., & Martin, R. (2013). Instructional supervision of agricultural education teachers: perceptions regarding selected beliefs. *Journal of Agricultural Education. 54. 99-113*. doi: 10.5032/jae.2013.02099

Robinson, J. S. & Haynes, J. C. (2011). Value and expectations of supervised agricultural experiences as expressed by agriculture instructors in Oklahoma who were alternatively certified. *Journal of Agricultural Education, 52(2), 47-57*. doi: 10.5032/jae.2011.02047

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist*, *55*(1), 68.

Schunk, D. H. (2012). *Learning theories: An educational perspective*. (6th ed.). Boston, MA: Pearson.

Tracy, S. J. (2010). Qualitative quality: Eight "big-tent" criteria for excellent qualitative research. *Qualitative Inquiry, 16*(10), 837-851. doi:10.1177/1077800410383121

Tschannen-Moran, M., & Hoy, A. W. (2001). Teacher efficacy: Capturing an elusive construct. *Teaching and teacher education, 17*(7), 783-805.

Wigfield, A., & Eccles, J. S. (2000). Expectancy–value theory of achievement motivation. *Contemporary educational psychology*, *25*(1), 68-81.

Secondary Agriculture Teachers' Knowledge, Beliefs and Teaching Practices of Climate Change

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Introduction

Global climate change (GCC) impacts on agriculture have been increasing and are projected to become severe in the future, leading to negative impacts including a decline in crop and livestock production, loss and degradation of critical agricultural soil and water assets, and disturbing food prices, storage and retailing at local, national, and global scales (Karl et al., 2012; Mader, 2012; U.S. Census Bureau 2012). In order to keep pace with GCC, it is critical to ensure agricultural communities adapt their practices in response to GCC and can aptly address concerns towards socio-economic issues. Leveraging agricultural education to generate knowledge and awareness is one way to mitigate the impacts of GCC (UNFCCC, 2018). However, very few K-12 teacher preparation programs in agricultural education require a focus on climate literacy or developing students' knowledge and understanding of GCC.

Climate literacy has experienced an increased emphasis in the past decade in K-12 science education. Supported by communities and organizations like American Association for the Advancement of Science (AAAS) and United States Global Climate Change Research Program (USGCRP) and states either adapting to Next Generation Science Standard (NGSS) or NGSS-like standards, topics about developing students' understanding of GCC are taught in middle and high school classrooms. In the U.S. about 75% of secondary science teachers include GCC in their classes and among those, most spend one to two hours on causes, evidence and impacts of the phenomenon (Plutzer et al., 2016). However, only 43% of secondary science teachers report receiving formal instruction and training in teaching about GCC, and 11% report having completed one or more courses entirely focused on climate change (Monroe Oxarart, Bowers & Chaves, 2017; Plutzer et al., 2016). This indicates that most science teachers lack required content knowledge and pedagogy for effectively teaching a complex topic like GCC and struggle to know when and where to include content about GCC that aligns to topics they already teach (Fortner, 2001). With few sustained opportunities for pre-service and in-service professional development, it is not surprising that teachers also hold misconceptions about GCC much like their students (Herman, Feldman, & Vernaza-Hernandez, 2017; Lambert, Lindgren, & Bleicher, 2012; Plutzer et al., 2016; Reynolds et al., 2010).

Although research has explored secondary science teacher's knowledge, beliefs, and instructional practices about GCC, no such attempt has been made to investigate secondary agricultural educators. Existing research studies provide strategies to help engage farmers for climate change adaptation and mitigation (Arbuckle et al., 2015; Tobin et al., 2017). However, there is a paucity of research exploring climate literacy within K-12 agricultural education. After conducting a literature review, only brief mentions of the topic were encountered. Therefore, it becomes critical to explore agriculture educators' conceptual understanding about the phenomenon of GCC, to address misconceptions about GCC, and to develop pedagogy required to teach the topics relevant to GCC in the context of food, agriculture, and natural resources. In

the future we expect to cultivate teacher preparation and professional development focusing on developing climate literacy relevant to K-12 agricultural education.

Purpose and Research Questions

Our purpose was to inquire and assess the foundational state of secondary agriculture teachers' knowledge, the choice of their practices, and their beliefs about GCC. Information acquired will be used to support strategically developing ongoing professional development opportunities that can be sustained and continue to impart information and training about teaching GCC. Our research questions are:

1) *How do secondary agriculture teachers conceptualize the phenomenon of GCC?*
2) *What beliefs do secondary agriculture teachers demonstrate about the phenomenon of GCC?*
3) *To what extent secondary agriculture teachers teach GCC in their classrooms and what are the concepts they emphasize?*

Methods/Procedures

Context and Participants

The study was conducted by using a cross-sectional survey examining in-service, secondary agriculture teachers' knowledge, instructional practices, and beliefs about GCC. All survey questions were integrated in an online interface using Qualtrics (Qualtrics, Provo, UT) and the resultant web-based survey was sent as a link embedded in an email to the teachers.

Instrumentation and Data Collection

The survey consisted of a total of 22 questions focused on eliciting secondary agriculture teachers' understanding, beliefs, and their instructional practices about GCC. The questions were divided into four blocks. Block one consisted of demographic questions, such as gender, age, and how much time was spent teaching about GCC. Participants were also asked to provide reasons for why they did or did not teach about GCC. Block two questions focused on eliciting conceptual knowledge about GCC. These questions were derived from Herman et al. (2017) and Lambert et al. (2012), two established and previously validated instruments. In total, there were five multiple choice questions and one open-ended question asking participants to describe GCC in their own words. Block three collected information about participants' teaching practices related to GCC. This section included a Likert-scale question asking participants to identify to what degree they incorporated GCC topics in their instruction. Participants were provided topics like "Impacts on water sources", "economic considerations" and "adaptations of species", and asked to select the amount of instruction provided from extensive/elicit, some, little/implied and none. In this block participants were also asked to describe their general approach to teaching climate change with options like avoidance, mentioned briefly, a distinct unit/lesson(s), and unifying theme of course. Participants were also provided a textbox to provide their own description. The final block (four), consisted of nine statements in which participants were asked to indicate the extent in which they agreed or disagreed to determine their beliefs. Some statements included "Climate change science methods are too unsure to be trusted", "I believe climate change is caused by human activities" and "I believe climate change is a natural phenomenon". The survey was piloted with four teachers from a convince group. Once responses

were collected, changes were made to the language of the questions as per their suggestions before distribution.

The lead researcher contacted faculty in 17 states and asked for assistance in distributing the survey. These states were selected as the lead researchers knew that faculty from these states had access to agricultural educators through professional affiliations and licensure programs. Of those, 12 states responded to the lead researcher's request; data collection commenced after receiving Institutional Review Board approval, over a 10-day period in April–May 2019. Participants were sent a reminder on day five of the survey being open to encourage more responses.

Data Analysis

Descriptive statistics were used for assessing results for RQ1, 2 and 3. In addition, thematic analysis of open-ended questions was conducted for analyzing secondary agricultural educators' conceptualization of GCC. For research question two, along with descriptive analysis, percentages of how many participants selected each level of the Likert scale were also analyzed. For research question three, the states were divided into three regions according to the US Census Bureau, West North Central, East North Central and South Atlantic.

Findings/Results

After the 10 days, *n*=258 (109 males, 146 females, and 3 unknown) secondary agriculture teachers from 14 states completed the survey. This was comprised of the 12 states that responded to the initial call, and two additional states from participants that previously belonged to one of the 12 initial states and had since moved. Of the These teachers belonged to a wide range of age from 21 to 67 years and taught a variety of subjects in the broad disciplines of science, agriculture, and technology. Most respondents were primarily licensed to teach agriculture (80.77%) with some licensed for science (19%), and earth science (2%). All participants were once on a state listserv for agricultural education and have since become either dual licensed or switched primary discipline areas. As this was a self-identified answer, it is difficult to determine if those that responded with something other than agricultural education teach multiple subject areas, or have left agricultural education in favor of another science discipline.

The first research question investigated respondents' conceptual understanding about the phenomenon of GCC. The participants responding to the survey demonstrated a comprehensive knowledge about the basic science concepts that constitute the understanding for GCC. Approximately 56% described carbon dioxide as a greenhouse gas capable of absorbing solar radiation, 3% described it as a gas released by plants, 86.4% identified that the amounts of carbon dioxide in the atmosphere had increased, and 92.11% correctly differentiated between weather and climate. Alternatively, 15.3% believed GCC to be natural and 18.8% believed it to be both a man-made and a natural phenomenon describing it to be a "*shifting of climate patterns, that have been observed over millions of years, mostly from anthropogenic influences to include burning of fossil fuels, habitat loss, and disruption of nutrient and matter cycles*." Certain misconceptions were also evident among the responses.

The second research question investigated respondents' beliefs about the phenomenon of GCC. The results indicated that the participants either strongly agree (35.65%) or agree (55.56%)

with scientists' consensus about the occurrence and that they hold sufficient to support climate change. Most participants also believed climate science creates scientifically testable predictions about the earth's climate (14.55% strongly agree, and 58.69% agree). However, it is interesting to note that although climate science is trustworthy and creates scientifically testable predictions, most participants believed that climate science needs to be based on controlled experiments (15.35% strongly agree and 48.37% agree), but they also believed that climate science is a valid science if only based on modeling. These two questions revealed contradicting beliefs. Contradicting results as for why GCC was occurring was also found as on one hand, most participants believed that GCC was mostly driven by natural causes (15.09% strongly agree, and 52.83% agree), but on the other hand, most of the participants also believed that GCC was mostly caused by human activities (29.30% strongly agree, and 48.84% agree). In addition, more than 70% of participants believed that climate change should be taught in agricultural education.

In the third research question, we investigated to what extent GCC was taught in their classrooms and what concepts they emphasized upon in their instruction. Survey data reported that 27.5% of the respondents did not include GCC as a part of their instruction, as compared to the rest of the respondents where topics about GCC were taught in varying amounts from 1-2 days (38.7%), 3-5 days (20.69%) to 6-10 days (6.9%). Only 6.13% of the respondents taught topics relevant to GCC for more than ten days. Among those who taught about GCC, only 18% taught it as a distinct unit or as a unifying theme while a majority (56.64%) mentioned GCC briefly in their everyday instruction. Respondents described teaching GCC as a part of their curriculum focusing on environmental science, natural resources, soil conservation, agricultural productivity, weather and climate, ecology, and agricultural science. Those who taught described including "both sides of the argument" and explaining about natural and anthropogenic nature of the phenomenon. Educators cited impacts on water sources, impacts on food supplies, and adaptation of species as the most frequent topics.

Conclusion

Overall, secondary agriculture teachers have a strong understanding about basic science concepts that help in understanding GCC; they are however, challenged by comprehending if the phenomenon is natural or anthropogenic. Teachers demonstrated their belief in scientists' consensus about the occurrence of GCC and trust in climate scientists' methods, although some question the validity of modeling-based data. Despite their knowledge and beliefs, most secondary agriculture teachers still agreed in the importance of teaching about GCC in agricultural education; however, they spend very little time to doing so. These results indicate that conversations about GCC between educators and their students are existent in K-12 agricultural education. The main challenge is helping educators developing an in-depth knowledge of GCC and identify where it aligns with the curriculum and standards for agriculture-based topics.

Discussion

Secondary agricultural educators responding to the survey demonstrated a strong knowledge about the basic science that is needed to understand GCC. Nonetheless, there are unclear about whether the phenomenon is natural or anthropogenic. In their descriptions, respondents stated the anthropogenic influence through fossil fuel combustion, increasing amount of carbon dioxide gas in the atmosphere and overuse of natural resources. For example

among the 55.7% that acknowledge the anthropogenic influence on GCC few described GCC as, "*A conglomeration of human interactions leading to rapid and substantial environmental changes*," and "*Humans continue to drill, mine and use fossil fuels that contribute to pollution and the decline of human health, as a result, the earth is warming up.*" On the contrary, 67.92% of teachers believed that GCC is a natural phenomenon. These respondents described Earth's natural cycles as "*A cyclic process of heating and cooling of our planet" and* "*climate change is a natural process that has occurred consistently over the course of this planet's existence*,". Similar findings were reported for secondary science teachers, where teachers understood the greenhouse effect, incoming/outgoing solar radiation and CO2 emissions, but they did not demonstrate a robust understanding about how the evidence for GCC was collected and processed (Clary & Wandersee, 2012; Summers et al., 2001; Plutzer et al., 2016). Hence, while the factual understanding about climate change prevails, the methods used by climate scientists and modeling-based data are not evident to most educators. Therefore, building epistemic understanding among educators about how the evidence for GCC is collected and data are processed by climate scientists is a critical next step. While agriculture and natural resources provide many opportunities for teaching and learning about GCC (Cross & Kahn, 2017; Shoulders & Myers, 2013; National Council for Agricultural Education, 2009), these aren't evident to educators and they need support in implementing this content in their classrooms.

References

Arbuckle Jr, J. G., Morton, L. W., & Hobbs, J. (2015). Understanding farmer perspectives on climate change adaptation and mitigation: The roles of trust in sources of climate information, climate change beliefs, and perceived risk. *Environment and behavior*, *47*(2), 205-234.

Clary, R. M., & Wandersee, J. H. (2012). Mandatory climate change discussions in online classrooms: Promoting students' climate literacy and understanding of the nature of science. *Journal of College Science Teaching*, *41*(5), 70.

Cross, S. M., & Kahn, S. (2018). Science in the Garden: A Qualitative Analysis of School-based Agricultural Educators' Strategies. *Journal of Agricultural Education*, *59*(4).

Fortner, R. W. (2001). Climate change in school: Where does it fit and how ready are we?. *Canadian Journal of Environmental Education (CJEE)*, *6*(1), 18-31.

Herman, B. C., Feldman, A., & Vernaza-Hernandez, V. (2017). Florida and Puerto Rico secondary science teachers' knowledge and teaching of climate change science. *International Journal of Science and Mathematics Education*, *15*(3), 451-471.

Karl, T. R., Gleason, B. E., Menne, M. J., McMahon, J. R., Heim Jr, R. R., Brewer, M. J., & Groisman, P. Y. (2012). US temperature and drought: Recent anomalies and trends. *Eos, Transactions American Geophysical Union*, *93*(47), 473-474.

Lambert, J. L., Lindgren, J., & Bleicher, R. (2012). Assessing elementary science methods students' understanding about global climate change. *International Journal of Science Education*, *34*(8), 1167-1187.

Mader, T. L. (2012). Impact of environmental stress on feedlot cattle. In *Western Section, American Society of Animal Science* (Vol. 62, pp. 335-339).

Monroe, M. C., Plate, R. R., Oxarart, A., Bowers, A., & Chaves, W. A. (2017). Identifying effective climate change education strategies: a systematic review of the research. *Environmental Education Research*, 1-22.

Plutzer, E., McCaffrey, M., Hannah, A. L., Rosenau, J., Berbeco, M., & Reid, A. H. (2016). Climate confusion among US teachers. *Science*, *351*(6274), 664-665.

Reynolds, T. W., Bostrom, A., Read, D., & Morgan, M. G. (2010). Now what do people know about global climate change? Survey studies of educated laypeople. *Risk Analysis: An International Journal*, *30*(10), 1520-1538.

Summers, M., Kruger, C., & Childs, A. (2001). Understanding the science of environmental issues: Development of a subject knowledge guide for primary teacher education. *International Journal of Science Education*, *23*(1), 33-53.

Shoulders, C. W., & Myers, B. E. (2013). Socioscientific Issues-Based Instruction: An Investigation of Agriscience Students' Content Knowledge Based on Student Variables. *Journal of Agricultural Education*, *54*(3), 140-156.

Tobin, D., Radhakrishna, R., Chatrchyan, A., & Allred, S. B. (2017). Addressing climate change impacts on agriculture and natural resources: Barriers and priorities for land-grant universities in the Northeastern United States. *Weather, Climate, and Society*, *9*(3), 591-606.

Reaching Science Literacy through School-based Agricultural Education

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Introduction

Over the next three decades, the human population has substantial, global challenges to solve. The human population is projected to increase from 7.6 billion people to approximately 9.8 billion (United Nations, 2017). More than half of this projected increase is expected to occur in Africa, with Asia being the second largest contributor (United Nations, 2017). Across the world, one in nine people (815 million) are food insecure and undernourished, with the majority of those people living in developing nations (United Nations, 2019). These challenges are complicated by climate change, which will affect every aspect of our society including our global food system, human health, and the economy (Hoegh-Guldberg, 2018).

In order to solve these issues, we must have a scientifically literate population (Rudolph & Horibe, 2016; Hurd, 1958). Science literacy is frequent in the popular lexicon with a multitude of scholarly definitions, but at its core, it is a general understanding of science necessary to participate in society as an informed citizen (DeBoer, 2000). A society that is scientifically literate has the knowledge to not only make informed decisions concerning their own personal lives but also form opinions on issues in society (NRC, 1996). Additionally, they have the skills to use their science knowledge to enact positive change within society through community involvement and democratic participation (Durant, Evans, & Thomas, 1989; Shen, 1975). Scientists alone cannot combat the effects of climate change and food insecurity; it will require citizens who understand scientific principles and are able to act in civic ways.

Agriculture is inextricably tied to science and will thus play a major role in solving the world's challenges. While the sciences of biology, chemistry, and physics work towards answering fundamental questions, agricultural science is an applied science that utilizes scientific knowledge to solve real-world problems, such as food insecurity and climate change. It is imperative then, that school-based agricultural education (SBAE) train the next generation of agriculturalists as well as consumers to become scientifically literate. There is a limited body of research regarding STEM, science integration, and therefore science literacy in agricultural education (Roberts, Harder, & Brashears, 2016). However, because of the applied, contextualized nature of agriculture, agricultural education has enormous potential to build the capacities of students as it pertains to science literacy and help them become informed consumers who will help solve local and global issues.

Conceptual Framework

The four rationales of science literacy from the National Academies of Science, Engineering, and Medicine served as the conceptual frame for this study (National Academies of Sciences, Engineering, and Medicine, 2016). The four rationales for the importance of science literacy are: the economic, personal, democratic, and cultural rationale. The economic rationale is a utilitarian argument for science literacy, which argues our economy requires a scientifically and technologically skilled population (NASEM, 2016). DeBoer (2000) states that one of the uses of science literacy is preparation for the world of work. For example, the agriculture industry needs

knowledgeable and skilled people to fill science and technology-related positions such as drone technologists and food scientists.

The personal rationale contends when people have science literacy skills they have a greater capacity to lead healthier, more sustainable lives. Beyond the personal the personal level, the democratic rational argues a democratic society functions better when its citizens, who are actively involved in civics, are scientifically informed (NASEM, 2016). Durant et al. (1989) suggested that public policy decisions can only be truly democratic if they result from informed debate. Civic participation in accordance with scientific consensus is more important now than ever if our society is going to be able to solve wicked challenges such as climate change, food insecurity, and disease.

The cultural rationale is unique from the other three rationales in that there is no extrinsic or practical justification (NASEM, 2016). Instead, the cultural rationale simply states the sciences are important to Western culture because they define how we understand the world (NASEM, 2016). Shen (1975) offered cultural science literacy as one of three types, and Durant et al. (1989) reasoned that people deserve to know about science because it is the greatest achievement of our culture. Hurd (1958) argued "If education is regarded as a sharing of the experiences of the culture, then science must have a place in the modern curriculum" (p. 13).

The American Association for Agricultural Education National Research Agenda (Roberts et al., 2016) indicates researching the integration of science and science literacy in Agricultural Education should be a high priority for the profession. Research Priority 3: *Sufficient Scientific and Professional Workforce that Addresses the Challenges of the 21st Century* and Research Priority 7: *Addressing Complex Problems* discuss the importance of science in Agricultural Education and preparing students for the future workforce. The present research seeks to contribute to these priority areas.

Purpose

The purpose of this study was to examine the concepts of science literacy in the context of school based agricultural education. This investigation was guided by the following research questions:

1. What are the historical and contemporary definitions of science literacy?
2. What are the similar components of science literacy definitions?
3. How does the three-circle model of Classroom instruction, FFA, and SAE align with the components of science literacy?

Methods

An extensive literature review of science literacy definitions was conducted with an exhaustive search of library databases such as ERIC, Google Scholar and journal websites with keyword searches of "scien* literacy". The researchers reviewed the definitions supplied by the literature review for common characteristics in order to develop a framework to illustrate which characteristics the definitions contained. Next, a review of the literature specific to agricultural education was conducted, and a crosswalk between the science literacy domains and SBAE developed. The *Journal of Agricultural Education* was selected as the bounds of the search due

to its place as the flagship refereed journal for agricultural education. A single coder was tasked with finding all science literacy and agricultural education research, while the generation of the science literacy framework and crosswalk were performed by the research team and reviewed by a panel of experts. The reliability of coding was established through peer debriefs.

Results

Defining Science Literacy

In its most simplistic form, science literacy is a general understanding of science (DeBoer, 2000). Pella, O'Hearn, and Gale, (1966) defined a science literate person among other things as someone with an understanding of the interrelationships of science and society. Another influential definition was brought forth by Shen (1975, p. 46-47) (as cited in NASEM, 2016) who defined three types of science literacy: practical, civic, and cultural. DeBoer (2000) identified nine separate uses of science literacy, and instead of trying to address all aspects of science literacy in science education, or trying to determine one universal definition, DeBoer suggested teachers should prioritize the goals of science literacy to meet the needs of their students.

Framework for Science Literacy

The review of literature returned a plethora of science literacy definitions, each contributing to the idea of what it means to be scientifically literate. To gain a better understanding of what these definitions have in common, as well as what makes them unique, we created a framework for science literacy. After an exhaustive review of all available definitions, we identified thirteen attributes organized in four broad domains. Table 1 displays the definitions of science literacy (ordered by author/publication date) and indicates which domains/attributes are present in the definition.

Table 1
Framework of Science Literacy Definitions

Domains	***Cognitive***			***Affective***				***Skills***		***Behaviors***			
Attributes	**Science Content Knowledge**	**Methods of Science**	**Connection to other Disciplines**	**Lifelong Science Learning**	**Cultural Importance**	**Inquiry Dispositions**	**Attitudes toward Science**	**Commu-nication**	**Critical Thinking**	**Civic Engagement**	**Personal Well-being**	**Industry Economic Connection**	**Interpreting Data**
Author(s)													
Pella et al. (1966)	x	x	x										
Shen (1975)	x				x	x				x			
Frank (1989)	x	x	x							x	x		
Durant et al. (1989)					x					x			
Baurer et al. (1994)	x					x	x			x			
Norris (1995)	x	x			x					x			
NRC (1996)	x	x				x		x	x	x	x	x	
NRC (2012)	x	x	x	x	x			x	x				
DeBoer (2000)		x	x		x		x		x	x		x	

Table 1 (continued).
Framework of Science Literacy Definitions

Domains	***Cognitive***			***Affective***				***Skills***		***Behaviors***			
Attributes	**Science Content Knowledge**	**Methods of Science**	**Connection to other Disciplines**	**Lifelong Science Learning**	**Cultural Importance**	**Inquiry Dispositions**	**Attitudes toward Science**	**Commu-nication**	**Critical Thinking**	**Civic Engagement**	**Personal Well-being**	**Industry Economic Connection**	**Interpreting Data**
Author(s)													
Ryder (2001)	x	x						x					x
Norris & Phillips (2003)	x	x					x						
Miller (2004)	x	x											
Bybee et al. (2009); OECD (2006)	x			x	x	x				x			x
NSB (2010)	x	x							x				
NSB (2016)	x					x	x			x			
Millar and Osborne (1998)								x					
Koeppen et al. (2008); OECD (2013)	x	x				x		x		x			x

Cognitive
The cognitive domain includes attributes of science literacy that relate to the process of acquiring and understanding knowledge. *Science content knowledge* is an essential building block of science literacy and is connected to all other attributes of the definition. Science education should consist of three components, including learning the facts, theories, and history of science (Norris, 1995). Understanding the *methods of science* focuses on how scientists go about designing and implementing a study. Miller (2004) stated, "A scientifically literate citizen needs to have… a general understanding of the nature of scientific inquiry" (p. 273). The third attribute of the cognitive domain, a *connection to other disciplines*, refers to understanding how the field of science is connected to other fields such as technology and the humanities, as Pella et al. (1966) suggested.

Affective
Attributes that concern beliefs and attitudes comprise the affective domain of science literacy. *Lifelong science learning* refers to the self-motivation of pursuing scientific knowledge outside the classroom. NRC (2012) suggested by the time a student finishes high school, they should have gained enough knowledge of science to continue to learn about science throughout their lives. As purported in the cultural rationale for science literacy (NASEM, 2016), *cultural importance* focuses on the belief that science is a valuable part of our culture and society. Shen (1975) contends the cultural form of science literacy refers to the drive to learn about science as an achievement of the human race. *Inquiry disposition* is a desire to find answers and is operationalized by the asking of questions. Bybee, McCrae, and Laurie (2009) discuss how scientific literacy involves the use of scientific knowledge to identify questions and gain new knowledge. *Attitudes toward science* specifically focuses on one's point of view or way of thinking/feeling in the field of science. DeBoer (2000) called it "Preparing citizens who are sympathetic to science" (p. 593).

Skills
The skills domain is made up of attributes that involve contextual engagement or completing a task. Being able to *communicate* with others about science is an important attribute. Communication of scientific information could occur in a variety of contexts, including verbal or written, as is often the case in modern times with social media. *Critical thinking* refers to the skills that allow someone to evaluate an issue and form an opinion such as reasoning, inferring, and identifying biases. NRC (1996) included critical thinking skills in their definition by stating "Scientific literacy entails being able to read with understanding articles about science in the popular press and to engage in social conversation about the validity of the conclusions" (p. 22).

Behavioral
It is in the behavioral domain of science literacy where the knowledge, skills, and attitudes (affective) are brought to action. *Civic engagement* utilizes knowledge and skills to address the root causes of needs within communities. This kind of participation is often associated with the political process, but it can occur in a variety of non-political ways. OECD (2006) suggested science literacy involves a "willingness to engage in science-related issues" (p. 12). The *personal well-being* attribute is characterized by individuals making decisions to positively affect their personal life. The NRC (1996) contends one aspect of science literacy is having the knowledge and skills needed for economic productivity, an example of an *industry/economic connection*.

While scarcely mentioned, *interpreting data* is yet another attribute of the behavioral domain with real-world implications. OECD (2013) defended that a scientifically literate person has the competencies to "analyse and evaluate data…and draw appropriate scientific conclusions" (p. 7).

Crosswalk for Science Literacy & School-based Agricultural Education

The three-component model of classroom instruction, experiential learning (SAE), and leadership development (FFA) forms the foundation of agricultural education in secondary school settings (National FFA Organization, 2018). We suggest there are parallels between the three-component model of agricultural education and the goals of science literacy. The most notable parallel is that of experiential learning. Just as agriculture teachers expect their students to engage in work-based experiences that deepen their understanding of the subject matter and hone their career skills, it is an objective of science literacy for students to be able to connect scientific subject matter with real-world problems. Likewise, the organization of students for premier leadership, personal growth, and career success in the leadership laboratory of the FFA is analogous to the civic development intentions of science literacy (Durant et al., 1989; Baurer, Durant, & Evans 1994; Norris, 1995). Finally, the structure of inquiry-based instruction where agricultural education students explore applied STEM concepts is mirrored in the efforts of building science literacy where the intent is not just to learn scientific facts, but apply scientific principles to specific contexts (Pella et al., 1966; Frank, 1989; NRC, 2012). Table 2 depicts a crosswalk of the three-circle model of agricultural education and the identified domains of science literacy which highlights specific ways SBAE can build the science literacy of students.

Table 2
Crosswalk of the Domains of Science Literacy and the Three-Component Model of SBAE

	Cognitive	***Affective***	***Skills***	***Behaviors***
Classroom	Contextualized Teaching and Learning	History of agricultural innovations; Inquiry-based instruction	Popular press article critique on agricultural issues	Service Learning, Applied STEM curriculum
FFA	Agriscience Fair CDE	Leadership development in the agrisciences	CDEs/LDEs	Community service outreach; involvement in community issues
SAE	Application of agriscience knowledge to Research (Invention) immersion SAE	Positive work-based dispositions and work ethic in science fields	Employability skills (Foundational SAE)	Earning potential of entrepreneurship/ placement SAEs

The above crosswalk is merely a cursory list of the ways agricultural education meets the identified domains of science literacy. Nonetheless, these parallels suggest a powerful synergy potential. That is to say, agricultural education holds great promise as a unique delivery vehicle for building the science literacy of students. The standard science classroom is limited to the confines of the academic building during the typical school day. The SBAE model of FFA and SAE allows for the extension of academic curriculum through real-world contexts. We argue the affective, skills, and behavioral domains of science literacy are particularly challenging to advance in traditional science classroom environments and are thus prime for development with a model like SBAE which engages students outside of structured class time.

Implications/Recommendations

The purpose of this research was to examine the concepts of science literacy in the context of school-based agricultural education. The review of literature revealed that the definitions of science literacy put forth by researchers can be categorized into four domains and thirteen attributes. In light of the fact agriculture is an applied science, incorporating science education in SBAE is not a foreign concept. Current research regarding science integration in SBAE includes studies that focus on teacher perceptions of science integration (Thompson & Balschweid, 2000), the barriers for integrating science into agriculture curriculum (Warnick, Thompson, & Gummer, 2004), and increasing science competence through inquiry-based instruction (Skelton, Blackburn, Stair, Levy, & Dormody, 2017), for example. In a study of Oregon agricultural

science and technology teachers, Thompson and Balschweid (2000) found the majority of teachers had a positive attitude towards integrating science in their classrooms and recommended teachers earn a science endorsement as well as have more experiences to teach and integrate science as part of their teacher preparation program.

Agricultural literacy is a prime focus of research within the Agricultural Education profession, however, most definitions of agricultural literacy and research conducted on agricultural literacy focus on knowing agriculture content. For example, a Delphi study reached consensus that agricultural literacy is defined as "possessing knowledge and understanding of our food and fiber system. An individual possessing such knowledge would be able to synthesize, analyze, and communicate basic information about agriculture" (Frick, Kahler & Miller, 1991, p. 52). A synthesis of two decades of agricultural literacy research showed a major purpose of the studies was to assess agricultural literacy, which primarily involved evaluating students' agriculture content knowledge (Kovar & Ball, 2013). Simply knowing students are knowledgeable about agriculture does not ensure they have the attitudes, skills, and behaviors necessary to solve the agricultural challenges our world faces. While there is a dearth of literature on science literacy within the agricultural education field, the present research suggests school based agricultural education can be a unique mechanism to engage students on the tenants of science literacy in an applied context. To that end, this study prompted the following recommendations.

Recommendations for Research/Practice

More research is needed to investigate the ways to measure science literacy in the context of agricultural education. Quantitative measures of science literacy do exist (e.g. Miller, 1998), but scholars argue they have not kept up with the changing definition of science literacy as it pertains to measuring aspects beyond knowledge (NASEM, 2016). Our review of research found no instrument designed to measure the knowledge, attitudes, skills, and behaviors of students enrolled in agricultural education. Such a measure, when encompassing of all four domains of science literacy, would be a valuable tool to determine the extent to which agricultural education builds the science literacy of youth.

In addition, we recommend experimental research be conducted to determine the most potent methods for building the science literacy of school-based agricultural education students. Specific teaching methods, strategies, and the inclusion of certain aspects of the three-circle model would be experimental variables of interest in the quest to build a library of best practices for pre-service and in-service agriculture teachers alike.

In light of the limited scope of research and focus on science literacy within the agricultural education field, it is recommended that preservice teacher education programs seek ways to build the self-efficacy of preservice teachers in the realm of science education. With more positive beliefs in their ability to conduct science themselves, teacher candidates will be better equipped to build the science literacy of their students in the domains of cognitive, attitudes, skills, and behaviors.

References

Baurer, M. W., Durant, J., & Evans, G. (1994). European public perceptions of science. *International Journal of Public Opinion Research, 6*(2), 163-186.

Bybee, R., McCrae, B., & Laurie, R. (2009). PISA 2006: An assessment of scientific literacy.

Journal of Research in Science Teaching, 46(8), 865-883.
DeBoer, G. E. (2000). Scientific literacy: another look at its historical and contemporary meanings and its relationship to science education reform. *Journal of Research in Science Teaching*, *37*(6), 582–601.
Durant, J. R., Evans, G. A., & Thomas, G. P. (1989). The public understanding of science. *Nature, 340*(6228), pg. 11-14.
Frank, M. (1989). Project 2061: Science for all Americans. *The Physiologist, 32*(5), 245-248.
Frick, M. J., Kahler, A. A., & Miller, W. W. (1991). A definition and concepts of agricultural literacy. *Journal of Agricultural Education, 32*(2), 49-57. DOI: 10.5032/jae.1991.0204
Hoegh-Guldberg, O., Jacob, D., Taylor, M.,Bindi, M., Brown, S., Camilloni, I., Diedhiou, A., Djalante, R., Ebi, K., Engelbrecht, F., Guiot, J., Hijioka, Y., Mehrotra, S., Payne, A., Seneviratne, S. I., Thomas, A., Warren, R., Zhou, G. (2018). Impacts of 1.5°C global warming on natural and human systems. In: *Global warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty* [V. Masson-Delmotte, P. Zhai, H. O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J. B. R. Matthews, Y. Chen, X. Zhou, M. I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, T. Waterfield (eds.)]. In Press
Hurd, P. (1958). Science literacy: It's meaning for American schools. *Educational Leadership, 16*, pg. 13-16.
Koeppen, K., Hartig, J., Klieme, E., & Leutner, D. (2008). Current issues in competence modeling and assessment. *Journal of Psychology, 216*(2), 61-73.
Kovar, K. A., & Ball, A. L. (2013). Two decades of agricultural literacy research: A synthesis of the literature. *Journal of Agricultural Education, 54*(1), 167-178. DOI: 10.5032/jae.2013.01167
Millar, R., & Osborne, J. F. (Eds.). (1998). *Beyond 2000: Science Education for the Future.* London: King's College London.
Miller, J. D. (1998). The measurement of civic scientific literacy. *Public Understanding of Science*, *7*(1), 203-223. DOI: 10.1088/0963-6625/7/3/001
Miller, J. D. (2004). Public understanding of and attitudes toward scientific research: What we know and what we need to know. *Public Understanding of Science, 13*(3), pg. 273-294. DOI: 10.1177/0963662504044908
National FFA Organization. (2018). *The Agricultural Education Mission.* Retrieved from https://www.ffa.org/agricultural-education/
National Academies of Sciences, Engineering, and Medicine. (2016). *Science literacy: Concepts, contexts, and consequences.* Washington, DC: The National Academies Press. doi:10.17226/23595.
National Research Council. (1996). *National Science Education Standards.* Washington, DC: National Academy Press.
National Research Council. (2012). *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas.* Committee on a Conceptual Framework for New K-12 Science Education Standards.
National Science Board. (2010). *Science and Engineering Indicators, 2010.* Arlington, VA: National Science Foundation.

National Science Board. (2016). *Science and Engineering Indicators, 2016.* Arlington, VA: National Science Foundation.

Norris, S. P. (1995). Learning to live with scientific expertise: Toward a theory of intellectual communalism for guiding science teaching. *Science Education, 79*(2), pg. 201-217.

Norris, S. P., & Phillips, L. (2003). How literacy in its fundamental sense is central to scientific literacy. *Science Education, 87*(2), 224-240.

OECD. (2006). *The PISA 2006 Assessment Framework for Science, Reading, and Mathematics.* Paris, France: OECD.

OECD. (2013). *PISA 2012 Assessment and Analytical Framework: Mathematics, Reading, Science, Problem Solving and Financial Literacy*. http://dx.doi.org/10.1787/9789264190511-en

Pella, M. O., O'Hearn, G. T., & Gale, C. W. (1966). Referents to scientific literacy. *Journal of Research in Science Teaching, 4*(3), pg. 199-208.

Roberts, T. G., Harder, A., & Brashears, M. T. (Eds). (2016). *American association for agricultural education national research agenda: 2016-2020.* Gainesville, FL: Department of Agricultural Education and Communication.

Rudolph, J. L., & Horibe, S. (2016). What do we mean by science education for civic engagement? *Journal of Research in Science Teaching, 53*(6), pg. 805-820.

Ryder, J. (2001). Identifying science understanding for functional science literacy. *Studies in Science Education, 36*(1), 1-44.

Shen, B. S. P. (1975). Scientific literacy and the public understanding of science. In S.B. Day (Ed.), *Communication of Scientific Information* (pg. 44-52). Basel, Switzerland: Karger.

Skelton, P., Blackburn, J. J., Stair, K. S., Levy, N., & Dormody, T. J. (2017). Agriscience education through inquiry-based learning: Investigating factors that influence the science competence of middle school students. *Journal of Agricultural Education, 59*(1), 223-237. https://doi.org/10.5032/jae.2018.01223

Thompson, G. W., & Balschweid, M. M. (2000). Integrating science into agriculture programs: Implications for addressing state standards and teacher preparation programs. *Journal of Agricultural Education*, *41*(2), pg. 73-80. DOI:10.5032/jae.2000.02073

United Nations. (2019). *Sustainable development goals*. Retrieved from https://www.un.org/sustainabledevelopment/hunger/

United Nations, Department of Economic and Social Affairs, Population Division (2017). *World population prospects: The 2017 revision, key findings and advance tables*. Retrieved from https://population.un.org/wpp/Publications/Files/WPP2017_KeyFindings.pdf

Warnick, B. K., Thompson, G. W., & Gummer, E. S. (2004). Perceptions of science teachers regarding the integration of science into the agricultural education curriculum. *Journal of Agricultural Education, 45*(1), 62-73. DOI: 10.5032/jae.2004.01062

Making the Jump: What Motivates Agricultural Education Instructors to Engage Students in Agriscience Research SAEs?

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Introduction and Review of Literature

It is well documented Supervised Agricultural Experience (SAE) involvement is declining (Dyer & Osborne, 1995; Retallick & Martin, 2008; Steele, 1997). Yet, active SAE engagement leads to positive student outcomes including the development of entry-level technical skills (Ramsey & Edwards, 2012), preparation for agricultural jobs (Dyer & Williams, 1997), and fostering relationships with community members (Robinson & Haynes, 2011). Consequently, efforts should be made to find ways to involve students in SAE in order to accomplish the mission of school-based agricultural education (SBAE) "to prepare students for successful careers," (The National Council for Agricultural Education, 2012, para. 3).

Barriers to SAE involvement have been recorded through prior research (Lewis, Rayfield, & Moore, 2012; Retallick, 2010; Steele, 1997; Wilson & Moore, 2007). A number of teachers struggle to manage a well-balanced SBAE program which gives equal focus to classroom instruction, SAE, and FFA (Wilson & Moore, 2007). Additionally, many teachers believe there are limited opportunities for SAE involvement in their communities (Wilson & Moore, 2007) and students often lack the resources necessary to successfully engage in SAE (Retallick, 2010).

It has been argued agriscience research (ASR) SAEs could be a useful solution SBAE teachers could use to engage more of their students in SAE, due to the flexibility ASR SAEs offer, along with the potentiality for reduced resources and inputs (Thiel & Marx, 2019). In addition, there are teachers who have integrated ASR SAEs into their programs successfully and thoroughly. Are there lessons we can learn from these agriscience pioneers which may lead more teachers to adopt ASR SAEs into their SBAE programs?

Theoretical Framework

Due to the nature of this qualitative study, the theoretical framework emerged during the analysis of the data, rather than driving the design of the study or the development of the interview guide. Based upon the findings of the study, Rogers' (2003) Diffusion of Innovations Theory served as the most logical theoretical framework for this study. This framework aligns with this study because the research questions are related to the adoption of an innovative SAE implementation strategy. Rogers (2003) identified five perceived characteristics of an innovation which impact the rate of adoption including (a) relative advantage, (b) compatibility, (c) complexity, (d) trialability, and (e) observability. Thus, for a teacher to adopt an innovative idea (such as ASR SAEs) into their SBAE program, they must have a need, see the potential benefits from engaging in the activity, have the ability to adopt the innovation, be able to experiment with the new idea in a supportive environment, and have witnessed others' successful implementation of the innovation or witnessed the positive results of the innovation.

Though the perceived characteristics of an innovation affect the rates of adoption, Rogers (2003) also characterizes adopters as (a) innovators, (b) early adopters, (c) early majority, (d) late majority, and (e) laggards. Participants in the present study were compared to the foundational

tenants of Rogers' (2003) theory as they made the decision to include ASR SAEs into their SBAE program.

Purpose of the Study

The purpose of this study was to examine what motivates high school agricultural education teachers to adopt agriscience research SAEs into their SBAE programs. Specifically, the study addressed the following question: What beliefs and factors influence teachers' decisions to utilize ASR SAEs?

Methods

The researchers utilized a basic qualitative design for this study as described by Merriam (2009). Data was collected through semi-structured interviews which included eight stem questions with 34 potential follow-up questions. The initial stem questions were reviewed for face and content validity through peer review with experts in teacher education, educational psychology, and school-based agricultural education. Though Rogers' (2003) Diffusion of Innovations was used as a theoretical lens for this study, the framework was not used to guide the development of the interview guide. Instead, participants' responses led the researchers to identify and use the theory as a framework for analysis.

Following data collection, the two researchers separately completed initial coding (Saldana, 2016) of verbatim interview transcriptions through the lens of Rogers' Theory of Diffusion of Innovations (2003). In an effort to improve trustworthiness (Patton, 2015), the researchers triangulated their analysis by analyzing the data individually and then comparing their findings (Patton, 2015). Together, the researchers then jointly collapsed their individual codes into categories, and ultimately into themes. To ensure accuracy and validity in reporting, the participants were asked to review the findings (Patton, 2015). Both researchers have previous experience as SBAE teachers. Participants for this study were selected through purposeful means by the researchers from current agricultural education instructors in North Dakota who had varied levels of familiarity with ASR SAEs and from a range of teaching experience. Nine (n=9) agricultural education instructors were invited to participate and all accepted. Participants took part in one-on-one interviews with the researchers either face to face or via Skype. Pseudonyms were used in reporting to protect the anonymity of the participants.

Findings

Theme 1: ASR needs to fit with the school and community.

Adoption is met with resistance if the environment does not support a new idea. Thus, the attitudes of the school and community affect adoption. In the case of the participants, many found their goals and wishes to adopt compatible with the philosophy of the communities and schools in which they taught. In viewing ASR SAEs as a means to challenge their students toward academic success, the adoption of ASR SAEs was compatible with the needs and wants of the community and school. Interestingly, most instructors saw a need for the adoption of ASR SAEs due to the lack of science fairs at their schools. "I was really surprised that [school] didn't [have a science fair], that our students didn't participate" shared Mike.

Theme 2: Focus on broad skill development
Consistently, participants highlighted broad skill development as a primary purpose of SBAE. This led teachers to seek specific opportunities for their students which would foster diverse skill development "…learning skills that maybe they never would've otherwise learned," remarked Amy. ASR SAEs were seen as a vehicle for the development of technical agriculture skills, academic content skills, and soft skills. The teachers recognized the diverse needs of their students and identified ASR SAEs as a useful tool which could be used to offer individualized experiences for students. Additionally, many teachers talked about using agriscience research to differentiate instruction. Agriscience research SAEs are "nice because you can push the high achieving students to do bigger, better, harder things. While you can still tailor something simple to those lower achieving students," shared Becca.

Theme 3: Peer collaborations and teacher perceptions
Teachers were motivated to adopt ASR SAEs through professional development and collaboration. "I never knew how to tackle them or even try to tackle them until…PDC (Professional Development Conference) a few years back, and that's kind of what got me going," said Sara. Continuing education was also a way to remove barriers to adoption, as evidenced by this comment from James, "my master's classes and coursework motivated me to do it."

Collaboration with other teachers who had more experience with agriscience research SAEs helped teachers implement them into their own programs. Often, experienced and successful teachers were described as "opinion leaders" or those who were role models the participants looked to for advice and support. "I toyed around with it but couldn't see the big picture and couldn't make that step…through peers that have done it, I just had to try", said Becca. In many cases, teachers discussed how the implementation of ASR SAEs "just made sense". The overall goal of ASR SAEs fit within the overarching goals of their SBAE programs or school districts. "It falls under how I like to teach, the inquiry, the here's the problem let's find the solution type of teaching," said Becca.

Theme 4: ASR accomplishes multiple tasks within SBAE program.
One challenge the teachers mentioned repeatedly was equal integration of the three-component model of SBAE. Zach simply stated, "I tried to talk about [SAE], get everyone doing it, and it kind of was too much all at once." Amy lamented "I think a lot of programs kind of leave SAE in the dust a little bit, including my own program." The teachers who participated overwhelmingly shared their intent to integrate all three components as equally as possible, noting that many did not feel successful in their attempt to do so. "Do I think all 3 of my circles are perfect? No, but they're all implemented. And I try to incorporate them as much as possible," shared Becca.

For many of the participants, SAE, including ASR SAEs, were integrated into their classroom teaching. Teachers viewed this as a way to overcome certain barriers, including supervision of students as evidenced by this comment from James, "if you expect the kids to do a lot of it out of class time, you're going to have a hard time getting some of that stuff done…you won't have the watchful eye on what's actually happening." Some teachers did supervise agriscience research projects outside of class time, though their overall involvement in ASR SAEs was limited to a few students versus a majority of students in other programs

Theme 5: Success depends on teacher planning and student support.
Teachers who were successful at engaging students in ASR SAEs used scaffolding and extensive planning. Agriscience projects were chunked throughout the year with clear deadlines and checkpoints for each part of the project. Finding the time to supervise projects was a barrier for many of the teachers. Because of the individual nature of ASR SAEs, teacher supervision was critical for success. Additionally, differentiating instruction and scaffolding for students of various ability levels took additional time and supervision by the teachers. Working with and trying to get students of lower ability levels excited about ASR SAEs was identified as a barrier to participation by some of the teachers.

Theme 6: ASR implementation is contingent upon student buy-in.
Ultimately, ASR SAEs could not be adopted into a program without student buy-in. Student buy-in was often determined by how a student viewed the purpose of agricultural education and whether or not ASR SAEs fit within that image. Zach expressed his frustration with misconceptions regarding agricultural education, "I'm still working toward getting the idea out of their heads that ag is not all mechanics and whatnot." Amy reflected on push-back she experienced when initially implementing ASR SAEs by sharing the following statement "The first year…I was kind of met with some resistance of why, that this shouldn't have to be, this isn't science class."

Conclusions/Implications/Recommendations

The purpose of this study was to examine what motivates high school agricultural education teachers to adopt ASR SAEs into their SBAE programs. Space concerns limit the amount of context we can provide to both the findings and our discussion herein given the nature of a qualitative report. The conversations with particpants as part of this study support Rogers' theory (2003). This study adds to the body of knowledge regarding behaviors and motivations as they relate to the adoption of innovative ideas. Examining what led teachers to adopt ASR SAEs into their programs can help state leaders, administrators, school boards, alumni groups, and teacher eductors to better understand how to support other teachers in the implemention of ASR SAEs into their programs. This will be especially important as the SAE for All framework continues to be adopted by SBAE teachers nationwide which may lead to an increased interest in ASR SAEs as a potential immersion SAE option for students.

First, in order for adoption to occur, the environment needs to be suitable. Even if the environment of a school district is not encouraging of adoption, the broader environment the SBAE program operates within may create pressure to adopt. For example, the environment created by agricultural businesses in need of graduates who are prepared for careers or the evolving culture of agricultural education across the state as a whole may be the tipping point towards adoption for programs in stagnant school districts. A female participant articulated this idea in the following comment, "there are some things that I recognize the way the industry is changing…there's big changes happening and more to come down the pipe and if you don't recognize that, your head is stuck in the dirt. You need to be current with what is happening in the industry. I think it's very important within ag education, and agriscience is a big part." Thus, as innovations are rolled out to SBAE programs, it is essential that consideration is given to the environment in which programs are operating within.

Successful adoption requires effective professional development, strong role models, and collaboration between teachers. State leaders and university faculty are encouraged to develop professional development for in-service teachers and high-quality instruction for pre-service teachers to minimize potential barriers of competency related to teaching the scientific method and supervising ASR SAEs conducted by high school students. The development of formal mentorship programs may also assist in the adoption of ASR SAEs. Capitalizing on the idea of observability (Rogers, 2003), identifying opinion leaders and highlighting their programs' success may lead other teachers to replicate ASR SAEs within their own programs.

The emergent idea of utilizing ASR SAEs to support student individualized skill development reflects the importance of relative advantage (Rogers, 2003) in the adoption of a new idea. Adopters must see the advantage or value of the idea in order to adopt. In this case, teachers saw a value in using ASR SAEs as an advantageous way to guide their students toward skill development within agricultural education. Further, teachers viewed agriscience research as a way to differentiate instruction for their students. Though we do not disagree that agriscience research can be an excellent way to challenge students of all levels, many teachers talked about agriscience being best for "high achieving students". We ask, what kinds of implications does this hold for Agricultural Education? There seems to be a common perception that agriscience research is best suited for advanced students, when really, it should be for all students.

SBAE teachers struggle to equally balance the components of the three-circle model. This is evidenced by the nationwide decline in SAE participation (Dyer & Osborne, 1995; Retallick & Martin, 2008; Steele, 1997). Agriscience research SAEs may offer the opportunity to accomplish many tasks with one activity. Not only are students developing important career skills and gaining experience through the SAE component of the project, but they may also be engaged in a graded component of their class and possibly an FFA activity through the Agriscience Fair. Many teachers discussed FFA as being the component of their programs the community valued most because it was the most visible. Agriscience research may overcome the perceived barrier of a well-balanced SBAE program by intersecting all three components of the Ag Ed model at once. Perhaps engagement in agriscience research SAEs may be a way to engage a larger number of students in SAE.

A common theme which emerged through this project was a general misunderstanding regarding the definition of an ASR SAE. The differences between a classroom project, agriscience research SAE, and Agriscience Fair project were indecipherable. There was no clear, shared definition of what constituted an SAE or other project among the teachers. In light of SAE for All and the push to bring SAEs back into the classroom, the line between what is defined as an SAE and what is defined as a classroom project will continue to be messy. Ultimately, does calling a learning experience an SAE or a classroom project change or impact the learning outcomes for students? We would argue that a student who completes an agriscience research project in the classroom is engaging in an SAE because it meets the intended outcomes of an SAE project. However, others would say SAEs must take place outside of the classroom in order for a project to be designated as such. Ultimately, this is a philosophical conversation worth having which has the potential to shape how SBAE functions from this point forward. Nonetheless, there is a need for clear, well-defined definitions of ASR SAEs, agriscience research projects, and Agriscience Fair projects.

References

Dyer, J. E., & Osborne, E.W. (1995). Participation in supervised agricultural experience programs: A synthesis of research. *Journal of Agricultural Education, 36*(1), 6-14. doi: 10.5032/jae.1995.01006

Dyer, J. E., & Williams, D. L. (1997). Benefits of supervised agricultural experience programs: A synthesis of research. *Journal of Agricultural Education, 38*(4), 50-58. doi: 10.5032/jae.1997.04050

Lewis, L. J., Rayfield, J., & Moore, L. L. (2012) Supervised agricultural experience: An examination of student knowledge and participation. *Journal of Agricultural Education, 53*(4), 70-84. doi: 10.5032/jae.2012.04070

Merriam, S. B. (2009). *Qualitative research: A guide to design and implementation.* San Francisco, CA: Jossey-Bass.

National Council for Agricultural Education. (2012). Agricultural Education. Retrieved from https://thecouncil.ffa.org/ageducation/

Patton, M. Q. (2015). *Qualitative research and evaluation methods* (4th ed.). Thousand Oaks, CA: Sage Publications, Inc.

Ramsey, J. W., & Edwards, M. C. (2012). Entry-level technical skills that teachers expected students to learn through supervised agricultural experiences (SAEs): A modified Delphi study. *Journal of Agricultural Education, 53*(3), 42-55. doi:10.5032/jae.2012.03042

Retallick, M. S. (2010). Implementation of supervised agricultural experience programs: The agriculture teachers' perspective. *Journal of Agricultural Education, 51*(4), 59-70. doi: 10.5032/jae.2010.04059

Retallick, M. S., & Martin, R. (2008). Fifteen-year enrollment trends related to the three components of comprehensive agricultural education programs. *Journal of Agricultural Education, 49*(1), 28-38. doi: 10.5032/jae.2008.01028

Robinson, J. S., & Haynes, J. C. (2011). Value and expectations of supervised agricultural experiences as expressed by agriculture instructors in Oklahoma who were alternatively certified. *Journal of Agricultural Education, 52*(2), 47-57. doi:10.5032/jae.2011.02047

Rogers, E. M. (2003). *Diffusion of innovation*s (5th ed.). New York, NY: Free Press.

Saldana, J. (2016). *The coding manual for qualitative researchers* (3rd ed.). Thousand Oaks, CA: Sage Publications, Inc.

Steele, R. (1997) Analysis of the continuing decline in use of supervised agricultural experience (SAE) in New York State. *Journal of Agricultural Education, 38*(2), 49-58. doi: 10.5032/jae.1997.02049

Thiel, B. L., & Marx, A. A. (2019). The influence of agriscience research SAEs on perceived self-efficacy of 21st century skill attainment. *Journal of Agricultural Education, 60*(1), 80-95. https://doi.org/10.5032/jae.2019.01080

Kansas Ag Teachers' Perceptions of Diversity & Inclusion in Agricultural Education

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Introduction/Literature Review

Agricultural education programs continue to become more diverse and dynamic. However, diversity does not necessarily ensure equity or inclusion (Elliott & Lambert, 2018). Vincent (2010) stated the variety of multicultural training, years of teaching and other teacher characteristics correlated with the ethnic diversity of FFA membership, and in the same sense, agricultural education enrollment. Agricultural education teachers' perceptions of *diversity inclusion* in their programs are variables that may have a strong influence on the number of students who enroll in agricultural education (LaVergne et al., 2012). Diversity inclusion builds upon three things, multicultural education, inclusion, and culturally responsive teaching (LaVergne, 2008). Multicultural education is an educational philosophy that seeks to help teachers acknowledge and understand the increasing diversity in society and the classroom, and to see their students' diverse backgrounds as assets that can support student learning and learning of others (Salend, 2008).

According to Gay (2000), culturally responsive teaching is the process by which educators use cultural knowledge, prior experiences, frames of reference, and performance styles of ethnically diverse students to foster more relevant and useful learning encounters. As a result, the academic achievement of ethnically diverse students will improve when they are taught through their own cultural and experiential filters (Gay, 2000). However, problems for creating proper multicultural understanding and teaching concerns result from the lack of essential multicultural preparation, isolation of teachers among their ethnic groups, and the possession of professional training that excludes direct, meaningful interaction with different cultures (Vincent et al., 2014).

FFA plays a vital role in the agricultural education model (Agricultural Education, 2019) and program recruitment (Myers, Dyer, & Breja, 2003). In their 2015 study over multicultural competence, Vincent & Torres found agriculture teachers within diverse FFA chapters have a higher multicultural knowledge score than teachers in non-diverse FFA chapters. However, Martin and Kitchel (2014) reported differences between the participants on the barriers relating to FFA activities not fitting into beliefs of the school and community coincided with previous studies which highlighted the negative perceptions some non-members had towards FFA.

In Kansas, over 13,000 students were enrolled in agricultural education in 185 school districts (Kane, 2018; Kansas FFA, n.d.). Programs were found in the state's largest cities, including Garden City, Wichita, Hays, Salina, Manhattan, Emporia, Topeka, Lawrence, Olathe, and Kansas City (Kansas FFA, n.d.). Nevertheless, only 15.4% of student enrollment were students of color (Kane, 2018). The data did not factor in other elements of diversity such as gender, sexual orientation, socioeconomic status or special needs.

As schools continue to become more ethnically diverse, so too should school-based agricultural education programs (Bowen & Rumberger, 2002). In order for agricultural education programs

to maintain success, a thorough understanding and recognition of students of color and students with disabilities must be relevant to agricultural education teachers (LaVergne, 2008).

For the purpose of this study the following definitions have been used to help build a better understanding diversity, inclusion, and diversity inclusion. The definition of diversity comes from Talbert, Vaughn, Croom and Lee (2014) as "the variety of differences within a category or classification" (p. 336). "Successful inclusive education happens primarily through accepting, understanding, and attending to student differences and diversity, which can include physical, cognitive, academic, social, and emotional" (McManis, 2017, para. 4).

Theoretical Framework

The diversity inclusion theory (LaVergne, 2008) served as the theoretical framework by examining strategies used by agricultural educators to promote diversity and inclusion in their programs and FFA chapters. LaVergne (2008) states that diversity inclusion welcomes all learners by actively engaging them in secondary agricultural education programs regardless of their race, ethnicity, or exceptionality (see Figure 1). Diversity inclusion is also the act of acknowledging these differences and in turn, fostering an atmosphere to teach every student effectively in the classroom. These components can be used to determine the perceptions of diversity and inclusion in Kansas agricultural education teachers.

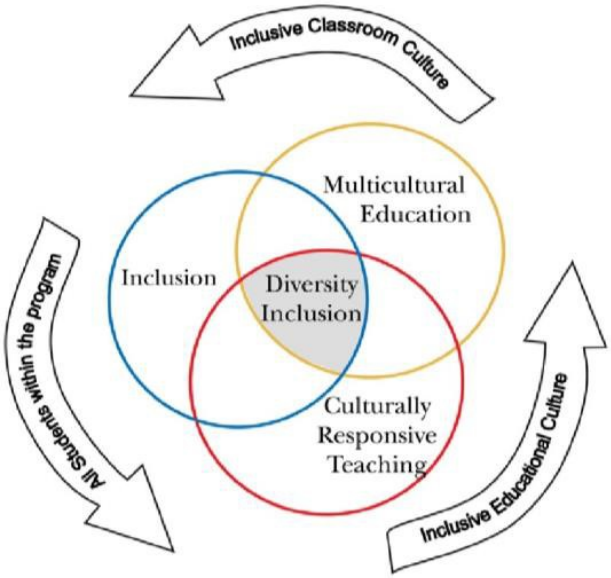

Figure 1. The Diversity Inclusion Program Model (as cited in LaVergne, 2008).

Purpose and Objectives

There is a need to recruit a more diverse workforce (Stripling & Ricketts, 2016) for the agriculture industry. To accomplish that goal, diversifying the secondary agriculture classroom and improving inclusion of all individuals is a priority. The purpose of this descriptive study was to determine the perceptions of diversity and inclusion in agricultural education of Kansas agricultural education teachers. The following objectives guided the study: 1) Determine Kansas Ag Ed teachers perception of diversity and inclusion, 2) Identify strategies used by Kansas Ag

Ed teachers in their programs and FFA chapters, 3) Identify strategies to increase diversity and inclusion among Kansas Ag Ed programs and FFA chapters.

Methodology

Because this study was a Master's Project the number of participants was significantly lower than most thesis-driven research. A researcher-developed survey was distributed to purposely selected participants (*N* = 65) via Qualtrics in February 2019. First-year teachers were excluded from this list as they had not experienced a full year of teaching at the time of the study. Teachers were selected from each of the state's seven districts to allow representation from across the state. Also, the school location, school size, and years of experience teaching were used to select the participants. After two follow-up emails, a response rate of 51% was obtained (*n* = 33).

The highest number of unduplicated students was 200, the lowest, 15, with the average of 69.4 students in each program. The average FFA membership was 65.6, with the highest membership set at 320 and the lowest, 13. The largest number of participants were in the 6-10 years (*n* = 11, 33.33%) and 2-5 years (*n* = 11, 27.27%) ranges. Those teaching between 11-20 years (*n* = 6, 18.18%), 21-30 years (n = 6, 18.18%) and 31+ years (*n* = 1, 3.03%) made up the remaining 13 respondents. Each of the seven FFA districts had teachers respond to the survey. Data was collected on respondents' location in the state by district. East Central district, as well as Northcentral district, had the highest response rate (*n* = 7, 21.21%). Northeast and Southeast district also had the same response rate (*n* = 3, 9.09%). Northwest made up 15.15% of the respondents with 5 and Southwest had 2 (6.06%). Additionally, data were collected on program type with 60.61% (*n* = 20) of respondents not from an FFA Affiliated program, while 39.39% (*n* = 13) were Affiliated. This demographic data is provided to provide a better conceptualization of the participants.

Teachers responded to a survey consisting of 10 open-ended questions and two multiple choice questions regarding their perceptions of diversity and inclusion in agricultural education and their FFA chapter as well as strategies used to promote diversity and inclusion. The responses were analyzed for common themes. There were efforts to establish reliability and validity of the instrument. Limitations exist in the mode of data collection used for this study.

Findings

Objective 1- Describe Kansas Ag Ed teachers' perception of diversity & inclusion.

The central theme found in the definition of diversity was *differences*. One teacher wrote, "*Diversity is differences in culture, socio-economic status, race, beliefs.*" Another wrote, "*Having different students. Different in their backgrounds, different in their ways, different in their thoughts.*"

Several teachers responded that diversity included differences in thoughts, cultures, and beliefs. Different genders, learning styles, and religion were also characteristics that made up definitions of diversity. Here are a few of their responses:

- "*Coming from a culture that is different than yours.*"

- *"Diversity is when a population (i.e., students in an FFA program) is made up of multiple races, ethnicities, sexual orientations, genders, and cultural backgrounds."*
- *"Diversity is people of different races, religions, and gender affiliations."*

The main themes found in defining inclusion were *acceptance*, *participation*, and *opportunity*. One response included, *"Inclusion means that everyone has the opportunity to participate no matter their limitations."* Another response was, *"Everyone has a fair opportunity to participate in whatever task is at hand."*

Others stated that acceptance and sense of belonging were elements of inclusion as well as open-mindedness and appreciation of one's differences.

- *"A sense of belonging- where everyone is valued and respected."*
- *"Inclusion is when all people, of all backgrounds, are welcome and included in all aspects of a program and feel as such."*
- *"Accepting everyone without judgment."*

When asked about the overall attitude of the program, including self and students, about diversity and inclusion, a common them was teachers believed they had a positive attitude towards their programs. *"I have a positive attitude about diversity and inclusion. My students don't always recognize the wide range there is to diversity."*

Teachers had mixed responses regarding how their students' attitudes towards diversity and inclusion.

- *"As a whole, my program is inclusive of people who are different than they are. Unfortunately, I have students who are not as welcoming."*
- *"My students and I are fairly inclusive. We have a nice mixture of students as far as political beliefs, sexual orientation, and gender within our program as well as a nice mixture of student backgrounds being from the city and the country."*
- *"My program is somewhat accepting of diversity. However, we do not have a great deal of diversity in our school."*
- *"While most students say they are inclusion, that is not always followed by similar actions."*
- *"The diversity in our school has led to a program with a higher than average diversity of students. Overall, diversity is welcome in our program, but there is room for improvement."*

Teachers chose elements of diversity they thought were representative of their agricultural education program (first number) and their FFA Chapter (second number reported). From these choices, the top four responses were 1) A mixture of students from non-agricultural backgrounds (n = 28; n = 25), 2) Gender diversity (n = 28; n = 24), 3) Students with special needs (students with IEP's, 504 plans, etc.) (n = 27; n = 22), and 4) Socioeconomic diversity (n = 25; n = 22). For each component (program and FFA chapter), one teacher responded "Other" with *"Family structure…foster kids, living with grandparents, single parents, two parents, etc."* Fourteen teachers responded with ethnic diversity (n = 11 for FFA Chapter), and ten responded with

students who identify as LGBTQ or other diverse sexual orientations for the program (*n* = 8 for FFA Chapter).

Teachers were asked to describe a diverse FFA program, identifying elements of diversity they felt were represented. The main themes from this question included sex (male vs. female), rural vs. nonrural students, and diverse backgrounds (ethnicity, culture, beliefs).

- *"A large population of females vs. males and rural background vs. city."*
- *"Different mix of ethnicity, gender, backgrounds, and beliefs."*
- *"Several ethnicities and cultures represented."*
- *"One that offers a wide range of activities to participate in."*

Additionally, teachers reported the size of the school determined whether an FFA chapter was diverse or not, including whether a program was traditional or nontraditional. *"Really, in my opinion, I consider diverse FFA programs to be the non-traditional ag programs usually…I think of programs that are at 6A size schools."*

Objective 2- Identify strategies used by Kansas Ag Ed teachers in their programs & FFA chapters.

Themes ranged from encouragement to participate, provide a variety of opportunities, setting expectations in the classroom, creating a safe culture/environment, to no strategies. One teacher wrote, *"I honestly don't think there are many strategies, per se, that I employ. I just welcome any kid who is interested in the content and make it clear that FFA is an organization for everyone and that everyone is welcome."* Another replied, *"I provide the same opportunities to all students regardless of who they are or what their background may be."* Another response was, *"We embrace a concept of mutual respect and place no barriers to involvement in our activities and opportunities."* One teacher replied, *"I set up a safe culture in my classroom from the very beginning of the year."* Additionally, one response was*, "I believe it needs to be relationship driven between students and advisor to help students to take advantages of their opportunities.* Additionally, one response was, *"We treat everyone fairly and kindly."*

Objective 3- Identify strategies to increase diversity and inclusion among Kansas Ag Ed programs & FFA chapters.

Three themes emerged related to training in diversity and inclusion; little/no prior training, coursework from college, and professional development offered from the school district. Most responses dealt with no prior training. Some teachers took classes during their pre-service education while others had one to two-day workshops offered by their school districts. One teacher replied, *"Just the courses offered in my block classes in college, as well as a few sessions in our school's professional development."* Another said, *"For professional development, I went through a two-day workshop on diversity and training…"* Several teachers reported they learned through experience and being in the classroom.

The most common type of training suggested was that in the form of workshops. However, several teachers responded they were not sure what kind of training they needed or wanted. One response was, *"I am not sure. I think it is important, but I don't know where to start on this topic.*

Sometimes it can be a touchy and hard subject to talk about." Another answer was, *"Ways to engage in tough conversations with students and student groups about diversity and inclusion would be helpful."* A few teachers commented they did not want any training. Finally, many teachers suggested including chapter officers and having training at the state's chapter leadership conference (SCCL). One teacher replied, *"I'd like to see FFA officers promote diversity within our ag classes and FFA activities…maybe one of the sessions at SCCL could focus on this issue?"*

Conclusions/Recommendations

The central theme of diversity throughout the study stems from the term, *different*. The most prominent differences teachers saw represented in their classrooms was rural/nonrural backgrounds, sex, and students with special needs. Additionally, when asked what a diverse program and FFA chapter was, their answers did not necessarily reflect their definition of diversity. As one teacher pointed out in their comment, they believed the *size* of the school is what determines whether a program is diverse. However, if size of the school determines what diversity looks like in Kansas Ag Ed, then it is recommended that training or professional development, like program exchanges, or courses, be implemented to help teachers see the bigger scope of diversity beyond size.

In their 2012 study, LaVergne et al. determined there was a statistically significant difference between teachers who taught in a suburban or urban setting and teachers who taught in a rural setting on proposed solutions to increase diversity inclusion in agricultural education programs. Even though the size of the school was not asked in the demographic data, teachers from districts such as East Central and South Central, where larger cities such as Lawrence, Topeka, Olathe, and Wichita are located, were more likely to propose solutions for training and promoting diversity and inclusion in the classroom.

Teachers believed they include all students in their program and FFA chapter but did not have specific strategies to promote diversity and inclusion in their classroom. Teachers believe inclusion meant everyone was involved or had an *equal opportunity* to participate. However, because something is equal opportunity, does not mean there is an *equality of opportunity*. Equality of opportunity is obtained when agents have a chance to reach the same goal(s) without the hindrance of the same obstacle(s) (Shields, n.d.). Many teachers also did not recognize whether inclusion included students of all levels and exceptionalities. Further research is recommended into equality of opportunity in Kansas Agricultural Education programs.

Professional development can be helpful when done effectively. According to LaVergne (2008), the success of agricultural education will depend on Ag Ed teachers' ability to provide appropriate instruction to students through diversity and inclusion. There seemed to be two sides in terms of professional development in diversity and inclusion among Kansas Ag Ed teachers. While many teachers were for professional development in diversity and inclusion, they also did not have any recommendations, or were sure where to start. Several teachers feel uncomfortable with recognizing whether diversity and inclusion is present in their programs as well as ensuring that their members are also recognizing and practicing this in the classroom and during chapter events. Since many teachers responded with "no" or "none" for training, this could indicate a lack of interest or desire to practice or promote diversity and inclusion. Recommendations for

practice include a statewide commitment to teacher training in diversity and inclusion, professional development specifically targeted to diversity and inclusion, and more coursework in the pre-service curriculum.

In a 2008 study, Banks determined research exclusively on diversity has shown a positive impact on students' cognitive and personal development. Because several teachers reported that their students had mixed views on diversity and inclusion, providing training to FFA members, such as chapter officers, on diversity and inclusion, could aid with promoting it in programs and chapters and therefore create a more aware and accepting environment. It is recommended that diversity and inclusion training during Kansas' State Conference for Chapter Leaders could be the starting point for Kansas FFA Chapter officers. Additional training for Kansas FFA District Officers could be another point for student awareness and practice.

In an ever-changing demographic, there is a need to address diversity and inclusion training and development in Kansas agricultural educators. By using the diversity inclusion model as a guide, continued research on teachers' perspectives and use of diversity and inclusion in agricultural education programs and FFA chapters could make an overall positive impact on the enrollment and engagement of students.

References

Agricultural Education. (2019) National FFA Organization. Retrieved from https://www.ffa.org/agricultural-education/

Banks, J.A., (2008). *An introduction to multicultural education.* Boston, MA: Allyn and Bacon.

Bowen, B. E., & Rumberger, C. L. (2002). Advancing Agricultural Education within the Context of an Increasingly Diverse Society. *Journal of Agricultural Education*, 43(1), 1-11.

Elliott, K. M., & Lambert, M. D. (2018). Urban and Rural Latino Students' Experiences in Agricultural Education: Toward Defining Rural Privilege. *Journal of Agricultural Education*, *59*, 198-212. doi.org/10.5032/jae.2018.03198

Gay, G. (2000). *Culturally responsive teaching: Theory, research, and practice*. New York: Teachers College Press.

Kane, M.R. (2018, February 8). [Kansas Agricultural Education Annual Report]. Unpublished raw data.

Kansas FFA Association (n.d.). About the Kansas FFA. Retrieved from http://www.ksffa.org/about.php

LaVergne, D. D., (2008). *Perceptions of Texas agricultural education teachers regarding diversity inclusion in secondary agricultural education programs* (Doctoral dissertation). Texas A&M University. Available electronically from http : / /hdl .handle .net /1969 .1 /ETD -TAMU -2008 -12 -205.

LaVergne, D., Jones, W. A., Larke Jr, A., & Elbert, C. D. (2012). Identifying strategies for diversity inclusive agricultural education programs. *NACTA Journal*, *56*(2), 47.

Martin, M. J., & Kitchel, T. (2014). Barriers to Participation in the National FFA Organization According to Urban Agriculture Students. *Journal of Agricultural Education*, *55*(1), 120-133.

McManis, L.D. (2017, November 20). Inclusive Education: What It Means, Proven Strategies, and a Case Study. Concordia University – Portland. Retrieved from: https://education.cu-portland.edu/blog/classroom-resources/inclusive-education/

Myers, B. E., Dyer, J. E., & Breja, L. M. (2003). Recruitment strategies and activities used by agriculture teachers. *Journal of Agricultural Education*, 44(4), 94-105.

Salend, S. J. (2008). *Creating inclusive classrooms: Effective and reflective practices.* (6th ed.). Upper Saddle River, NJ: Pearson Prentice Hall.

Shields, L. (n.d.). An Introduction to Equality of Opportunity. Retrieved April 14, 2019, from https://edeq.stanford.edu/sections/equality-opportunity-introduction

Stripling, C.T., & Ricketts, J.C. (2016). Research Priority 3: Sufficient scientific and professional workforce that addresses the challenges of the 21st Century (pp. 30). In G.T. Roberts, A. Harder, & M.T. Brashears, *American Association for Agricultural Education National Research Agenda: 2016-2020*. Gainesville, FL: Department of Agricultural Education and Communication.

Talbert, B. A., Vaughn, R., Croom, D. B., & Lee, J. S. (2014). *Foundations of Agricultural Education* (3rd ed.). Upper Saddle River, NJ: Pearson Education, Inc.

Vincent, S. K., (2010). *A comparison of teachers' and students' multicultural competence and racial color-blindness in ethnically diverse and non-diverse FFA chapters* (Doctoral dissertation). University of Missouri, Columbia.

Vincent, S. K., Kirby, A. T., Deeds, J. P., & Faulkner, P. E. (2014). The Evaluation of Multicultural Teaching Concerns among Pre-Service Teachers in the South. *Journal of Agricultural Education*, *55*(1), 152-166.

Vincent, S. K., & Torres, R. M. (2015). Multicultural Competence: A Case Study of Teachers and Their Student Perceptions. *Journal of Agricultural Education*, *56*(2), 64-75.

The Shortage of Licensed Secondary Agriculture Instructors in Illinois: An Examination of the Impact on Secondary Agricultural Education Program Quality

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Introduction

During the past twenty-five school years, Illinois has consistently experienced a shortage of licensed secondary agriculture instructors (Dittmar, 2017). The number of unfilled openings created each year required Illinois schools to hire provisionally licensed instructors. In fact, in the past five years, Illinois schools have hired 356 teachers, and 105 of those were provisional instructors (Dittmar, 2017). Almost one in three of these new teachers have not received training to teach in an agriculture classroom. The shortage was not limited to Illinois. In 2016, a nationwide supply and demand study reported 22 percent of the agriculture teachers hired were non-licensed or alternatively licensed (Ingram, Sorensen, Warnick, and Lawver, 2018).

The measurement of quality within a high school agriculture program was difficult to define, and often was subjective. One objective way to compare or measure the quality of programs was through the Agricultural Education Incentive Funding Grant (Hepner, 2017). In 1986, the Illinois General Assembly passed Public Act 84-1452, which was an effort to improve and update agricultural education in Illinois. To support this effort, the state of Illinois appropriated funds to benefit agricultural education programs from Pre-K to adults. With the help and advice from the Illinois Committee for Agricultural Education, the Illinois Association of Vocational Agriculture Teachers, and the Illinois State Board of Education, funds were allocated based upon the objectives of the Illinois Plan for Agricultural Education and Illinois First Through Quality Agricultural Education: A Strategic Plan for Illinois Agricultural Education (Hepner, 2017).

The grant allocation supported local high school program improvement, curriculum development, teacher in-service, and pilot projects. All the high schools in Illinois offering approvable programs in agricultural education at the secondary level were eligible to apply for incentive funding grants. Detailed data ranging from the year 2002 to 2018 was posted on the Illinois Agricultural Education website. Each school earned a score based upon the number of quality indicators, or X, they earned throughout the school year. The quality indicators were updated and reviewed each year. The weighted categories for the 2018 Quality Indicators and their potential X values were as follows: qualified teachers (25X), student services (5X), instructional programs (28X), Supervised Agricultural Experiences (15X), FFA (26X), facilities and equipment (8X), agriculture advisory council (8X), and K-adult programs (6X). The total number a school could have earned was 121 X in Fiscal Year 2018 (Hepner, 2017).

The teacher, or teachers, completed the initial parts of the application for the Incentive Funding Grant (IFG) online by completing a checklist within each of the categories listed above. The Illinois FFA Office and the Facilitating Coordination in Agriculture Education (FCAE) Field Advisors both inputted and verified data entered by each school's agriculture instructor. When the process was complete, each school received funding based on the total number of X's, or quality standards, earned during the previous school year. Depending on the fiscal year, there

were 170 to 190 different quality indicators. A summary page of which schools met each of the quality indicators was available on the website, "Illinois Agricultural Education".
Specific techniques of data mining were used to collect and process large amounts of information from the online incentive funding grant applications. According to Martin Brown (2014), the conditions for data mining, in general, had never been any better when it came to amounts of data, data collection software, and availability of places to store data. Data were stored in different ways including web access logs, user profiles, data from sensors, summaries, and educational data. The result was massive quantities of data. According to Brown, data mining was a five-step process: identifying the source information, picking the data points, extracting the relevant information from the data, identifying the key values from the extracted data set, and interpreting and reporting the results (Brown, 2014).

Theoretical/Conceptual Framework

To understand the impact of provisionally licensed teachers on program quality, a five-year longitudinal study was conducted using the online archived data from every school's IFG application. The three-circle concept (Phipps, 2008), provided the foundation for the creation of the quality indicators within the IFG application. The data collected related to each high school's performance in the areas of classroom instruction, FFA and SAE.

Mannila (2000) put forth a theoretical framework for data mining, contending that data mining was very close, in its nature, to statistics. Data mining was often used as a secondary analysis, while data compression was another goal of data mining. Data mining was about finding actionable patterns but could also provide a similar purpose to factor analysis and unveil previously unseen but preexisting pieces of knowledge.

Hung (2012) conducted a case study with a total of 7,539 students, whose activities resulted in 23,854,527 learning logs in 883 courses. Hung's study utilized data mining for program evaluation of K-12 online education. His study demonstrated how data mining can be incorporated into program evaluation in order to generate in-depth information for decision making. In addition, he explored potential electronic data mining applications at the K-12 level that have already been broadly adopted for higher education institutions.

Data mining techniques were used to collect every high school agriculture program's incentive funding grant application for a period of five years. There were 1,603 incentive funding grant applications submitted, with 881 quality indicators that provided us with 1,412,243 data points.

The conceptual framework of the three-circle model (Phipps, 2008) and the data mining theory (Mannila, 2000) combined to make up the framework for this study (see Figure 1). Data mining techniques enabled the researchers to collect and analyze every quality indicator summary report from the archived data on the Illinois Agricultural Education website.

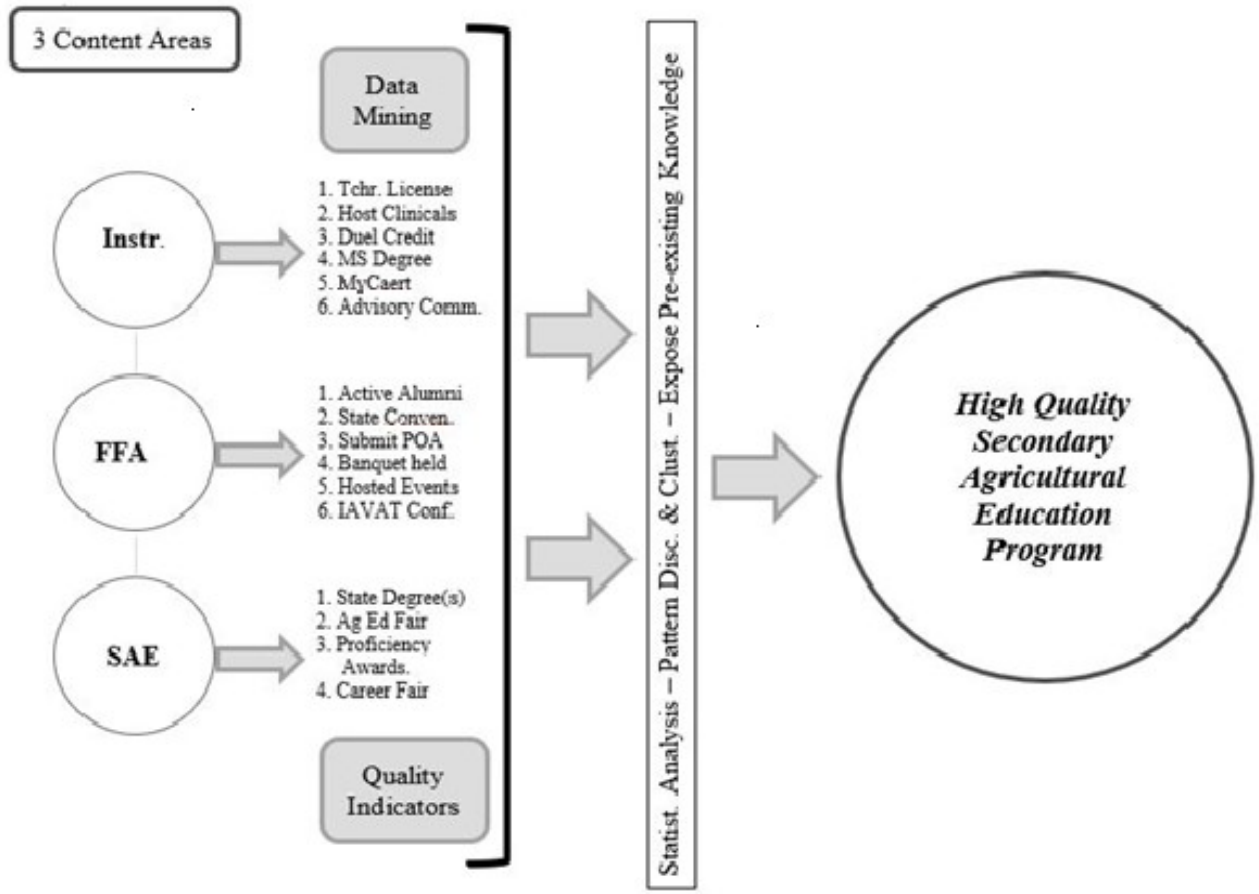

Figure 1. Framework for Assessing the Quality of Illinois Agricultural Education Programs: A Modification of the Inductive Data Mining Theory (Phipps, 2008; Mannila, 2000).

Purpose

The purpose of this research was to evaluate the impact of the shortage of licensed instructors on the quality of high school agriculture programs and to determine whether the hiring of provisional instructors impacts the quality of a high school agriculture program.

The following research questions were addressed in this study:

1. What impact did the type of license a high school agriculture teacher possessed have on the quality of a high school agriculture program?
2. Which of the quality indicators in the Illinois Incentive Funding Grant (IFG) application were the most strongly correlated to a high quality secondary agricultural education program, as indicated by a high X-score on the IFG application?

Methods/Procedures

This research employed a 5-year longitudinal repeated measures research design that examined whether the shortage of licensed high school agriculture teachers in Illinois impacted the quality of Illinois programs. The target population of this study was comprised of two groups which included every high school agriculture program in Illinois. To address the first research question, the schools were separated into two groups. The first group consisted of schools with

fully licensed instructors, and the second group was comprised of provisionally licensed instructors. The type of teacher was identified in the archived applications and their program quality indicators. During fiscal year 2018, there were 257 high schools with fully licensed instructors, and 86 high schools in Illinois with provisionally licensed instructors. Each instructor's school or program was evaluated by his/her program's attainment of quality indicators; therefore, the terms "Program" and "Teacher" were used interchangeably in this study. The terms "School" and "Program" were used interchangeably as well.

This study employed the Illinois Incentive Funding Grant X-scores to measure the quality of high school agriculture programs. The Illinois State Board of Education began the Incentive Funding Grant (IFG) in fiscal year 1989 and continues to collect data through the IFG program. In fiscal year 2018, the grant application consisted of 179 Quality Indicators that schools either met or failed to meet. Based on the number of Quality Indicators achieved, the school earned its X-score. The quality indicators on the Incentive Funding Grant Application were grouped into the following categories: qualified teachers; student services; instructional program; Supervised Agriculture Experience; FFA; facilities, equipment, and supplies; advisory committee; and K-Adult Agricultural Awareness Programs (Dittmar, 2016). The Incentive Funding Grant's categories were not the focus of the research. The decision was made to focus the research on the individual quality indicators.

The total possible X-scores varied over the years. The maximum X-scores during this study were as follows: fiscal year 2014, 152X; fiscal year 2015, 117X; fiscal year 2016 117X; fiscal year 2017, 117X; and fiscal year 2018, 121X. Consequently, yearly X-scores were normalized to percentages scored within the total possible score for that year, so that percent scores could be compared equally over a five-year period. If a school had multiple instructors, the school's X-scores were included in each of the categories, where fully licensed and provisionally licensed teachers worked together. This research required determination of the arithmetic mean quality (as a percentage of the X-score for that year) of every agriculture program in Illinois. The researcher collected the data from each high school's X-scores over a five-year period (fiscal years 2014 – 2018). SPSS was used to calculate the mean X-score.

The second research question required the researcher to analyze the individual quality indicators to locate the indicators that had the highest impact on a programs X-score. Out of the 179 quality indicators, the researcher selected ten quality indicators that had the highest correlation to a high X-score. The ten indicators were selected using SPSS 24 to run Pearson correlation tests between all 179 of the quality indicators. After using the Pearson correlation coefficient, the researcher elected to remove multiple collinearity to reflect expert input on the indicator's measurability. After the top ten quality indicators were selected, the completion percentage of those indicators for the provisionally licensed and fully licensed instructors were compared.

Five years (fiscal year 2014-fiscal year 2018) of data were collected from an online repository for each of the Illinois agricultural education programs' Incentive Funding Grant applications. HTTrack Website Copier (Roche, 2017) was employed for data mining purposes.

Findings/Results

Research question one resulted in the following findings: schools with a licensed instructor five-year average mean X-score was 57 percent, while schools with a provisional instructor five-year average mean X-score was 38 percent. As illustrated in Figure 2, X-scores for schools with certified instructors ranged from 56 to 58 percent from the fiscal year 2014 to fiscal year 2018. X-scores for programs with provisional instructors ranged slightly more from 36 to 41 percent. Figure 2 demonstrated a yearly difference with the largest gap between provisional and certified instructors being 21 percent in fiscal year 2016. The smallest gap was 16 percent in fiscal year 2017.

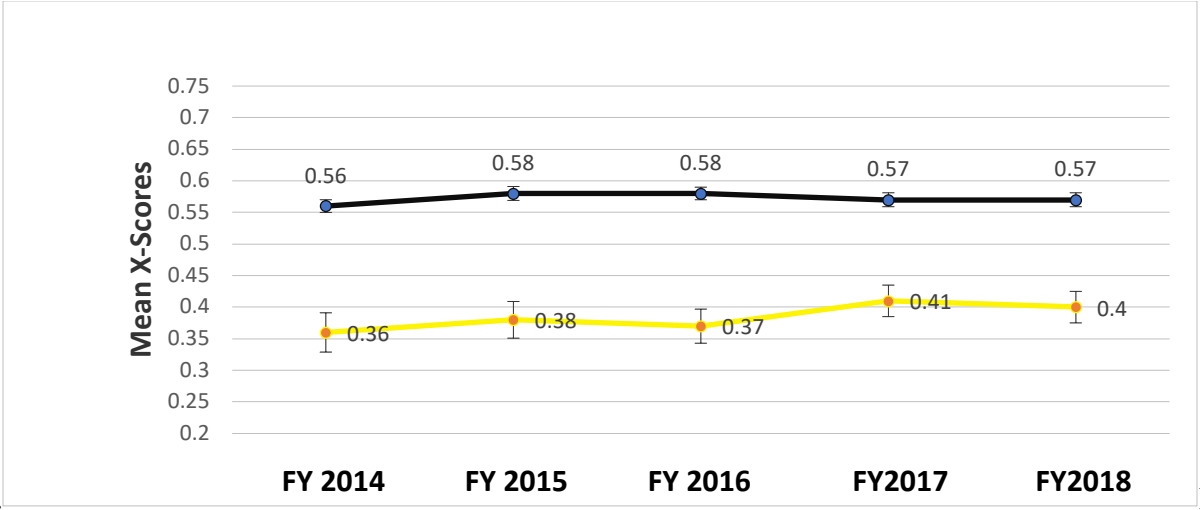

Figure 2. X-scores for Schools with Provisional or Licensed Teachers from FY14 to FY18 (Heavner, 2018)
Note: The black line represents licensed instructors, and the yellow line represents provisional.

After examining the Pearson correlation coefficients, the researcher selected the following ten quality indicators: hosting section IAVAT or FFA events, attending the IAVAT Conference, participating in the Section Agriculture Education Fair, sending students to career fairs, submitting six or more SAE's for section judging, earning at least one state FFA degree, attending state FFA convention, having an alumni affiliate, submitting a National Chapter Award application, and having two or more advisory council meetings (Table 1).

Table 1.
Correlation of Quality Indicators Achievement by Percentage to High IFG Scores

ISBE QI	Quality Indicator Description	Mean %	Pearson r	P Value
A4f	Hosted a Section IAVAT/FFA Event	0.67	0.59**	0.000
A5a	Attended IAVAT Conference	0.68	0.57**	0.000
B7	Students attended a Career Fair	0.75	0.40**	0.000
D4b	Submitted 6 or more SAE's for Section Judging	0.34	0.64**	0.000
D5	Three or more exhibited in Section Ag Ed Fair	0.42	0.62**	0.000
D6	One or more Earned State FFA Degree	0.53	0.65**	0.000
E3	Submitted POA for National Chapter Award	0.53	0.65**	0.000
E7a	Attended Illinois FFA Convention	0.83	0.60**	0.000
E8	School Supported by Alumni Affiliate	0.63	0.57**	0.000
G2	Advisory Council meets 2 or more time per year	0.49	0.53**	0.000

** Pearson Correlation is significant at the 0.01 ($P < 0.01$) level (2-tailed).

Schools with fully licensed instructors had a higher completion rate on every one of the top ten quality indicators, resulting in a higher correlation to a higher X-score (Table 2). Schools with fully licensed instructors achieved seven of the ten quality indicators at a level of 24 to 34 percent more frequently than schools with provisionally licensed instructors. The least amount of difference was 15 percent, which existed with the quality indicators related to attending career fairs and applying for the National Chapter Award Program.

Table 2.
Licensed and Provisional Instructors' Achievement Level of Quality Indicators.

Quality Indicator	Licensed			Provisional			
	n/N	%	R	n/N	%	R	% Diff.
Hosted FFA Events	914/1336	68	4	100/267	37	5	31
Attend IAVAT Conf.	1019/1336	76	3	118/267	44	4	32
Attended Career Fair	864/1056	82	2	153/233	67	1	15
6 SAE's at Section Awards	547/1336	41	10	38/267	14	10	27
3 or more at Ag Ed Fair	785/1336	59	7	67/267	25	8	34
Earned State Degree	590/1056	56	8	57/233	24	9	32
Submit NCA/POA	898/1336	67	5	139/267	52	3	15
IL FFA Convention	1180/1336	88	1	171/267	64	2	24
Active Alumni	849/1336	64	6	98/267	37	6	27
Advisory Council 2+	671/1336	50	9	90/267	34	7	16
Total	8317/12800	65	X	1031/2602	40	X	25

Conclusions

The results of this study indicate the shortage of licensed secondary agriculture instructors have a negative impact on the quality of secondary agricultural education programs in Illinois. The research indicates a substantial difference exists between the performance of high school agriculture programs with fully licensed instructors and programs with provisionally licensed instructors. The schools with a licensed instructor five-year mean X-score was 57 percent, while schools with a provisional instructor five-year average mean X-score was only 38 percent. When looking at the year to year differences between fiscal year 2014 to fiscal year 2018, every year the scores for schools with fully licensed instructors were higher ranging from 16 to 20 percent.

It is worthy to note that the X-scores from year to year were consistent for schools with fully licensed instructors and schools with provisionally licensed instructors. Schools with fully licensed teachers had a high of 58 percent and a low of 56 percent over the five years. The year-to-year X-scores for schools with provisional teachers demonstrated a little more variation starting at a 37 X-score and ending at a 40 X-Score.

The results from the second research question were consistent with the results of research question one. The provisional instructors performed at a lower percentage on all the top ten quality indicators. On seven of the ten, schools with provisional instructors were 25 or more percent lower than schools with fully licensed instructors. Interestingly, when the rank of indicators from one to ten was examined, the consistency between the two groups was obvious. The top five and bottom five quality indicators were the same for both groups of schools.

Therefore, it could be implied that the provisional and the fully licensed instructors placed a similar priority for completion on those quality indicators.

Recommendations, Limitations, and Discussion

The first recommendation is to address the finding of lower program quality among schools with provisionally licensed faculty. It is recommended that in-service training be provided for provisional instructors in the areas of classroom instruction, FFA, and SAE. The in-service training should be created and provided by a collaboration between the Illinois Association of Vocational Agriculture Teachers, the Illinois State Board of Education, and the teacher-licensure universities in Illinois. The results of the second research question about the top ten quality indicators should be used to prioritize the focus of the topics covered within those in-services.

The second recommendation is to create a pathway for schools with provisional instructors to become fully licensed instructors without being forced to quit their jobs and return to the universities. The Illinois State Board of Education and the universities with agricultural education programs should coordinate efforts to provide both online and supervised training programs for provisional instructors to become fully licensed instructors. The pathway should include a mentor program pairing every provisionally certified instructor with a fully licensed instructor. This program would provide a clear path to obtaining a teaching license while keeping the provisional instructor in the classroom; thus, increasing retention of current instructors to help reduce the initial challenge of the teacher shortage.

The third recommendation is to replicate the methods of this study to determine the impact that teachers' gender, teacher retention, length of teaching contract, and geographic regions have on the quality of agricultural education programs in Illinois.

It should be noted that there are limitations to this study. The first was the study's data was limited to the state of Illinois. Therefore, the results cannot be generalized to other states. This study was conducted to report the five-year percentage of the school's performance of quality indicators. This study did not analyze the schools' X-scores or performance of quality indicators for year-to-year increases or decreases to identify trends as to whether schools were improving or falling behind.

The purpose of this research was not to condemn schools with provisional instructors. A study conducted by Bowling and Ball (2018) suggested that we, as a profession, must work together to support the preparation and sustainability of alternatively certified teachers. States should develop agreed-upon standards and create a community of collaboration for provisional instructors. Just as a pathway for success should exist for every student, shouldn't a pathway for success be provided for every teacher? In order to succeed in the common goal of providing quality agricultural education programs, educators must work with a sense of inclusion rather than exclusion.

References

Bowling, A. M., & Ball, A. L. (2018). Alternative certification: A solution or an alternative problem? *Journal of Agricultural Education*, *59*(2). 109-122. doi:10.5032/jae.2018.02109

Brown, M. (2014). 5 steps to start data mining. Retrieved on March 19, 2018 from: http://scitechconnect. elsevier.com/5-steps-start-datamining/

Dittmar, D. (2017). Illinois secondary agriculture teachers supply & demand. Retrieved on February 22, 2018, from: http://www.agriculturaleducation.org/images/editor/ Data/Teacher%20Supply %20and%20Demand%20Summary%202017-2018.pdf

Dittmar, D. (2016). 2015 Illinois agricultural education report: 7-12 agriculture teachers. Retrieved on March 18, 2018, from: http://www.agriculturaleducation.org/images/ editor/2017%20IL%20Ag%20Ed%20Report%20FINAL%20Web%20Lowest%20Resolution%20(2).pdf

Facilitating Coordinating Agriculture Education (FCAE). (2017). 2017 Illinois agricultural education report. Retrieved on March 18, 2018, from: http://www.agriculturaleducation .org/images/editor/2017%20IL%20Ag%20Ed%20Report%20FINAL%20Web%20Lowest%20Resolution%20(2).pdf

Heavner, H. K. (2018). The Shortage of Licensed Secondary Agriculture Instructors in Illinois:An Examination of the Impact on Secondary Agricultural Education Program Quality. Southern Illinois University at Carbondale.

Hepner, H. (2017). Agricultural education incentive funding grant: Background. Retrieved on March 18, 2018, from: http://agriculturaleducation.org/linkpages/ifga//Incentive FundingBackground.asp

Hung, J. L., Hsu, Y. C., & Rice, K. (2012). Integrating data mining in program evaluation of K-12 online education. *Journal of Educational Technology & Society*, *15*(3), 27-41.

Ingram, M. L., Sorensen, T. J., Warnick, B. K., & Lawver, R. G. (2018). The influence of school-based agricultural education on preservice agriculture teachers' choice to teach. *Journal of Agricultural Education, 59*(2), 64-78. doi: 10.5032/jae.2018.02064

Mannila, H. (2000). Theoretical frameworks for data mining. SIGKDD Explorations Newsletter, 1 (2) 30-32. Retrieved February 22, 2018, from: https://dl.acm.org/citation.cfm? id=846191

Phipps, L. J., Osborne, E. W., Dyer, J. E., & Ball, A. (2008). Handbook on Agricultural Education in Public Schools (6th ed.). Clifton Park, NY: Thompson Delmar Learning

Roche, X. (2017). *HTTrack Website Copier*. Retrieved December 11, 2017 from: http://www.httrack.com

Teacher Perceptions of the Impact and Challenges of Middle School Agricultural Education Experiences in Kansas

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Introduction/Literature Review

Middle school is the time to get students involved in future career areas and explore what type schooling, vocational school or college will be needed (Anderman & Maehr, 1994). Agricultural education should provide for students the skills needed for future employment through classroom, FFA, and laboratory experiences (Hughes & Barrick, 1993). Middle school FFA and agriculture classes allow students to expand the possibilities of exploring different careers in agriculture and agricultural issues (National FFA Organization, 2018). When a teacher plans for a middle school class, the focus needs to be about personal development, career exploration, agricultural literacy, and introduction to future career skills (Rayfield & Croom, 2010).

Middle school agriculture classes need to be different and separated from high school agriculture classes (Frick, 1993). Middle school students have unique developmental traits that are different from elementary age students and high school age students (Booker, 2018). Having school involvement for a student during middle school is important in influencing life choices and career patterns; furthermore, total alienation or no real engagement during this age may cause a student to have a difficult time entering society or dropping out of school altogether (Anderman & Maehr, 1994).

In 1988, 7th and 8th graders were allowed to become National FFA members, when the National FFA constitution was changed at National FFA Convention (National FFA Organization, 2018). Nationally 7th and 8th graders can participate in several different FFA activities, Career Development Events (CDEs), Leadership Development Events (LDEs) (National FFA Organization, 2018). In Kansas, agriculture classes and FFA focuses more on high school students (9th – 12th graders) than middle school students (6th – 8th).

Conceptual Framework

The conceptual framework for this study included career exploration and belongingness. Middle school students are at a development stage in which they are excited to learn, curious, and are beginning to become aware of future career decisions they need to make in the near future (Budke & Woodin, 1971). Goodenow & Grady (1992) define sense of belonging when applied to middle school students as feeling personally respected, included, accepted, and supported by teachers and other adults. It is important teachers see to their students' needs and have a caring connection to help foster students' sense of belonging (Ellerbrock & Kiefer, 2014). Providing high quality middle school agricultural experiences has the potential to positively impact the students' career decision and provide a sense of belonging for each student.

Purpose and Objectives

The purpose of this study was to determine agriculture teachers' perceptions of the impact of middle school agricultural education experiences. The need for this study is connected to Research Priority 5 of the *2016-2020 American Association for Agricultural Education National Research Agenda: Efficient and Effective Agricultural Education Programs* (Thoron, Myers, & Barrick, 2016).

For this study, middle school agricultural experiences are defined as agriculture class enrollment and exposure to FFA activities for 6th – 8th graders. The specific objectives for this research study are:

1. Identify perceived challenges agriculture teachers have when teaching a middle school agriculture class.
2. Investigate the potential impact of middle school agricultural experiences on personal growth and high school agricultural education participation.
3. Investigate how to improve middle school agriculture education (agriculture classes and FFA) at the local and state levels in Kansas.

Methodology/Methods

A recruitment email was sent to all Kansas agriculture teachers ($N = 240$) at the end of August 2018 requesting they complete a researcher-designed survey to investigate middle school agriculture classes and FFA. Researchers sent three reminder emails to participants who had not responded to the survey. The survey closed in early October 2018. A total of 154 teachers ($n = 154$) completed the survey, with a response rate of 64%. Efforts were made to minimize non-response error through the multiple reminder emails and sending the survey to all Kansas agriculture teachers. Additionally, early to late responders were compared (Lindner, Murphy, & Briers, 2001) on the scale items and there was no statistical difference between the two groups.

The survey flow was designed to have blocks of questions based off the objectives of the study. Participants were first asked if they taught any middle school classes. If yes, teachers were asked to answer questions on their characteristics, background of the program, problems/challenges teaching middle school, and then the extent of what is being done with 6th, 7th, and 8th graders depending upon which grade the teacher taught. If the teachers answered no, they do not teach a middle school agriculture class, then they were asked to answer a question of why not. Every participant answered questions on how to improve Kansas middle school agriculture classes and FFA at the local and state levels. The quantitative data consisted of questions with a sliding scale (0-100) for the response. Open-ended questions allowed for more descriptive information connected to middle school agriculture programs.

The survey was evaluated by a committee of three Kansas State University professors, one KSU instructor who was a former Kansas agriculture teacher, one employee from the Kansas Department of Education, and one employee of the Kansas FFA Association. This committee evaluated the survey for content validity and made recommendations to improve the survey. Post-hoc reliability was conducted on the 11 scale items resulting in a Chronbach's alpha of .85. Furthermore, these results cannot be generalized to other states, but may offer suggestions for future studies in other states.

Results/Findings

Of the 154 Kansas agricultural teachers who participated in this study, 102 teachers (66.23%) indicated they teach some type of agricultural middle school (6th - 8th grades) class. Incomplete surveys were removed from further analysis, therefore 100 teachers indicated teaching middle school courses, 51 teachers did not teach any type of middle school courses.

Of the 100 teachers who completed the full survey, it was approximately even between females (51%) and males (49%). The majority of the teachers were married (64%), and between the ages of 21-25 (28%). The most reported years of teaching middle school agriculture in Kansas was 2-5 years (44%). The majority reported that their school has been offering middle school agriculture less than 5 years (n = 40, 40%) or 6 to 10 years (n = 36, 36%). The vast majority of agriculture courses were taught by one teacher (n = 98, 97.03%) even at multiple teacher programs.

Objective one asked teachers to identify the challenges of teaching a middle school agriculture class. Teachers were asked to select challenges of teaching middle school agriculture class from a list of challenges identified through the literature review and committee feedback during survey content validation. The biggest challenges indicated by teachers included students have different interest and involvement levels (n = 47), lack of middle school FFA CDEs offered above the local level (n = 42), too full class schedule (n = 33), lack of resources and curriculum (n = 31), lack of middle school FFA LDEs offered the local level (n = 27), recruitment (n = 20), and insufficient funds (n = 18). Additional challenges included insufficient class length (n = 10), location of middle school (n = 9), administration support (n = 7), and other (n = 11). (Teachers were able to select more than one challenge, therefore the percent total does not equal 100). No teachers selected community support as a challenge to teaching middle school agriculture.

Objective two investigated the potential impact of middle school agricultural experiences on personal growth and high school agricultural education participation. Teachers were asked to perceive middle school student growth in several areas. These areas were assessed based on a scale from 0 = not interested to 100 = extremely interested. The highest perceived growth was agricultural awareness with a mean of 69.67 (SD = 21.42), second highest was personal growth (M = 69.20, SD = 69.20), and third highest was performance in agriculture class (M = 67.84, SD = 17.08). Table 1 includes all of the areas.

Table 1
Teachers' Perceptions of the Areas of Middle School Students Growth (*n* = 96)

Variable	Mean	Standard Deviation	Range
Agricultural Awareness	69.67	21.42	8-100
Personal Growth	69.20	18.93	6-100
Performance in Agriculture Class	67.84	17.08	22-100
Career Awareness	66.47	20.11	21-100
Leadership	57.63	21.33	6-100
Accountability for Agricultural Course Work	56.42	21.17	0-100

Note. 0 = Not Interested, 100 = Extremely Interested

Teachers were asked to perceive the impact the middle school agricultural education had on high school agricultural education by elevating several key areas. The areas were assessed based on a scale from 0 = not interested to 100 = extremely interested. The highest ranked area was an increased enrollment in secondary agriculture classes with a mean of 70.83 (SD = 24.14). All areas are included in Table 2.

Table 2
Perceived Impact of Middle School Agriculture Education Experiences on High School Agriculture Involvement (*n* = 100)

Variable	Mean	Standard Deviation	Range
Increased Enrollment in Secondary Agriculture Class	70.83	24.14	8-100
Increased Involvement in FFA CDEs	61.46	21.71	7-100
Increased Involvement in FFA LDEs	54.63	23.07	0-100
Increased Participation in SAEs	51.72	23.09	0-100
Increased "Burn Out"	31.33	23.80	0-100

Note. 0 = Not Interested, 100 = Extremely Interested

Objective three investigated how to improve middle school agriculture education (agriculture classes and FFA) at the local and state levels in Kansas. The major finding was to make the middle school agriculture course a required rotational course. Other themes were to increase resources, have a middle school curriculum, and allow middle school students to compete at contests.

When asked how to improve middle school agriculture courses at the state level, the majority of responses were not sure, but others identified having a state curriculum, and increased funding. One teacher indicated, "*A standard curriculum for 7th and 8th grade classes would be appreciated as the competency profiles (outcomes) have NOT been updated in the past several years!*"

In addition, teachers identified how to improve middle school FFA at the local and state levels. The major theme was allowing middle school students to compete or at least watch CDEs. One teacher said, "*Locally I wish I had more CDEs that I could take the 8th graders to, in order to boost excitement about FFA, 8th graders have way more enthusiasm than high school students."* Other responses included longer classes and offering more opportunities/activities for middle school students. Several teachers suggested having a middle school discovery day or conference. One teacher stated:

> *Have a "Middle School Conference" similar to a career fair/ all activities that are involved in future years with the FFA. This can include Conferences, Conventions, CDEs, LDEs, SAEs, etc. Have this as a state-wide deal that students can see the true potential of FFA and help recruit the kids that are more of the non-typical FFA Member."*

Conclusions/Recommendations

The purpose of this study was to investigate Kansas agricultural education teachers' perceptions of the impact and challenges of middle school agricultural education experiences.

When teachers perceived the impact of middle school agriculture experiences on high school agriculture involvement, the majority concluded that middle school agriculture experiences had increased enrollment in high school classes. Extracurricular activities helped students feel more connected and have a better chance of a positive transition from middle school into high school (Akos, 2006). One recommendation for future research is to explore additional events to expose middle school students to state-level events in Kansas FFA.

The majority of the content currently taught to middle school students includes animal science, careers in agriculture, and plant science, but teachers indicated the need for a state middle school agriculture curriculum. Rayfield and Croom (2010) recommended middle school agriculture class curriculum have an agriculture emphasis and comprised of hands-on activities. Rossetti (1994) reported middle school students were more knowledgeable about agricultural careers, agriculture in general, and benefited more than high school students from hands-on experiences. Roberts (2003) supports that SAEs are an important part of middle school agricultural education, due to giving students an opportunity of hands-on experiences in areas of the students' interest compared to what is being taught in the classroom. Having a more challenging curriculum will help middle school students with the transition to high school, by allowing them to have more responsibilities and learning different strategies to foster confidence for high school (Cauley & Jovenovich, 2006). A recommendation for practice includes revising the middle school agriculture classes in Kansas, supporting teachers in developing curriculum, and providing in-service on effective teaching practices for this age group.

Middle school students who have taken an agriculture course had more awareness about agriculture careers and agriculture in general (Rossetti & McCaslin, 1994). Most teachers indicated the need to make at least one middle school agriculture class part of a required rotational class system. It is recommended teachers work with their local school districts, administrators, and counselors to fit a middle school course into the curriculum.

Teachers reported a desire to allow middle school students to compete at events above the local level. Teachers perceived a positive impact on high school student involvement when students

were involved in FFA CDEs during middle school. A recommendation would be to allow middle school students to compete in their own division and at the state level. Teachers also want a State Discovery Day, or some type of conference where middle school students can come and experience CDEs, LDEs, SAEs, and explore agricultural careers. Also, having more events for middle school students to get involved will foster the sense of belonging. Osterman (2000) stated that when students have a community in which they feel connected it helps with promoting the sense of belongingness.

A final recommendation for future research is to repeat this study in 5 to 10 years to see if there are any improvements to middle school agricultural experiences in Kansas. Also, have this study conducted in different states to see what extent of middle school agriculture experiences are happening across the country. Another recommendation for research is a longitudinal study of students who participated in middle school agriculture through high school and post-secondary to determine the effects of early agricultural education on career choice, academic achievement, and participation.

References

Akos, P. (2006). Extracurricular participation and the transition to middle school, *RMLE Online, 29(9), 1-9,* doi 10.1080/19404476.2006.11462032

Anderman, E. M. & Maehr, M. L (1994). Motivation and schooling in the middle grades. *Review of Educational Research*, *64(2), 287-309.*

Booker, K. (2018). The hightide raises all ships: Middle grades teachers' perspectives on school belonging in early adolescence. *RMLE Online, 4(8), 1-15.* doi 10.1080/19404476.2018.1505402

Budke, W.E., & Woodin, R. J. (1971). New approaches to occupational exploration in the middle school. *Journal of the American Association of Teacher Educators in Agriculture, 12(3), 1-8.* doi 10.5032/jaatea.1971.03001

Cauley, K. M. & Jovanovich, D. (2006). Developing an effective transition program for students entering middle school or high school. *The Clearing House: A Journal of Educational Strategies, Issues and Ideas, 80:1,* 15-25, DOI: 10.3200/TCHS.80.1.15-25

Ellerbrock, C., Kiefer, S. M., & Alley, K. M. (2014). School-based interpersonal relationships setting the foundation for young adolescent's belonging in middle school. *Middle Grades Research Journal, 9(2), 1-17.*

Frick, M. (1993). Developing a national framework for a middle school agricultural education curriculum. *Journal of Agricultural Education, 34,* 77-84. doi 10.5032/jae.1993.02077

Goodenow, C. & Grady, K. E. (1992). The relationship of school belonging and friends' values to academic motivation among urban adolescent students. *Journal of Experimental Education, 62(1), 60-71.*

Hughes, M. & Barrick, R. K. (1993). A model for agricultural education in public schools. *Journal of Agricultural Education, 34,* 59-67. doi: 10.5032/jae.1993.03059

Lindner, J.R., Murphy, T.H., Briers, G. E. (2001). Handling nonresponse in social science research. *Journal of Agricultural Education, 42*, 43-53. doi: 10.5032/jae.2001.04043National FFA Organization (2018). *Official FFA manual*. Indianapolis: National FFA Organization.

Osterman, K. (2000). Students' Need for Belonging in the School Community, *Review of Educational Research, 70(3), 323-367.* doi 10.3102/00346543070003323

Rayfield, J. & Croom, B. (2010). Program needs of middle school agricultural education teachers: A delphi study. *Journal of Agricultural Education, 51, 131-141.* doi: 10.5032/jae.2010.04131

Roberts, T. G. (2003). Middle school SAE: The teacher's role. *The Agricultural Education Magazine. 75(6), 10-11.*

Rosetti, R., & McCaslin, N. L. (1994). A status report on middle grade agricultural education and FFA programs in the United States. *Journal of Agricultural Education, 35(2). 22-26. doi: 10.5032/jae.1994.02022*

Thoron, A.C., Myers, B. E., & Barrick, R.K. (2016) Research Priority 5: Efficient and Effective Agricultural Education Programs. (pp. 41-48). In G.T. Roberts, A. Harder, & M.T. Brashears, *American Association for Agricultural Education National Research Agenda: 2016-2020*. Gainesville, FL: Department of Agricultural Education and Communication.

Women Agvocates' Approaches to Using Instagram

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Introduction

When the first settlers came to the United States, their challenge was to adapt their agriculture practices and learn how to cultivate the new land they had stumbled upon. Today, people within the agriculture industry face new challenges brought on by consumers questioning how food is produced and handled from start to finish. More consumers today are becoming concerned about the treatment of the livestock that produce their food, including dairy cattle.

Social media can be used as a tool for agriculturalists to build connections with the Millennial consumer. Today, seven in ten people in the United States use social media as a form of communication or a method to gather information (Pew, 2018). Much research has been conducted in the field of communications that shows the benefits of using platforms like Facebook and Twitter, but little research has focused on Instagram. Instagram, with 1 billion users, is among the top five social media platforms, with some estimates placing it in the second spot for most popular (Worthy, 2018). According to the Pew Research Center (2018), Instagram has seen a 25% increase in users in the last five years. Currently, 50% of Instagram users are women (Worthy, 2018).

Many agriculturalists have turned to Instagram to promote the industry. Instagram as a social media platform appeals to the Millennial generation because it is photo- and video-based and easy to use. Users can form an online community of followers that they can educate about their cause, and they can follow others that promote the same cause. Additionally, women have taken the agriculture industry by storm. Roughly 30% of farmers in the United States are women (Griffeth et al., 2018). More women are being encouraged to take on leadership roles within the industry to diversify agricultural groups, and they have a higher level of "social sensitivity," or the ability to handle intense or awkward social encounters (Griffeth et al., 2018, p. 3). The growing number of women in agriculture, their increasing role in promoting the food and fiber industry (Stiers, 2019), and their reliance on social media like Instagram make female agricultural advocates an ideal case study for this research.

One sector of U.S. agriculture that is currently under scrutiny is the dairy industry. In the last two decades, animal-rights advocates and dairy alternatives have shifted public perceptions of dairy production, and producers are finding innovative ways to fight back.

Purpose and Objectives

It is important for agriculturalists to understand the use of social media, specifically Instagram when it comes to connecting with the consumer. The combination of women and social media may bring the dairy industry to the millennial consumer like they have never seen it before. The purpose of this study was to evaluate how Instagram is used by female dairy farmers when trying to educate the consumer about the industry. The following objectives guided this study:

> RO1: To identify messaging of agricultural posts on Instagram accounts of women involved in the dairy industry; and

RO2: To describe how Instagram accounts of women in the dairy industry used posts to develop transparency and trust with followers.

Conceptual Framework

Media dependency theory and uses and gratification theory have all been used to describe how social media play a major role in communication today. Transparency was also incorporated into the study's conceptual framework.

Media Dependency Theory

Media dependency theory states that the more people depend on media, the greater their effect on users (Baldwin, Perry & Moffit, 2004). As people begin to rely on media for information, those outlets allow them to have access to some information they may not otherwise have access to. The level of dependency also is determined by the social group and culture of the person (Baldwin, Perry & Moffit, 2004). More than 85% of adults worldwide use the internet, and very few people go a day without checking a social media site (Gharis et al., 2014). Brinkman, Kinsey, and Henneman (2017) reported that 65% of the population uses social media platforms. Of people between the ages of 18 and 29, 90% use social media. This is a good indication that consumers are using media to get a large portion of their information, and that may influence their opinions.

Uses and Gratification Theory

The uses and gratification (U&G) theory, developed by Blumler and Katz in 1974, states that people actively seek out media, and that the media continues to compete with other sources of information. People will choose a medium that is most beneficial to them (Graybill-Leonard et al., 2011). Graybill-Leonard et al. (2011) used U&G theory to explain why agricultural professionals utilize groups formed on social media. Participants in the study felt it was their duty to support and promote the industry and lifestyle in which they were raised. They hope to leave behind the same, if not a better, environment for their children (Graybill-Leonard et al., 2011). Others felt that the social media movements in these groups provided a safe platform for people within the industry to unite to address issues. Abrams and Sackman (2014) surveyed 120 Illinois farmers to gauge the amount of time they spent on social media, what they were using it for, and how their usage related to "social capital and business viability" (p. 5). On average, the respondents spent 16 hours a week on the internet using different social media sites for both personal and business use, mainly researching information on farming topics or engaging and searching for customers.

Transparency

Millennials are considered the information-seeking generation and want to know where their food is coming from (Oesterreicher et al., 2018). In focus groups, college students recommended that Florida beef producers present information about the industry through videos and photographs to help build more transparency in the industry. Stebner, Ray, Becker, and Baker (2015) interviewed food bloggers who visited Kansas farms. Overall, the bloggers felt that the farms that they visited were open and transparent with them, and they were able to have questions answered about general practices, and concerns about animal welfare were addressed. The tour allowed farmers to be open and honest about their practices and receive feedback about

what consumers are looking for. The bloggers on the tour all noted that much of the interaction they get comes from Pinterest or Instagram, photo-based social media platforms.

Methods

This qualitative case study examined the use of Instagram by women in the dairy industry in their efforts to educate consumers. Posts were collected from five public Instagram accounts, all of which met the following criteria set by the researchers: operated by women who are directly involved in the dairy industry; with over 5,000 followers; that are located in the United States; and that promote agriculture in some manner (Table 1).

Table 1
Instagram Account Overview

Account	Location	Followers	Tagline	# of Posts
@dairycarrie	Wisconsin	14,000	Strangely passionate about milk. Boy mom, dairy farmer, beer drinker, speaker, leader. Proud to be a WI cheese head.	33
@dairygirlfitness	Florida	5,259	PA —>📍FL 🌴 Agvocate here to promote dairy and a healthy, balanced life 💚🐮 Chocolate milk connoisseur 🥛🧃@bowmar_nutrition Athlete 😈 #DairyGirlStrong	66
@newmexicomilkmaid	New Mexico	13,500	"Questions about agriculture? Let me show you life on our family dairy farm from my perspective as an environmental scientist, farmer & mom"	64
@nyfarmgirls	New York	24,500	Dairy and crop farm 🐄🚜 Central New York🌲 3 sisters 👭 Filling the gap between consumers and producers	34
@wiscowsingal	Nebraska	22,000	🌻 #FarmHer Jenna in the Sandhills of Nebraska enjoying life with beef & dairy cows, 3 dogs, Cody & a premature daughter with #shortbowelsyndrome. 🌼	47

Posts were collected from each account between January 1 and March 31, 2019. Screenshots of each post were taken and labeled with the date of the original post and the account name. A spreadsheet was created to track each account's posts, and observation notes were recorded on each to track themes and repetitive words and/or hashtags. Photo filters were considered and noted in the document. Thematic analysis was used to identify themes of the posts, following methods used by Smith and Sanderson (2015).

Findings

A total of 244 posts were evaluated. Each was examined and placed into one of seven themes by the principle researcher to help guide the observations for later discussion (Table 2).

Table 2
Instagram Post Themes

Theme	# of Posts	Description
Beauty	2	Post provides hair, makeup or skin care tips or tutorials.
Cows	50	Post contains a picture of a cow but does not give any educational information or call to action.
Dairy	80	General posts about the account owners, their life, or promotion of their merchandise.
Education	39	Primary purpose of the post is to educate the viewer either through the picture or caption.
Family	27	Post focuses specifically on the account owner's family.
Fitness	28	Post contains fitness/workout routines or tips.
Food	15	Post contains mostly food and talks about how to make that meal or the use of dairy products.

All the posts in the study are well lit or shot in the sunshine and had vivid colors, conveying a feel-good attitude. Most posts contained pictures of cattle or something directly related to the dairy industry. The photos were a mix of candid and posed photos; both included people that are smiling or animals that look comfortable and healthy: The cows are alert, in a clean environment, and do not appear to be sick. When all posts are listed in order by date, trends can be seen in the scheduling of these posts: Serious, educational posts are not always posted back to back and account owners throw in funny, motivational, or personal posts to mix up the content.

Certain posts can be seen as a method to build transparency and trust with followers as the account owners open up about various topics. Transparency was especially key to the themes of dairy, education, and family. Within the dairy theme, posts range from introductions of kids on the farm to general dairy information. The accounts aim to share information on a more personal level. The account owners share with their followers' other interests outside of their dairies. The education theme posts tackle some of the more difficult topics that go along with the dairy industry. In these types of posts, the hashtag #dairytruth is used frequently because the users want their followers to know the truth about what really happens in these situations. Finally, the family theme may be considered the most vulnerable posts collected from all five accounts. All five accounts share information about their other pets, significant others, and children.

Discussion

The five account operators understand that the millennial consumer does not have knowledge of basic farming practices and of those who devote their lives to the dairy industry. They also understand that this new group of consumers is turning to social media to collect their information. With almost 80,000 followers combined, the women have been able to build an online community of people interested in their messages. Their posts, adding up to 244 in just three months, help keep followers engaged on a regular basis and support the notion that both the account holders and their followers rely on the platform for information they deem important (Gharis et al., 2014). People are engaged in the stories these women tell and may feel connected to the accounts when buying dairy products. The account owners understand the importance of imagery to the next generation of consumers. Many consumers have the image of a "factory farm" in their minds when picturing where their food comes from, so this tactic attempts to battle those misconceptions. The feel-good photo, with the sun shining, draws attention to the post and the accounts use this as an opportunity to include certain messaging to educate their followers on different causes. The account owners clearly rely on Instagram as a means of sharing positive information about their livelihoods, like those farmers studied by Graybill-Leonard et al. (2011), while their followers learn about dairy production from the source.

The five accounts of the study do a very good job of establishing trust and transparency. Many of the posts are raw and personal, as they are exposing themselves to complete strangers. In posts like this, they are developing a foundation with their followers to show that they are real people who struggle like anyone else. They discuss common events that people go through, such as sick children or body image issues. Each user addresses these personal messages from different angles, but all are successful in humanizing the people that are involved with the dairy industry.

This study is not without limitations. Coding was undertaken by a single researcher for the purpose of a graduate thesis, and thus the findings of the study cannot be extrapolated beyond the five Instagram account owners whose posts were analyzed for this study. However, this study does represent a first look at how female agvocates use Instagram as a means of reaching out to consumers.

References

Abrams, K. M., & Sackmann, A. (2014). Are alternative farmers yielding success with online marketing and communication tools for their social capital and business viability? *Journal of Applied Communication*, 98(3). Retrieved fromhttp://doi.org/10.4148/1051-0834.1085

Baldwin, J. R., Perry, S. D., & Moffitt, M. A. (2004). *Communication theories for everyday life*. Boston, MA: Pearson.

Blumler, J. G., & Katz, E. (1974). The uses of mass communications: Current perspectives on gratifications research. *Sage Annual Reviews of Communication Research, Volume 3*. https://eric.ed.gov/?id=ED119208

Brinkman, P., Kinsey, J., & Henneman, A. (2017). Increasing the capacity of social media to extend your outreach. *Journal of Extension*, 55(1). Retrieved from https://www.joe.org/joe/2017february/tt4.php

Gharis, L. W., Bardon, R. E., Evans, J. L., Hubbard, W. G., & Taylor, E. (2014). Expanding the Reach of Extension through Social Media. *Journal of Extension*, 52(3). Retrieved from https://www.joe.org/joe/2014june/a3.php

Graybill-Leonard, M., Meyers, C., Doerfert, D., & Irlbeck, E. (2011). Using Facebook as a communication tool in agriculture-related social movements. *Journal of Applied Communications*, 95(3), 45-56. Retrieved from http://newprairiepress.org/jac/

Griffeth, L. L., Tiller, L., Jordan, J., Sapp, R. & Randall, N. (2018). Women leaders in agriculture: Data-driven for action and perspectives on furthering the conversation. *Journal of Extension*, 56(7). Retrieved from https://www.joe.org/joe/2018december/a2.php

Oesterreicher, S., Lundy, L. K., Rumble, J. N. & Telg, R. W. (2018). Collegiate millennials' perceptions of locally produced beef. *Journal of Applied Communications, (102)*4. Retrieved from http://doi.org/10.4148/1051-0834.2226

Pew Research Center. (2018, February 5). Demographics of social media users and adoption in the United States. Retrieved from https://www.pewinternet.org/fact-sheet/social-media/

Stebner, S., Ray, J., Becker, J., & Baker, L. M. (2015). Totally transparent: A qualitative study about the impact of farm tours on bloggers. *Journal of Applied Communications, (99)*4. Retrieved from http://doi.org/10.4148/1051-0834-1059

Stiers, J. (2019, July 23). Survey: Women are active advocates for ag [web log post]. Retrieved from https://farmweeknow.com/story-survey-women-are-active-advocates-ag-0-192549

Worthy, P. (2018). Top Instagram demographics that matter to social media marketers. Retrieved from https://blog.hootsuite.com/instagram-demographics/

How Gender Plays a Role in Explaining Differences in Water Conservation Practices of Urban Homeowners?

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Introduction

In the United States (U.S.), the increasing urban population has led to increased water demand for household activities (St. Hilaire et al., 2008). For example, across the U.S., between 40 -70% of residential water in urban areas is used for lawn/landscape irrigation, which often more than the actual water required by plants (Kjelgren, Rupp, & Kilgren, 2000; St. Hilaire et al., 2008). In Florida, more than 65% of water supplied to residential areas is used for lawn/landscape irrigation (Baum, Dukes, & Miller, 2005). On average, each Florida resident uses about 158 gallons of water/day with a majority of this used for irrigating landscapes (South Florida Water Management District, 2008). In addition, approximately 50% of the water used for landscape irrigation is lost through evapotranspiration and runoff due to excess water application (South Florida Water Management District, 2008). Hence, efficient use of water is an increasing need and change in water use behaviors among urban residents particularly in their lawn and landscape areas is important to prevent potential water shortages in Florida (Baum et al., 2005; Kumar Chaudhary et al., 2017).

As noted by Sauri (2013), water conservation behaviors among residents depend on an understanding of the factors that could influence residents' irrigation practices. Recent studies have shown that different factors such as demographic characteristics, attitudes towards water conservation, norms, and perceived ability to perform recommended irrigation practices influence conservation behaviors (e.g., Kumar Chaudhary et al., 2017; Warner, Lamm, & Kumar Chaudhary, 2018). Among demographic characteristics, the gender of the respondent has been found to be significantly influencing pro-environmental behavior and attitudes (Suh, Khachatryan, Rihn & Dukes, 2017; Dietz, Stern & Guagnano, 1998, Brehm, Pasko & Eisenhauer, 2013). Some studies report that compared to males, females demonstrate a higher environmental concern (Schan & Holzer, 1990; Blaikie, 1992) whereas others have found males and females show similar levels of environmental concern (Arcury & Christianson, 1993). In addition, Stern, Dietz & Kallof (1995) and Roberts (1993) found females show high levels of positive environmental behavior compared to males. In contrast, Suh, Khachatryan, Rihn & Dukes (2017) found females show less pro-environmental behavior in terms of water conservation in residential lawn irrigation compared to males. Recently, a study by Kumar Chaudhary, Warner, and Ali (2019) found gender as a significant factor related to residents' landscape water conservation practices, where more males than females tend to be engaged in the least number of water conservation practices.

Theoretical/Conceptual Framework

This study draws on the tenets of the Theory of Planned Behavior (TPB). The TPB posits that individuals will show increased intentions for adopting a practice if they have a positive attitude towards it, believe in their ability to implement the practice (perceived behavioral control), and have others who support their intentions (subjective norms, Ajzen, 1991). It is generally believed that people's intentions about a behavior most often lead to actual behavior change or practice adoption (Ajzen, 1991; Gao et al., 2016). In relation to water conservation, it is expected that male and female residents with positive attitudes, strong subjective norms, and a high sense of perceived

behavioral control over recommended irrigation best practices will demonstrate a high intent of behavioral change (Gao et al., 2016; Lam, 1999; Warner et al., 2018).

Purpose and Research Questions

The purpose of this study was to understand how the gender of urban homeowners influences their water conservation decisions. Specific research questions guided this study were:

- Is there a difference between male and female residents regarding their water conservation personal norms, attitude, perceived behavioral control, and social norms in relation to their intent to engage in water conservation behaviors?
- What factors influence male and female residents' intent to engage in water conservation behaviors?

Methodology

The results presented in this study are part of a large statewide multi-year project that examined the water conservation practices of urban homeowners in [State] from 2014 to 2016 with Institutional Review Board approval from [University]. The data were collected using a purposive sample by an online survey sampling company. We used purposive sampling because there was no existing sampling frame for urban residents in Florida who have lawns/landscapes and who also control the irrigation of them (Kumar Chaudhary et al., 2017; Warner et al., 2018). Over the course of the study period, more than 7,880 residents met eligibility requirements to participate in the study after they answered four screening questions about their age (>18 years), presence of lawns/landscape at their home, and presence of owner-controlled irrigation systems. Out of 7,880 residents, 3, 832 residents provided complete responses for a completion rate of 48.6%. Three hundred and thirty-eight completed responses were found to be unusable for this study because they were exposed to an experimental treatment in the year 2015. An additional 174 responses were removed from the analysis because they have deemed outliers that could influence the study outcome. Thus, the final sample of 3,320 respondents was used in the final analysis.

Instrumentation and Data Collection

We used a researcher-developed online survey to collect data from respondents over the three-year period. The survey had seven parts. The first four parts of the survey asked respondents to indicate their personal norms, social norms, attitude, and perceived behavioral control related to water conservation. We measured water conservation attitude and perceived behavioral control using five-point semantic differential scales and used a five-point Likert-type scale (1 = *strongly disagree* to 5 = *strongly agree*) to capture information about personal and subjective norms. As per Cronbach's alpha, the reliability of attitude, perceived behavior control, personal norms, and subjective norms scales were 0.87, 0.89, 0.90, and 0.90, respectively.

In the fifth part of the survey, we asked respondents to indicate their intent to engage in 12 specific practices that lead to water conservation on a five-point Likert-type scale (1 = *very unlikely* to 5 = *very likely*). We collected information on respondents' demographic characteristics in the final part of the survey. We measured the age of the respondents on a continuous scale and gender and highest education level (1 = high school/GED or lower education and 2 = some college or higher education) using a categorical scale. For data analysis, the education variable was dummy coded. In addition, we asked respondents about their interaction with Cooperative Extension (0 = never to 6 = *more than 3 times a week*). We recoded interaction with Extension for data analysis (0 = *no interaction* and 1 = *interaction*).

To ensure the instrument was suited to our study context for the data collection, we asked a panel of experts to review the instrument for its face and content validity. The panel members had expertise in Extension programming, agricultural and biological engineering, landscape best management practices, water conservation, and survey methodology. We pilot tested our instrument with a small portion of the target population who were not part of the study.

Data Analysis

We used the *t*-test to compare male and female residents for their age, their residential irrigation attitudes, personal norms, social norms, and perceived behavioral control. In addition, we used chi-square analysis to differentiate between male and female residents' highest educational level and access to Cooperative Extension. We used *Cramer's V* and *Cohen's d* to calculate effect sizes for the chi-square and t-test to determine the practical significance of the tests. To determine the factors explaining water conservation intentions among male and female residents, we used multiple regression analysis. Prior to running regression analysis, we checked all the assumptions of multiple regression and our data met all the assumptions.

Results

Demographic characteristics

There were significant differences among male and female residents related to their demographic characteristics (see Table 1).

Table 1

Comparison among demographic variables of male and female residents in Florida

Variable	Male (N = 1461)		Female (N = 1859)		*t*-value	*P*	Cohen's d
	M	SD	M	SD			
Age	49.94	16.527	46.65	15.911	5.820*	.000	0.202
Categorical variable	%	n	%	n	χ2	*P*	Cramer's V
GED/ high school or less	10.1	147	15.0	278	17.544	.000	0.073
Some college or higher	64.4	941	70.9	1318	15.848	.000	0.069
Cooperative Extension interaction	66.4	263	33.6	133	91.625	.000	0.062

Phycological differences between male and female residents in relation to their water conservation

As per independent-samples t-test, there was statistically significant difference among male (M= 4.66, SD = .50) and female (M = 4.84, SD = .33) residents in terms of attitude t (2399.351) = 12.146, $p < 0.01$. The observed difference in conservation attitudes had a moderate practical effect size (*Cohen's d* = 0.434). Similarly, males (M = 4.17, SD = .61) and females (M = 4.23, SD = .60) differed significantly in their personal norms towards good residential irrigation behavior t (3342) = 2.417), p = 0.16). There was a low practical effect size of this observed difference. On the other hand, males and females have similar levels of perceived behavioral control and social norms related to water conservation with no significant statistical differences.

Examining the factors that explains male and female residents' intentions to engage in good residential irrigation behaviors

The regression results indicate that the overall model significantly predicted water conservation intentions among females [R^2 = .228, R^2_{adj} = .225, F(8, 1848) = 68.290, p < 0.01] and males [R^2 = .355, R^2_{adj} = .351, F(8, 1452) = 99.856, p < 0.01]. A summary of regression coefficients is presented in Table 2 indicate that five out of the eight independent variables significantly contributed to explain water conservation intentions of both male and female residents.

Table 2
Determinants of water conservation intentions among male and female residents in Florida

Predictors	**B**		***β***		***t***		***p***	
	Female	***Male***	***Female***	***Male***	***Female***	***Male***	***Female***	***Male***
Age	-.004	-.007	-087	-.139	-4.2	-6.0	<.001	<.001
High school graduate or less	-.059	-.050	-.031	-.019	-1.1	-0.8	.255	.430
College (some college, 2-year and 4-year college)	0.16	.036	.011	.022	0.4	0.9	.690	.362
Interaction with extension	-.166	-.201	-.063	-.099	-2.9	-4.1	.003	<.001
Attitude	-.004	-0.71	.002	.045	0.1	-1.7	.943	.089
Personal norms	.279	.371	.245	.289	8.9	9.2	<.001	<.001
Perceived behavioral control	.144	.113	.126	.088	5.1	3.3	<.001	.001
Social norms	.169	.248	.180	.234	6.5	7.4	<.001	<.001

Conclusions and Recommendations

In examining the influence of gender on water conservation practices, the findings of this study clearly indicate that males and female residents differ from each other. Consistent with previous research (Roberts, 1993; Stern et al., 1995, Kumar Chaudhary et al., 2019), the study demonstrates that females have stronger attitudes towards adoption of good irrigation practices and feel a stronger personal obligation to engage in irrigation water use practices in their lawns/landscape compared to males.

The psychological variables were significant predictors of both male and female residents' intentions to engage in lawn/landscape irrigation best practices in the future. These findings are consistent with the findings of Kumar Chaudhary et al. (2017). Comparison of regression models for both male and female residents indicate that in males, personal norms, social norms, and perceived behavioral plays a bigger role in explaining the intentions to engage in lawn/landscape irrigation best practices compared to females. This suggests that educational messages on conservation could incorporate "a feel-good component" to encourage practice adoption because people tend to adopt a practice when they feel in charge of the practice and their efforts are appreciated.

Age and interaction with Cooperative extension were negatively related to intentions for irrigation best management practices for both males and females. Young males and females were less likely to show intent to undertake good irrigation practices in the future. This finding suggests that Extension could make a conscious effort to reach young males and females in their

residential water conservation outreach programs. Although interaction with cooperative was negatively related to conservation intentions, this anomaly could be explained by the low level of participants who indicated that they had interacted with Extension in the course of several weeks or months.

References

Ajzen, I. (1991). The theory of planned behavior. *Orgnizational Behavior and Human Decision Processes*, *50*, 179–211. https://doi.org/10.1016/0749-5978(91)90020-T

Arcury, T. A., & Christianson, E. H. (1993). Rural-urban differences in environmental knowledge and actions. The Journal of Environmental Education, 25(1), 19-25

Baum, M. C., Dukes, M. D., & Miller, G. L. (2005). Analysis of Residential Irrigation Distribution Uniformity. *Journal of Irrigation and Drainage Engineering*, *131*(4), 336–341. https://doi.org/10.1061/(asce)0733-9437(2005)131:4(336)

Blaikie, N. W. (1992). The Nature and Origins of Ecological World Views: An Australian Study. Social Science Quarterly, 73(1), 144-65.

Brehm, J. M., Pasko, D. K., & Eisenhauer, B. W. (2013). Identifying key factors in homeowner's adoption of water quality best management practices. Environmental management, 52(1), 113-122.

Dietz, T., Stern, P. C., & Guagnano, G. A. (1998). Social structural and social psychological bases of environmental concern. Environment and behavior, 30(4), 450-471.

Gao, Y., Babin, N., Turner, A. J., Hoffa, C. R., Peel, S., & Prokopy, L. S. (2016). Understanding urban-suburban adoption and maintenance of rain barrels. *Landscape and Urban Planning*, *153*, 99–110. https://doi.org/10.1016/j.landurbplan.2016.04.005

Kjelgren, R., Rupp, L., & Kilgren, D. (2000). Water conservation in urban landscapes. *HortScience*, *35*(6), 1037–1040.

Kumar Chaudhary, A., Warner, L. A., & Ali, A. D. (2019). Using perceived benefits to segment residential landscape irrigation users. Urban Forestry & Urban Greening, 38, 318-329.

Kumar Chaudhary, A., Warner, L. A., Lamm, A., Israel, G., Rumble, J., & Cantrell, R. (2017). Using the Theory of Planned Behavior to Encourage Water Conservation among Extension Clients. *Journal of Agricultural Education*, *58*(3), 185–202. https://doi.org/10.5032/jae.2017.03185

Saurí, D. (2013). Water Conservation: Theory and Evidence in Urban Areas of the Developed World. *Ssrn*, 227–250. https://doi.org/10.1146/annurev-environ-013113-142651

South Florida Water Management District (2008). Water conservation: A comprehensive program for south florida. Retrieved from https://www.sfwmd.gov/sites/default/files/documents/waterconservationplan.pdf.

St. Hilaire, R., Arnold, M. A., Wilkerson, D. C., Devitt, D. A., Hurd, B. H., Lesikar, B. J., … Zoldoske, D. F. (2008). Efficient water use in residential urban landscapes. *HortScience*, *43*(7), 2081–2092.

Suh, D., Khachatryan, H., Rihn, A., & Dukes, M. (2017). Relating knowledge and perceptions of sustainable water management to preferences for smart irrigation technology. Sustainability, 9(4), 607.

Warner, L. A., Lamm, A. J., & Kumar Chaudhary, A. (2018). Florida residents' perceived role in protecting water quantity and quality through landscape practices. *Landscape and Urban Planning*, *171*(November 2017), 1–6. https://doi.org/10.1016/j.landurbplan.2017.11.007

Warner, L. A., Diaz, J. M., & Kumar Chaudhary, A. (2018). Informing Urban Landscape Water

Conservation Extension Programs using Behavioral Research. Journal of Agricultural Education, 59(2)

The Contributions of George Washington Owens to the Development of Agricultural Education Opportunities for African Americans

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Introduction

Many prominent agricultural education institutions, including the National FFA Organization and *The Agricultural Education Magazine*, have recently expressed a desire to improve diversity and inclusion efforts within the field (FFA, 2019; Ewing, 2018). Problems surrounding the inclusion and representation of African Americans in secondary agricultural education could likely be traced back to the very introduction of agricultural education in the secondary school setting. Croom and Alston (2009) discuss early models of educating African Americans about agriculture that "raised the standard of living for African Americans," but could not be "sustained under the tremendous social pressures associated with race and ethnicity of the 20th century" (p.1).

The historic 1954 Brown vs. Board of Education of Topeka court case ended the highly criticized practice of segregating schools (National Archives, 2016). During this turbulent period of civil unrest, the National FFA Organization merged with the New Farmers of America in 1965 (National FFA Archives, 2016). As Wakefield and Talbert (2003) found, members of the NFA believe that after the merger, there was a lack of black representation in the FFA, feelings that the merger was inevitable due to government and societal pushes, and a loss of identity among African Americans in FFA. To better understand the representation of African Americans engaged in agricultural education throughout history, research should be conducted on those events, practices, early developments, and individuals that have impacted cultural and racial inclusion in this field. To this day, African Americans still represent underserved populations in agricultural, career, and technical education (Croom, Moore & Armbruster, 2005).

George Washington Owens is an important figure in the development of agricultural education opportunities for young African Americans. His impact can be traced to the present, yet no research and few publications mention his significance.

Theoretical Framework

The theoretical framework for this research is aligned with the need to understand our agricultural history. The *American Association for Agricultural Education National Research Agenda* outlines this need through Research Priority One, *Public and Policy Maker Understanding of Agriculture and Natural Resources* (Enns, Marker, Spielmaker, 2016). According to this priority, providing accurate and informative information about agriculture to the public has been part of an ongoing effort to increase agricultural literacy. This effort includes sharing historic information.

The National Research Council (1988) recommended "that an agriculturally literate person's understanding of the food and fiber system would include its history…" (p.89). It is important that we understand and appreciate our historical foundations as we work to make agricultural education more diverse and inclusive for all students.

Purpose and Objectives

The purpose of this historical study was to document the life and legacy of George Washington Owens and evaluate his impact on agricultural education for African Americans in the early twentieth century. This study was guided by two research objectives:

1) Describe the early history of George Washington Owens' life.
2) Articulate George Washington Owens' role in developing agricultural education opportunities for African Americans.

Methodology

This study was completed using historical research methods. Fraenkel and Wallen (2009) state five reasons for historical research including: making people aware of past mistakes and achievements, learning if past practices are applicable today, predicting the future, testing ideas, comprehending current educational trends. The purposeful search and acquisition of documents, artifacts, and other sources of data were completed to answer the research questions (Borg & Gall, 1983).

A preliminary bibliographical reference was created using primary and secondary sources. Online databases at Kansas State University, Virginia State University, Tuskegee University, the National FFA Archives, and the Historically Black Colleges and Universities Library Alliance were used to find all primary and secondary sources. Primary sources of information were mostly derived from two handwritten autobiographies from Owens, housed in the archives at both Kansas State University and Virginia State University. Other primary sources included photographs, manuscripts, and proceedings from National New Farmers of America Conventions. Secondary sources consisted of newsletters, refereed journal articles, and historical information available from established institutions associated with Owens.

Efforts were made to establish trustworthiness of the study according to standards established by Lincoln & Guba (1985). These standards include establishing credibility, transferability, dependability, and confirmability. All resources were evaluated for both external and internal criticism. Analyst triangulation was used to review the findings through the lens of multiple analysts, which is intended to find multiple ways of looking at the findings to reduce bias (Lincoln & Guba, 1985). These analysts included a Kansas State University Agricultural Education Faculty member, an Agricultural Education undergraduate student, and a faculty member from the Department of History who specializes in American Agricultural, Environmental, Native American, and Digital History. The primary sources were all original documents and the context and language aligned with the time period. Additionally, secondary sources were compared to primary sources to determine accuracy.

Results/Findings

The first research objective was to describe the early history of George Washington Owens' life. Owens was born January 21, 1875, on a rural Kansas livestock farm. He is the son of ex-slaves who emigrated to Kansas from Tennessee (Owens, 1976). They moved around the state and eventually settled in Wabaunsee County with "many other colored people from Tennessee" (Owens, 1976, p.1). According to his autobiography (1976), they secured 80 acres near Alma, Kansas, under the Homestead Act. Owens and his siblings attended school, grew up, and worked

with white children, whom were mostly European immigrants (Owens, 1976). In school, Owens "was considered very apt and ambitious, eager to learn, ready to read or study any literature to which he had access, even old books, papers, or journals" (Owens, 1976, p.2).

This desire to learn was recognized by several of Owens' mentors who pushed him to pursue an advanced education. He obtained a teaching certificate, "passing the examination with good grades" (Owens, 1976, p.3), and explored the idea of teaching, but there was nowhere for a black man to teach. Consequently, with the help of mentors, he decided to enroll at the Kansas State Agricultural College (KSAC), the predecessor to Kansas State University (Owens, 1976). To his surprise, Owens was the only African American student at the college and he came to realize there had never been an African American graduate (Owens, 1976). He resolved to become the first and, in 1899, he achieved that when publishing his senior thesis, entitled *Dairy Form as an Index to Character,* and receiving his KSAC diploma (Owens, 1898). Figure 1 is a photo of Owens used in his senior thesis.

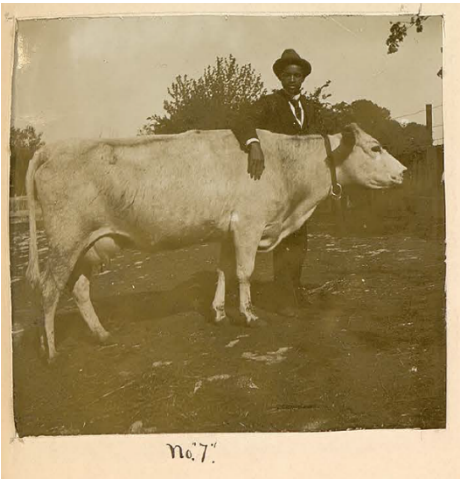

Figure 1. Owens standing with a dairy cow used in his research for his senior thesis. Screenshot taken from Owens, G.W. (1898). *Dairy-Form as an Index to Character* (Senior thesis, Kansas State Agricultural College). Retrieved from https://krex.k-state.edu/dspace/handle/2097/37468

Upon graduating from KSAC, Owens accepted a position as an assistant to George Washington Carver at the Tuskegee Institute, which was headed by Booker T. Washington (Kansas Industrialist, 1947). Owens "formed lifelong friendships" with both Carver and Washington (Owens, 1976, p.4). He remained at Tuskegee, maintaining the dairy herd at the Tuskegee Experiment Station, until 1908 (Carver, 1908). Owens left Tuskegee to assist in starting the new Department of Agriculture at Virginia Normal and Industrial Institute (VNII), now Virginia State University. Table 1 is an excerpt from Owens' autobiography and details some of the important dates relating to his early life and career in agricultural education.

Table 1

Year Record Excerpt from George Washington Owens Autobiography

Year Record of G.W. Owens Career in Agricultural Education	
1875	He was born on a farm near Alma Kansas
1889	Attended District Schools when not working
1889	Took examination for teacher certificate in Wabaunsee County. First colored person to secure certificate.
1896	Enrolled as a Freshman at Kans. State Agr. College Manhattan
1899	Graduated in June 1899 from K.S.A.C. First negro student to graduate at K.S.A.C.
1899	Begin Teaching (sept) at Tuskegee Inst. Ala. Charge creamery
1900	Put in charge Dairy Herd, Tuskegee under Dr. G.W. Carver.
1908	Begin work as Farm Mgr. at Va. Normal and Ind. Institute Petersburg Va.
1908-1918	Taught Agriculture and Managed farm.
1918	Took charge as Vocational Teacher of Smith-Hughes Work
1919	Promoted to State Agr. Teacher Trainer. Smith Hughes Agr Education
1918	Attended summer school at Cornell University summer
1919	Attended special Smith Hughes classes at Hampton Inst. For One month
1920	Begin teaching Nor. Teacher Training at V.N.I.I.
1921-1928	Served at different times as Director of Agr. Department
1920	Started Normal Training Classes
1924	College teacher training classes
1926	Organized Virginia State "New Farmers of Virginia" later called "New Farmers of America" G.W. Owens was founder of same. As teacher trainer, Prof Owens wrote Constitution and By-Laws.
1927	The N.F.A. held its first state rally and exhibit at Petersburg.
1928	The first sectional "rally" held included S. Carolina, North Carolina, and Virginia at A.T. College, Greensboro N.C.
1935	National [NFA] Conference organized at Tuskegee with national program officers, etc.

Note: Adapted from a handwritten table in George Washington Owens' Autobiography (Owens, 1976, p.50)

Research objective two sought to articulate George Washington Owens' role in developing agricultural education opportunities for African Americans. During Owens' time at VNII, he ran into troubles with his young agriculture department. Owens and his colleagues "tried to develop favorable attention towards farming. Most of the colleges and high schools of that day gave very little attention to agriculture or any instruction in same. In fact they rather looked down on such education as not a worthy subject for instruction" (Owens, 1976, p.11). He eventually built up the department, starting an official agriculture course of study in 1911, which brought in male and female students (Owens, 1976). Figure 2 depicts Owens teaching a class in gardening.

Figure 2. Owens teaching about English peas in a gardening class at Virginia Normal and Industrial Institute. Virginia State University Special Collections and Archives. (1919). *1919 Boys Gardening* [photograph]. Virginia State University, Petersburg, VA.

In 1918, Owens' focus shifted to work on the Smith-Hughes Act. Owens collaborated with the state agricultural education supervisor to "to consider the problem of organizing the work among the Negro Training Schools" (Owens, 1976, p.14). To learn how to prepare African Americans to teach agriculture, Owens attended summer school taught by H.O. Sargent at the Hampton Institute (Owens, 1976). The Virginia Normal and Industrial Institute started training vocational agriculture teachers shortly after. Around 1919, Owens was promoted to State Agricultural Teacher Trainer, headquartered at VNII, and helped establish new agriculture programs at surrounding schools (Owens, 1976). After several years of work, Owens helped spread agricultural education to African American schools all across Virginia.

Perhaps one of Owens' most noteworthy achievements was his connection to the New Farmers of America. In his autobiography (1976, p.25), he wrote "we developed [our students'] vocational interests and their vocational work on the farm, in the farm shop, and other educational activities, but also their social life and its connection with their work." He prided himself on this and saw the need to develop an organization for these students. In the winter of 1926-1927, upon the suggestions of national and state supervisors, specifically H.O. Sargent (NFA, 1963), he wrote a constitution and set of by-laws for such an organization (Owens, 1976). The organization came to be known as the New Farmers of Virginia, the direct predecessor to the NFA. Their first state meeting was held in 1927 (NFA, 1963).

Owens retired from his post as state teacher trainer on June 30, 1945 (Owens, 1976) and passed away in 1950 at age 75 (Kansas State University Libraries, 2015). He was seen as a "dynamic figure in the development of agricultural education throughout the South" (NFA, 1963, p.4).

Conclusions and Recommendations

George Washington Owens had a tremendous impact on the development of agricultural education for African American students, particularly in Virginia. He established opportunities for African American youth that did not previously exist. These opportunities exposed young African American students to agricultural education and jumpstarted educational programming for segregated schools in the southern United States. His reach extended throughout the country even more with his foundational ties to the NFA and the organization's subsequent spread across the south.

More research should be conducted to fully understand his life and legacy. Recommendations include further analysis of agricultural education publications written during Owens' career span to better determine his impact.

To conduct a more thorough review of Owens' life, several limitations will need to be overcome. An on-site visit to the Tuskegee University and Virginia State University archives is warranted. This will allow the researcher to further investigate the relationships Owens had with Virginia agricultural education colleagues, Tuskegee faculty, and other important figures involved in the development of the NFA and agricultural education opportunities for African Americans. Another limiting happenstance was a fire that occurred in the main library at Kansas State University that has greatly hindered access to library resources, including many of the archival materials related to Owens and his time at Kansas State Agricultural College.

As the National FFA Organization and the New Farmers of America approach the centennials of their founding, work is needed to honor underrepresented minorities in agriculture and agricultural education. The contributions of Owens' and other minority figures should be shared during this time of heightened media coverage and celebration.

References

Borg, W. R. & Gall, M. D. (1983). Educational research (4th ed.). New York, NY: Longman.

Carver, G.W. (1908). *Bulletin #14: How to Make Cotton Growing Pay*. Tuskegee University Archives Repository (Carver Documents), Tuskegee University, Tuskegee, AL. Retrieved from http://192.203.127.197/archive/handle/123456789/207

Croom, D.B., Alston, A. (2009). The Problem of Agricultural and Industrial Education for African Americans: A Historical Inquiry. *Journal of Agricultural Education*, 50(3), 1-10. doi:10.5032/jae.2009.03001

Croom, D.B., Moore, G., & Armbruster, J. (2005). National FFA career development events: An introspective inquiry. In J. Kotrlik (Ed.) Southern Agricultural Education Research Conference Proceedings. Agricultural Education Division, Southern Association of Agricultural Scientists. Little Rock, AR.

Enns, K., Martin, M., Spielmaker, D. (2016). Research Priority 1: Public and Policy Maker Understanding of Agriculture and Natural Resources (pp. 13). In G.T. Roberts, A. Harder, & M.T. Brashears, *American Association for Agricultural Education National Research Agenda: 2016-2020*. Gainesville, FL: Department of Agricultural Education and Communication.

Ewing, J.C. (2018, May/June). Diversity Matters. *The Agricultural Education Magazine*, Volume 90(6), 2

Fraenkel, J. R. & Wallen, N. E. (2009). How to design and evaluate research in education (7th ed.). New York, NY: McGraw-Hill.

Kansas Industrialist. (1947, March). *First Negro Grad from KSC Founds Program for Boys*. Kansas Industrialist. Kansas State University Morse Department of Special Collections (G.W. Owens Vertical File), Hale Library, Kansas State University, Manhattan, KS.

Kansas State University Libraries. (2015). *George Washington Owens Papers*. Kansas State University, Manhattan, KS. Retrieved from https://findingaids.lib.k-state.edu/george-washington-owens-papers

Lincoln, Y. S. & Guba, E. G. (1985). Naturalistic inquiry. Newbury Park, CA: Sage Publications.

National Archives. (2016, August). *Documents Relating to Brown v. Board of Education*. National Archives, Washington, D.C. Retrieved from https://www.archives.gov/education/lessons/brown-v-board

National FFA Archives. (2016). *New Farmers of America Records, 1929-1965*. Indiana University Ruth Lilly Special Collections & Archives, University Library, Indiana University, Bloomington, IN. Retrieved from https://www.ulib.iupui.edu/special/nfa

National FFA Organization. (2019). *Diversity and Inclusion*. Retrieved from https://www.ffa.org/diversity-and-inclusion/

National Research Council (1988). Understanding Agriculture: New Directions for Education. Washington, DC: National Academy Press.

NFA. (1963). *Guide for NFA* (12th ed.). The French Bay Printing Co., Baltimore, MD.

Owens, G.W. (1976). [Autobiography of G.W. Owens] *Biography of Prof George W. Owens*. Virginia State University Special Collections and Archives (Box 1, folder 1), Johnston Memorial Library, Virginia State University, Petersburg, VA.

Owens, G.W. (1898). *Dairy-Form as an Index to Character* (Senior thesis, Kansas State Agricultural College). Retrieved from https://krex.k-state.edu/dspace/handle/2097/37468

Virginia State University Special Collections and Archives. (1919). *1919 Boys Gardening* [photograph]. Virginia State University, Petersburg, VA.

Wakefield, D.B., Talbert, A. (2003). A Historical Narrative on the Impact of the New Farmers of America (NFA) on Selected Past Members. *Journal of Agricultural Education*, 44(1), 95-104. doi:10.5032/jae.2003.01095

Agricultural Education Teachers' Knowledge and Perceptions of Service Learning

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Introduction

School-Based Agricultural Education (SBAE) is conceptualized with a three-component model. These components are classroom instruction, leadership development (FFA) and work-based learning (SAE). In this conceptual model, no component is more important than the other and all components work in cohesion to prepare students for successful careers and a lifetime of informed choices in the global agriculture, food, fiber and natural resources systems (National FFA, 2018).

Building communities through acts of service is an identifying characteristic of chapters of the National FFA Organization. It is emphasized in the Program of Activities (POA) and the National Chapter Award. When developing the POA area of Building Communities, FFA chapters plan activities to address the following quality standards: Environment, Human Resources, Citizenship, Stakeholder Engagement and Economic Development (National FFA, 2018).

SAEs are the work-based learning aspect of SBAE. Recently, service learning has become an area of emphasis for SAE. Students can establish SAE programs by conducting and evaluating a project designed to provide a service to the school, public entities or the community (National Council, 2017). These projects encompass work-based learning by being of sufficient scope to enable development of skills and abilities aligned to skills and competencies within the agriculture, food and natural resource industry.

Community service and service learning can be present in all components of the SBAE model. However, service learning and community service are not synonymous. This study serves to evaluate teachers' knowledge of service learning as a pedagogy, identify the perceived service learning projects done by Kansas agricultural education programs and identify which components of authentic service learning are present in these projects.

The results of this study give agricultural education professional development providers tangible information about the assistance agriculture educators need to implement service learning in their programs.

The major limitation of this study is teachers' responsibility to self-evaluate their service learning activities. Results may not be completely accurate based on the teachers' bias and ability to self-reflect.

Theoretical/Conceptual Framework

Educators across Kansas utilize various educational pedagogies founded on the thoughts, feelings and beliefs of many different educational practitioners and philosophers. One such pedagogy, known as experiential learning, can be identified by four distinct pillars derived from the philosophies of Dewey, Knapp, Stimson and Lancelot. These identifying pillars include: learning in real-life contexts, learning by doing, learning through projects and learning by

solving problems (Knobloch, 2003). By analyzing these four pillars and the philosophies that comprise experiential learning, Knobloch concluded that experiential learning is authentic learning because it involves the construction of knowledge, disciplined inquiry and a value beyond school. In his Experiential Learning Model, Kolb suggested that learning involves the entirety of a person, which includes thinking, feeling, perceiving and behaving (Baker, Robinson, & Kolb, 2012). In order for an experience to enable learning, the learner should experience, reflect, think and act. Each of these four stages are included in service learning.

One way many educators choose to make learning experiential is through service learning (see Figure 1). Service learning is a collaborative teaching and learning strategy designed to promote academic enhancement, personal growth and civic engagement (Ash & Clayton, 2004). Students render meaningful service in community settings that provide experiences related to academic material. Through guided reflection, students examine their experiences critically, thus enhancing the quality of both their learning and their service. This definition gives three qualifications for a service learning experience: it is collaborative; it relates to academic material; and it involves reflection as demonstrated in Figure 1. Service learning is also defined as collaborative since an effective service learning project addresses the needs of the community and the educational needs of the students (Zhang et al., 2011). Reflection is crucial to any service learning program because in order for learning to occur, the experience must be grasped by the students, but the experience must also be both meaningful and relevant (Knapp & Benton, 2006).

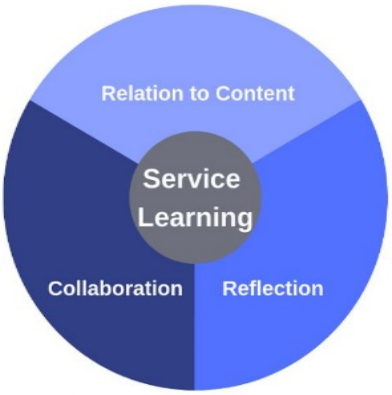

Figure 1. Components of Service-Learning

There are distinct characteristics of a service learning project that make it more complex than community service. Community service focuses on the needs of those receiving the service, but service learning begins by considering the learning needs of the service provider. Tangible learning related to the course objective is a product of a systematic structure of service learning. Lakin and Mahoney (2006) identified lack of controlled evaluation and unsystematic design within youth service projects as a limitation to the impact service learning can have on students and communities. One method used to ensure that service learning is more than just community service is the Context, Input, Process and Product Evaluation Model (CIPP). This model divides a service learning project into four phases. The context phase is a needs assessment; the input phase identifies procedures to achieve the desired results for the service providers and those being served; the process phase evaluates the progress toward achieving project goals; the product phase is an assessment of how well the project met the needs of both the students and those being served. Without using the CIPP model, needs may not be as carefully identified, the match between the needs of participants may not be as meticulously ensured, problems in the

implementation process may not be identified and corrected in a timely manner and multiple methods may not be designed into the assessment (Zhang et al., 2011). Using the CIPP model may help translate a community service project into service learning by enabling the learning to be process-based rather than product-based, which was identified as essential by Kolb (Baker, Robinson, & Kolb, 2012).

Research has suggested that service learning is an adequate means of learning course content, but also provides other benefits to students. Service learning has been identified as empowering and, when students are allowed to work together to choose and implement the project, it builds community among peers (Lakin & Mahoney, 2006). In a rural SBAE program, students reported that their service learning experience increased their awareness of the community and its needs. For students, their service learning experience changed their perceptions about themselves, others and their role in the community in ways superior to traditional classroom learning environments (Henness, Ball, & Moncheski, 2013). Participation in a service learning project significantly affected students intent to be involved in future community action (Lakin & Mahoney, 2006). When structured using the CIPP model, service learning has been shown to foster an understanding and connection among service providers, community partners and other stakeholders and can effectively promote long-term sustainability of a service learning project (Zhang et al., 2011). If a service learning project engages organizations and community members in the service, it can strengthen ties between generations and impact serious issues in the community over several years.

Service learning has unique potential within the SBAE model because FFA chapters exist partially to build communities. Many programs have a history of providing service to their communities and the National FFA Organization has specifically emphasized community involvement with the National Chapter Award (Roberts & Edwards, 2015). Research supports the concept that classroom/laboratory, SAE and FFA complement each other in the teaching and learning process (Williams & Dyer, 1997). However, further study is needed on how to effectively use each of these components to enhance student learning. Baker, Robinson and Kolb (2012) concluded that experiential learning should encompass each of the three areas identified in an agricultural education program. Roberts and Edwards (2015) expounded that agriculture teachers should use service learning throughout their program to apply learning in meaningful, curriculum-based projects that benefit the community.

Purpose and Research Questions

The purpose of this study is to evaluate the service learning experiences Kansas agriculture teachers provide their students. Through self-evaluation of the teachers' knowledge, the local program's service learning projects and identification of the resources needed for the teacher to effectively conduct service learning, teacher educators and teacher supporters will be better able to provide necessary resources and information.

This study seeks to answer the question: How do Kansas agriculture teachers incorporate service learning with classroom instruction to engage students in learning opportunities that include all components of service learning? By answering this question, teachers will also answer these two questions: What service learning activities are being implemented by agriculture educators in

Kansas? What resources do Kansas agriculture educators need in order to fully implement service learning in the classroom?

These responses will be useful for supporters wanting to assist teachers in developing service learning experiences. Results may be used by teacher educators to include and improve service learning content in teacher preparation programs.

Methods

This study collected information through a quantitative, online survey. Of the 203 agricultural education programs with a good standing FFA chapter in Kansas, one teacher from 136 programs was asked to respond. Only one teacher per program was surveyed because it was anticipated that different teachers within the same program would not have differing responses. A sample of 136 is representative of all Kansas agricultural education programs (Dillman, Smyth, & Christian, 2009). A usable sample of 78 was received, for a response rate of 57.4%. Non-response error was addressed through a comparison of early to late responders (Lindner, Murphy, & Briers, 2001), no differences were found between the two groups, therefore non-response error was not a factor and results were generalized to the target population.

Participating teachers were selected using a stratified random sample. Seven groups of teachers were selected based on the geographical districts defined by the Kansas FFA Association. The number of teachers polled in that district was identified based on the number of good standing FFA chapters within that district, represented as a percentage of the entire state. Teachers were randomly assigned a number, organized numerically and then chosen in an ascending order until the number of teachers needed within that district had been reached. Research on human subjects protocol were approved and followed.

Respondents were asked to provide a personal definition of service learning and up to 10 service learning experiences provided to their students. Once the experiences were provided, participants watched a short, educational video about the components of an authentic service learning experience. Upon the video's conclusion, respondents selected which of the three components (collaboration, relation to content and reflection) were present in each of the activities they listed previously. In addition, questions were presented to collect demographic data and teachers' beliefs of elements required in a service learning project. The instrument was reviewed by Agricultural Education faculty for face and content validity. A pilot test was completed with agriculture teachers who were not part of the target population to determine usability and reliability. After finding low reliability, adjustments were made and a second pilot was conducted, reliability is estimated at .76.

Findings

Participants were asked to define service learning in their own words. Definitions were analyzed to determine which of the three components were present. This count showed that 9 definitions included collaboration only, 13 definitions included relation to content only and 1 definition included reflection only. Both relation to content and collaboration were included in 3 definitions and collaboration and reflection were included in 1 definition. No definitions contained all three components of service learning.

When asked how important it is that a service learning project be led by students, 75% of the respondents said it was either very important or extremely important (see Table 1). It was noted by 83.4% of the respondents as either very important or extremely important that a service learning project require students and teachers to identify a specific need in the community. It was identified as either very important or extremely important that students set measurable goals in a service learning project by 65.2% of respondents. Relating service learning projects to a course objective or course standard identified by the State Department of Education was identified as either very important or extremely important by 18% of respondents. When asked how important it is that a service learning project require student reflection on their experiences, 70.8% of respondents said it was either very important or extremely important.

Table 1
Teachers' level of importance for elements of service learning (n=72)

	Not at all Important		Slightly Important		Moderately Important		Very Important		Extremely Important	
	f	%	*f*	%	*f*	%	*f*	%	*f*	%
Be led by students	0	0.0	4	5.6	14	19.4	37	51.4	17	23.6
Identify community need	0	0.0	3	4.2	9	12.5	38	52.8	22	30.6
Measurable goals	1	1.4	0	0.0	24	33.3	32	44.4	15	20.8
Objective or Standards-based	11	15.3	22	30.6	26	36.1	8	11.1	5	6.9
Include Reflection	1	1.4	5	6.9	15	20.8	34	47.2	17	23.6

Respondents were asked to report up to 10 service learning activities completed in their program (see Figure 1). A total of 259 service learning experiences were identified. Of these experiences, 44 (17.0%) had the collaboration component only, 14 (5.4%) had the relation to content component only and 3 (1.2%) had the reflection component only. There are 6 (2.3%) experiences that had reflection and relation to content, 52 (20.1%) with collaboration and reflection and 39 (15.1%) had relation to content and collaboration. Respondents identified that 79 (30.5%) of the experiences contain all three of the components of a service learning project and 22 (8.5%) experiences contain none.

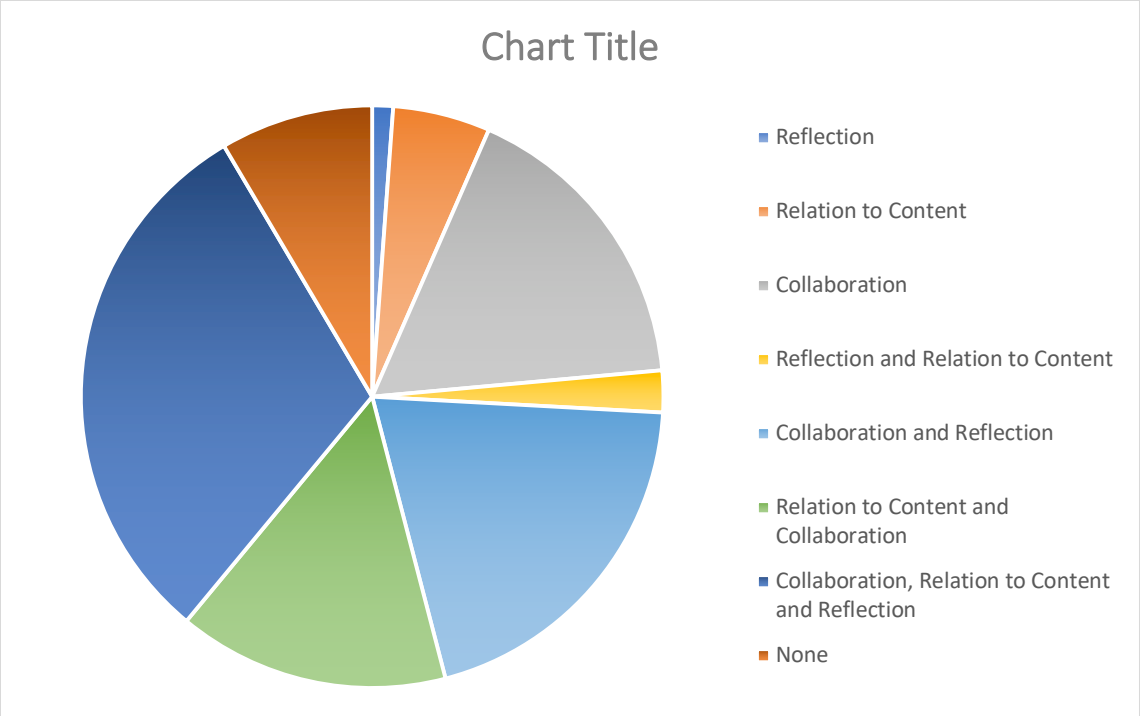

Figure 1. Percentage of each component in provided service learning activities.

More than 70% of respondents noted that the following resources would be either very useful or extremely useful: a list of service learning project examples, reflection worksheets and example grading rubrics would be the most useful resources. Professional development workshops relating to service learning would also be beneficial, with more than 90% of respondents identifying them as moderately useful, very useful or extremely useful.

Conclusions

Respondents indicated remarkable involvement in their community and a desire to improve their schools and towns. However, less than 1/3 of the perceived service learning activities have collaboration, relation to content and reflection. It is concluded that the majority of perceived service learning activities in Kansas are actually community service. This is likely due to the teachers' limited knowledge of service learning as a pedagogy, which impacts their personal definitions of service learning because they do not see the need for each of the three identified components. Community service is a vital component of SBAE, but these perceived service learning activities limit student and community impact because of unsystematic design (Lakin & Mahoney, 2006).

Recommendations

Teachers should be encouraged to serve their communities in any form, but they should understand that shifting from community service to service learning will have a greater impact on student development. Since the majority of perceived service learning projects did not contain all three of the components of authentic service learning, it is recommended that teacher educators and/or state leaders provide professional development experiences that connect service learning with experiential learning to ground the model in a familiar context. It will also be beneficial for teacher supporters and educators to provide agriculture teachers with a list of

example service learning projects, reflection worksheets and example grading rubrics. With these resources, deeper knowledge and advanced teaching philosophies, agriculture teachers will be able to create meaningful, authentic service learning experiences for their students. Use of the CIPP model will help educators incorporate collaboration and reflection in service learning experiences (Zhang et al., 2011).

FFA chapters' mission to grow leaders and build communities is often done through acts of service to the community. It is possible that teachers perceive their community service projects done through FFA to be service learning activities even though they may be missing one or more of the three components of authentic service learning. To help strengthen classroom learning, teachers should examine how they can incorporate each of these three components into current service programs to provide students with authentic service learning experiences.

Opportunities for further research include teachers' willingness and ability to connect service learning with the POA of the FFA chapter and student involvement in service learning SAEs.

References

Ash, S. L., & Clayton, P. H. (2004). The articulated learning: An approach to guided reflection and assessment.Innovative Higher Education, 29(2), 137-154. doi:IHIE.0000048795.84634.4a

Baker, M. A., Robinson, J. S., & Kolb, D. A. (2012). Aligning kolb's experiential learning theory with a comprehensive agricultural education model. Journal of Agricultural Education, 53(4), 1-16. doi://dx.doi.org.er.lib.k-state.edu/10.5032/jae.2012.04001

Dillman, D. A., Smyth, J. D., & Christian, L. M. (2009). *Internet, mail, and mixed-mode surveys: The tailored design method*(Third ed.). Hoboken, NJ: John Wiley.

Henness, S. A., Ball, A. L., & Moncheski, M. (2013). A community development approach to service-learning: Building social capital between rural youth and adults. New Directions for Youth Development, (138), 75-95. doi://dx.doi.org.er.lib.k-state.edu/10.1002/yd.20059

Knapp, D., & Benton, G. M. (2006). Episodic and semantic memories of a residential environmental education program. Environmental Education Research, 12(2), 165-177. doi:10.1080/13504620600688906

Knobloch, N. A. (2003). Is experiential learning authentic? Journal of Agricultural Education, 44(4), 22-34. Retrieved from http://search.proquest.com.er.lib.k-state.edu/docview/62172874?accountid=11789

Lakin, R., & Mahoney, A. (2006). Empowering youth to change their world: Identifying key components of a community service program to promote positive development. Journal of School Psychology, 44(6), 513-531. doi://dx.doi.org.er.lib.k-state.edu/10.1016/j.jsp.2006.06.001

Lindner, J. R., Murphy, T. H., & Briers, G. E. (2001). Handling nonresponse in social science research. *Journal of Agricultural Education*, 43-53. doi:10.5032/jae.2001.04043

National Council for Agricultural Education. (2017). SAE For All Teacher Edition [PDF].

National FFA Organization. (2018). *National FFA Official Manual,* retrieved from https://ffa.app.box.com/s/mh5q6d383ytamr737isa9rwaqes6trrg/folder/52470061743

Roberts, R., & Edwards, M. C. (2015). Service-learning's ongoing journey as a method of instruction: Implications for school-based agricultural education. Journal of Agricultural Education, 56(2), 217-233. Retrieved from http://search.proquest.com.er.lib.k-state.edu/docview/1969009027?accountid=11789

Williams, D. L., & Dyer, J. E. (1997). Benefits of supervised agricultural experience programs: A synthesis of research. Journal of Agricultural Education, 38(4), 50-58. Retrieved from http://search.proquest.com.er.lib.k-state.edu/docview/62540231?accountid=11789

Zhang, G., Zeller, N., Griffith, R., Metcalf, D., Williams, J., Shea, C., & Misulis, K. (2011). Using the context, input, process, and product evaluation model (CIPP) as a comprehensive framework to guide the planning, implementation, and assessment of service-learning programs. Journal of Higher Education Outreach and Engagement, 15(4), 57-84. Retrieved from http://search.proquest.com.er.lib.k-state.edu/docview/968110133?accountid=11789

An Examination of the Curriculum for Agricultural Science Education (CASE) Certified Educators Perceptions of the Curriculum

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Introduction

In 2007, The National Council for Education created the Curriculum for Agriculture Science Education (CASE), to create a series of courses to emphasize the science of agriculture in a nationally provided curriculum. These curriculums provided structure for courses, increased rigor, and integrated more science and math (CASE, 2012). The curriculum, fashioned and written by agriculture educators, utilizes PowerPoints, teacher notes, student activities, and assessments (CASE, 2012). Instead of focusing on lectures the creators highlighted inquiry-based hands-on activities because they have been shown to be more effective for student learning and development. This promotes students to have more advanced knowledge, as well as increased problem solving and critical thinking skills. Activities, problems, and projects, which constitute the cornerstones of the curriculum help students become more engaged in lessons by using inquiry-based learning, a strategy applied to bring math and science concepts to life with the students while acquiring more skills (CASE, 2012). Students who are engaged in lessons are likely to learn more from the lesson (Witt, Ulmer, Burris, Brashears, & Burley, 2014). This study was conducted in hopes of better understanding the CASE teachers perceptions of the curriculum and their perceived effects on students enrolled in CASE. As the CASE curriculum and professional development strategies expand it is essential to gain insight to the perceptions of the teachers who work with the curriculum every day.

Conceptual Framework

The framework for this study was founded in the core conceptual framework for studying the effects of professional development on teachers and students (Desimone, 2009), in combination with the core features from both the CASE curriculum to create the core features of CASE and Professional Development Model (see Figure 1.) This study focuses on the first stage of the model exploring the teachers' knowledge, skills and attitudes towards the CASE curriculum and the Framework.

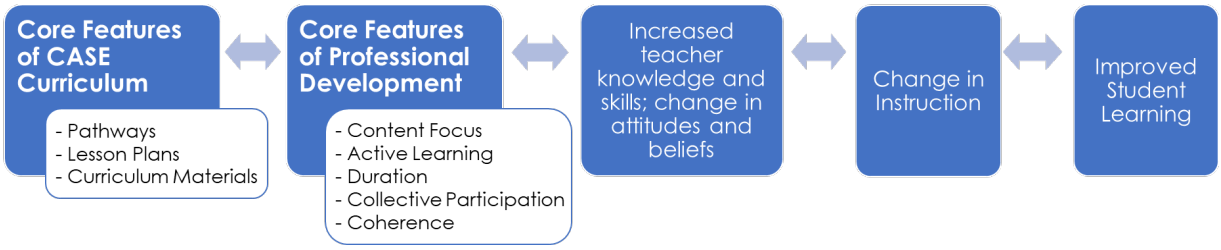

Figure 1. *Core Features of CASE and Professional Development Model adapted from proposed core conceptual framework for studying the effects of professional development on teachers and students in* "Improving impact studies of teachers' professional development: Toward better conceptualizations and measures," by L. M. Desimone, 2009, Educational Researcher, 38(3), 181–199, and the CASE pathway framwork from the Curriculum for Agricultural Science Education, 2012, http://case4learning.org/.

The framework for this study was created using core features from both the CASE curriculum and Desimone's (2009) core features of professional development. Each component plays a key role. The core features of CASE (pathways, lesson plans and supporting materials) line up with the core features of professional development. Desimone (2009) identified the core features of professional development as follows: development, content focus, active learning, coherence, duration and collective participation. These aspects during professional development lead to increased teacher knowledge, which leads to change in teacher instruction and improved student learning (Desimone, 2007).

The core features of CASE (pathways, lesson plans and supporting materials) and their pathways framework, as well as the model for Agricultural Education, provided the conceptual frameworks for this research. Teachers become certified after this training in a specific course pathway. The pathways are Animal Science, Plant Science, Agricultural Engineering, Natural Resources and Agribusiness (CASE, 2012). The courses that comprise each pathway are built upon one another. Each pathway is made up of courses specific to that pathway. Each pathway begins with Introduction to Agriculture, Food, and Natural Resources (AFNR)course. Figure 2 includes a visual representation of the CASE pathway framework (CASE, 2012). At the time of this research the courses for which training had been provided were: Principles of Agricultural Science – Animal (ASA), Principles of Agricultural Sciences – Plant (ASP), Agricultural Power & Technology (ATP), Natural Resources & Ecology (NRE), Food Science & Safety (FSS), and Animal & Plant Biotechnology (APB). The Model for Agricultural Education, or the 3-circle total program model, is incorporated into each of the CASE courses.

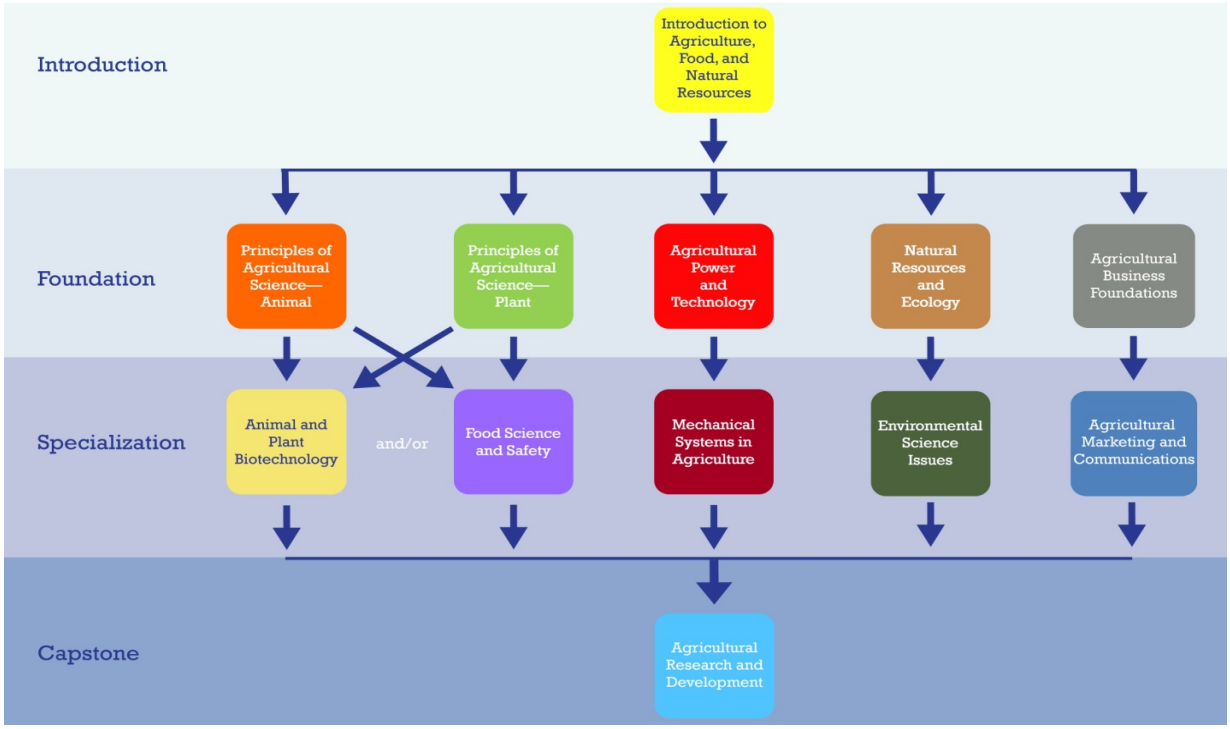

Figure 2. CASE Curriculum Flow chart create by the Curriculum for Agricultural Science Education, 2012,. *CASE information*. Retrieved from http://case4learning.org/.

Purpose/Objectives

The purpose of this study is to describe CASE agricultural teachers' perceptions of the CASE curriculum. Four objectives were developed to structure the research:

1. To determine the perceptions of educators using the CASE curriculum related to the lesson plans, materials and courses in the curriculum.
2. To determine the perceptions of educators on the CASE curriculum as it relates to the total agricultural education model.
3. To determine the educators' perceptions and attitudes of their students' views of the CASE curriculum.
4. To determine the educators' perceptions of the CASE curriculums continuity throughout the application of a framework.

Methods

Utilizing descriptive survey research methodology (Ary, Jacobs, Sorensen & Walker, 2014), an electronic survey instrument was developed using the CASE Framework as the foundation for question development. At the time of the research 1,147 individuals had been trained in the CASE curriculum. A pilot study was conducted utilizing teacher educators, or collegiate level CASE certified educators (n=31), who were then excluded from the total list. CASE staff and educators without emails were also excluded from the study, which left 1,029 educators to participate in this census survey.

Likert type statements were used to assess the participant's evaluation of CASE curriculum aspects. Participants had to select if they strongly disagreed, disagreed, somewhat disagreed, somewhat agreed, agreed, or strongly agreed to each statement. Using Qualtrics, display logic was applied so individuals only answered questions that pertained to the CASE courses in which they were certified. Each of the eight courses in the CASE curriculum had their own set of statements. This allowed the researcher to discover the participants perceptions towards each individual course, implementing each individual course in a classroom, courses supporting materials, the courses compared to previous curriculums and the student's views perceived by their teachers specifically related to the CASE curriculum.

The pilot test was sent out through an anonymous link to the pilot test population. Many corrections were recommended as a result of the pilot test (n = 31). There was not sufficient data to conduct a reliability construct, therefore reliability was established using data from the final survey. Spilt-half reliability was used to establish reliability of the instrument. A Spearman-Brown coefficient was calculated for each course within the instrument. All courses exhibited "exemplary" reliability (Robinson, Shaver, & Wrightsman, 1991) as the Spearman-Brown Coefficients ranged from .832 to .979.

Descriptive statistical analyses appropriate for the respective scales of measurement were performed on the data. The final response rate for this study was 52% (N=538). Of the respondents; 59% indicated they best identified as a female, while 97% indicated they were white. There were 46% educators with a Bachelor's Degree, 52% educators with a Master's Degree, and 2% educators with a PhD. Additionally, the respondents included representatives from 42 of the United States, with Iowa having the 16% of the respondents.

Findings/Results

The initial aspects of the survey sought information related to respondents CASE certifications, courses, and pathway utilization. The longest any of the respondent had been using the curriculum was 8 years (*f*=1), while 7% had been using it for 1 year, 24% for 2 years, 21% for 3 years, 15% for 4 years, 7% for 5 years, 3% for 6 years, and 1% for 7 years. Additionally, 90% of those responding indicated they were currently using CASE curriculum, however only 14% of respondents were certified in an entire pathway.

The CASE courses for which the respondents are currently trained can be found in Figure 3. The AFNR course was the curriculum for which the most respondents (*n*=324) were certified and had implemented the curriculum, while ATP (*n*= 22) had the least. Figure 4 contains the years in which respondents certified in each course. The total certifications per year as reported by respondents were: 2007 *n*=13, 2008 *n*=8, 2009 *n*=12, 2010 *n*=26, 2011 *n*=57, 2012 *n*=120, 2013 *n*=186, 2014 *n*=232, and 2015 *n*=264.

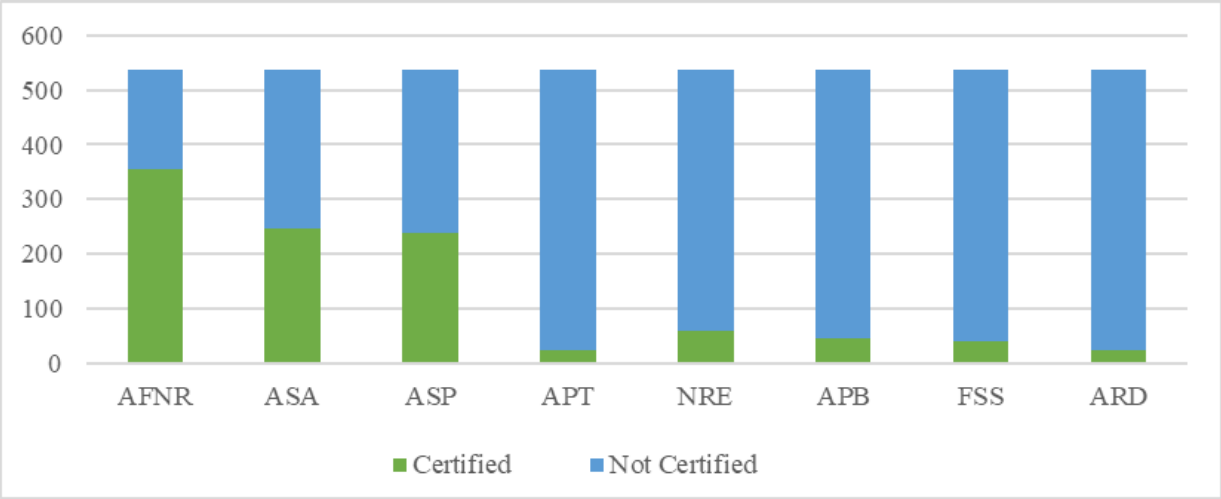

Figure 3. Respondents CASE course certifications. The AFNR course was the curriculum for which the most respondents (*n*=324) were certified and had implemented the curriculum, while ATP (*n*= 22) had the least.

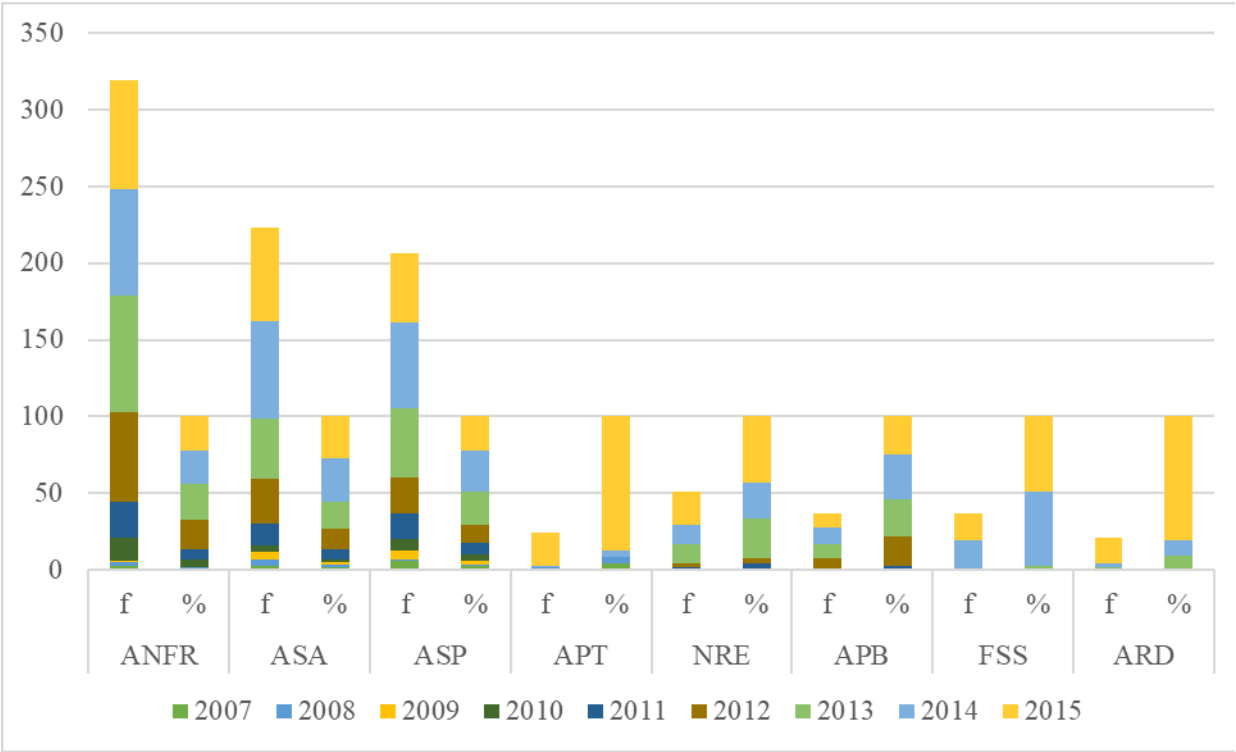

Figure 4. Respondents CASE course certifications. The total certifications per year as reported by respondents were: 2007 *n*=13, 2008 *n*=8, 2009 *n*=12, 2010 *n*=26, 2011 *n*=57, 2012 *n*=120, 2013 *n*=186, 2014 *n*=232, and 2015 *n*=264.

Respondents were also asked what courses they have taught or are currently teaching in their classroom, as some CASE participants may get certified but may not have yet implemented the curriculum. See Table 1 for findings. Additionally, only 13.6% of the respondents indicated they were certified in an entire pathway, none of whom had implemented the total pathway into their programs.

Table 1.
Are you Currently Teaching a CASE Course in your Classroom?

	Yes		No		
	f	%	*f*	%	*n*
AFNR	331	93.24	24	6.76	355
ASA	205	88.74	26	11.26	231
ASP	164	77.36	48	22.64	212
APT	19	86.36	3	13.64	22
NRE	37	69.81	16	30.19	53
APB	27	69.23	12	30.77	39
FSS	28	77.78	8	22.22	36

For each course teachers taught they were asked a series of questions related to the lesson plans, for which a vast majority of participants agreed or strongly agreed with all statements (see Table 2). This indicates positive perception of the lesson plans in each of the examined CASE course curriculums.

Table 2.
CASE Lesson Plans[a]

	AFNR *n*=301	ASA *n*=191	ASP *n*=158	ATP *n*=19	NRE *n*=36	FSS *n*=28	ABS *n*=27
Plans are user friendly to anyone who tries to use them.	97.7	80.5	96.2	94.7	97.2	100	92.6
Plans contain the material to be taught in each lesson.	96.0	94.8	94.3	100	97.2	96.4	92.6
Plans contain the material to be taught in each unit.	97.0	93.7	94.9	94.7	97.2	92.9	92.6
Plans overall contain the needed amount of material.	96.3	93.2	94.3	94.7	97.2	96.4	92.6

Note:[a] Reported by % of respondents who agreed with the statement.

The participants were asked to rate if the CASE curriculum was inferior, equal to, or superior to the curriculum they were using before implementing the specific CASE course when it came to the 3 components of the Agricultural Education Model. A vast majority of respondents indicated the classroom and laboratory components of the curriculum were superior to their previous curriculum. When it came to the FFA and leadership and SAE components only 14% to 38% indicated CASE was superior. However, when including respondents who indicated the CASE curriculum was equal to their prior curriculum, a majority of respondents for all courses indicated that it was equal to or superior to their previous curriculum in all aspects of the Agricultural Education Model (see Table 3).

Table 3.
Respondents Perceptions of the Agricultural Education Model into the Courses[a]

	AFNR *n*=295	ASA *n*=301	ASP *n*=301	ATP *n*=19	NRE *n*=301	FSS *n*=27	ABS *n*=26
Classroom and laboratory	89.2 10.9	85.9 12.6	86.7 10.8	84.2 10.5	86.1 13.9	89.3 7.1	92.6 7.4
FFA and leadership	21.4 41.4	22.1 45.3	19.9 50.6	21.1 47.4	22.9 48.6	14.8 48.2	30.8 50.0
Supervised Agriculture Experiences	23.5 44.8	23.8 48.2	26.8 47.1	26.3 52.6	27.8 55.6	21.4 42.8	38.5 42.3
All aspects of an Agricultural Education Program	60.4 33.1	58.4 35.3	58.6 33.1	53.6 36.8	61.1 33.3	62.9 29.6	69.2 26.9

Note:[a] the first line is the % of respondents who indicated that the CASE curriculum was <u>superior</u> to their previous curriculum. The second line is the % of respondents who indicated that the CASE curriculum was <u>equal</u> to their previous curriculum.

The final series of questions related to the CASE educators' perceptions of their students' thoughts and engagement in the CASE courses (see Table 4). Additionally, the respondents indicated they perceived that their students became more excited over time by the CASE curriculum (see Figure 5).

Table 4
Respondents Perceptions of Students in CASE Courses[a]

	AFNR *n*=300	ASA *n*=301	ASP *n*=159	ATP *n*=301	NRE *n*=301	FSS *n*=301	ABS *n*=27
Students enjoyed the creativity of the course lessons.	96.3	94.7	94.9	89.5	97.2	100	96.3
Students enjoyed the spontaneity of the course lessons.	89.3	90.1	88.0	84.2	97.2	96.4	92.6
Students enjoyed the course.	96.6	94.8	95.61	84.2	97.2	100	100

Note:[a] Reported by % of respondents who agreed with the statement.

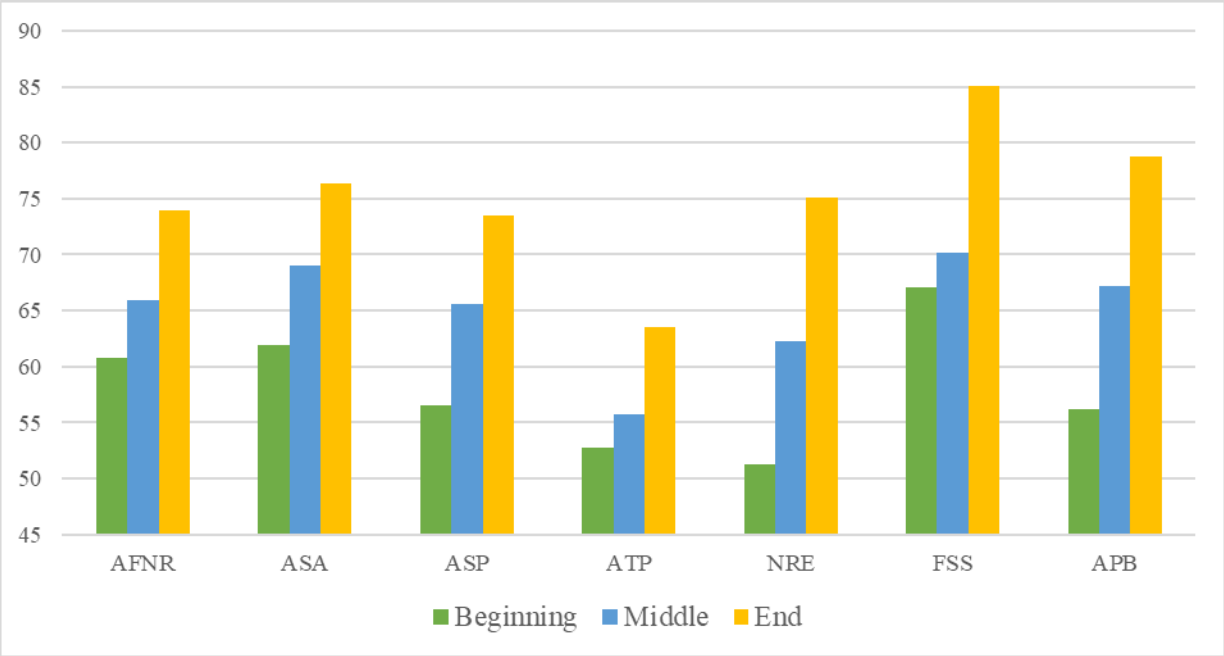

Figure 5. Respondents were asked to indicate their perceptions of the students excitement over the implementation of the curriculum on a scale from 1 to 100. The results show respondents believe their students are more excited by the curriculum the longer they engage with CASE curriculums.

Discussion & Recommendations

The curriculum and materials for all the courses was well received, which was expected given the support for the CASE curriculum implantation. The majority of respondents agreed the

lessons and PowerPoints included relevant materials for lessons and units. Respondents also agreed they were user friendly and contained an appropriate amount of information.

A vast majority of respondents indicated that the Classroom and Laboratory components of the CASE curriculum were superior to their previous curriculum. Far fewer indicated the FFA and SAE components of the curriculum were superior. A majority of respondents in each of the curriculum areas indicated it was equal to or superior; indicating most do not see it as a decrease in those components of the model. Previous articles have indicated that to keep CASE in line with the 3-circle Agricultural Education model, teachers need to supplement the aspects of FFA and SAEs (Mensch, 2012) in their curriculums.

The vast majority respondents agreed they perceived that their students enjoyed the creativity and spontaneity of the lessons in the course, and the courses overall. Although they enjoyed it and their learning improved, the student's levels of positive excitement were around average, with a mean of 50 on a scale form 1-100, or slightly above. Though this scale and its measurement leave room for subjectivity and interpretation, the positive indications are related to the increase of the excitement over the course of the curriculum. The teachers all perceived an increase in the students' excitement over the course of the semester, which may suggest that as students become adjusted to the curriculum and the expectations they get more excited to engage in learning. Please note, objective 4 was unable to be examined because none of the respondents indicated they had implemented an entire pathway.

Given additional research which has been published since the development and data collection of this research project, there is a strong foundation of research which now clearly identified CASE educators support and positive perceptions of the Core Features of the CASE curriculums. Additionally, multiple research projects have identified the CASE Professional Development institutes an exemplary example of professional development for agricultural teachers. As we move forward with examining the Curriculum for Agricultural Science Education it is recommended to focus on the later 3 components of the Model for studying the core features of professional development. Quantifying and qualifying the change in teachers instruction, their implantation of the CASE curriculums, and ultimately the improvements made to student learning is essential.

References

Ary, D., Jacobs, L. C., Sorenson, C., & Walker, D. A. (2014). *Introduction to research in education* (9th ed.). Belmont CA: Wadsworth Cengage Learning.

Common Core Standards Initiative. (2012). *About the standards*. Retrieved, from http://www.corestandards.org/about-the-standards/development-process/.

Curriculum for Agricultural Science Education. (2012). *CASE information*. Retrieved from http://case4learning.org/.

Desimone, L. M. (2009). Improving impact studies of teachers' professional development: Toward better conceptualizations and measures. *Educational Researcher, 38*(3), 181–199. doi: 10.3102/0013189X0833114.

Desimone, L. M., Andrew, A. C., Garet, M., Yoon, K.S., and Birman, B. (2002). Does professional development change teachers' instruction? Results From a Three-Year Study." *Educational Evaluation and Policy Analysis, 24*(2), 81-112.

Jansen, D. (2013). CASE: Positioning agricultural education as a solution for school-wide challenges. *Agricultural Education Magazine, 85*(2), 16- 17.

Lambert, M.D., & Elliott, K. M. (2013). 9 tips from teachers who have implemented CASE. *Agricultural Education Magazine, 85*(2). 18-19.

Mensch, M. (2013). Frequently asked CASE questions. *Agricultural Education Magazine, 85(*2). 20-22.

Ulmer, J.D., Velez, J.J., Lambert. M.D., Thompson, G.W., Burris, S., & Witt, P.A. (2013). Exploring science teaching efficacy of CASE curriculum teachers: A post-then-pre assessment. *Journal of Agricultural Education, 54*(4). 121-133 DOI: 10.5032/jae.2013.04121.

Witt, P.A., Ulmer, J.D., Burris, S., Brashears, T., & Burley, H. (2014). A comparison of student engaged time in agriculture instruction. *Journal of Agricultural Education, 55*(2). 16-32. DOI: 10.5032/jae.2014.02016.

Agricultural Teacher Perceptions of Facilitating Inquiry-Based Instruction Following a Yearlong PD Experience

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Introduction

Over 50% of high school students in the United States (U.S.) lack proficiency in science (Partnership for 21st Century Skills, 2008), and in Nebraska, 27% of 11th grade students lacked proficiency in science during the 2014-15 school year (Nebraska Department of Education, 2015). In response to this national and local problem, researchers at the University of Nebraska—Lincoln (UNL) aim to enhance science literacy by providing agriculture educators with a rigorous professional development (PD) program that teaches science through the context of genetics, muscle biology, microbiology, and nutrition while utilizing inquiry-based instructional teaching methods.

Traditional instruction oftentimes relies upon direct and unilateral instruction originating from the teacher and ending with the student, leaving students sometimes uninvolved and uninterested (Abdi, 2014). Newmann (1994) posits that when a student's efforts to become competent are successful, this generates continued investment, creating a positive feedback cycle. Warner and Myers (2011) describe inquiry-based instruction (teaching) as an opportunity to solve problems by asking questions, making observations, and to applying their new knowledge.

A 2014 study by Abdi compared a control group that was taught with traditional, direct instructional methods compared to a group of students who were taught the same content using inquiry-based learning methods. The results of this study indicate students instructed with inquiry-based learning achieved higher assessment scores than those who were taught the same information using the traditional method. In 2004, Edwards emphasized a need for school-based agricultural education program to adopt curricula that exposes students to advanced concepts that will challenge them within academic content (Wells et al., 2015).

Conceptual Framework

Several models of inquiry-based learning instruction following five general phases, including Orientation, Conceptualization, Investigation, Conclusion and Discussion (Pedaste et al., 2015). Pedaste et. al. (2015) provides an overview of each of the 34 inquiry-based activities can fit into the five phases of inquiry. Student activities promoted in this study did not utilize all 34 activities in an inquiry study but rather incorporated several within each of the five phases of inquiry-based learning.

Purpose of the Study

The purpose of this case study is to describe the perceptions of secondary agricultural education

teachers' ability to facilitate inquiry-based instruction within their agricultural curricula based on their participation in a 12-month PD experience.

Research Questions

The central question of this research study is, "What are agriculture teachers' perceptions of their ability to facilitate inquiry-based instruction after participating in a 12-month PD experience?" Sub-questions include:

1. How do teachers perceive the 12-month PD program?
2. How do teachers perceive their ability to utilize genetics, nutrition, microbiology, and muscle biology during science instruction?
3. How do teachers perceive their ability facilitate inquiry-based instruction?

Methods

A case study approach was selected as the design for this study in order to more completely understand the perspectives of teachers regarding inquiry-based learning. Stake (2005) suggests that case studies are less a methodology, but rather a choice of the researcher in terms of what is studied within a bounded system (bounded by time and location).

Description of 12-Month PD

Nebraska agriculture teachers and science teachers participated in a 12-month PD series designed to help them integrate science concepts in animal and meat sciences into their coursework using inquiry-based learning methods. Teachers participated in summer regional workshops and monthly video conference meetings during the school year. The PD was funded by a grant, which provided necessary teaching supplies. While science teachers were initially invited, only one participated.

Participant Selection/Data Collection

The 10 teachers who completed the 12-month PD were selected to participate in a focus group which allowed for data to be collected through the facilitation of questions to a group of individuals (Berg, 2001). The focus group lasted 80 minutes and utilized a semi-structured protocol. Researchers audio recorded the focus group, which was transcribed verbatim. Researchers took handwritten notes as a form of secondary data collection. (Creswell & Poth, 2018; Merriam & Tisdell, 2016). In order to ensure and enhance the trustworthiness of the study, researchers utilized triangulation and member checks in addition to dependability and confirmability audits (Lincoln & Guba, 1985). Data from the planned focus group was triangulated between the participating investigators.

Data Analysis

Researchers analyzed the data using a thematic analysis method, allowing them to reduce the data in order to identify and focus on repeated phrases and words relating to the case study and evidence of answers to the research questions (Grbich, 2007). Researchers utilized a coding system which used open coding, axial coding, and selective coding (Corbin & Strauss, 1990). Researchers identified themes that emerged.

Findings

Six themes were identified; (a) perceived value of inquiry-based learning, (b) alignment to state and local expectations, (c) value and challenges of a 12-month program, (d) challenges in engaging science teachers, (e) confidence in teaching technical content, and (f) integrating science concepts. These themes and supporting statements are described below with participating teachers labeled as "T1" through "T10".

Perceived Value of Inquiry-Based Learning

Teachers who participated in the 12-month PD program felt learning and practicing inquiry-based learning as a teaching method was a strength of the program. T8 said,

> …we get so busy in teaching and kind of sometimes it feels like you get into a rut of doing the same thing or just surviving sometimes. And so to have this to challenge you or challenge me to do more inquiry, you know, kind of just brought it back. I've done it in the past but it kind of brought it to the forefront and I'm going to say forced me to do more of it, which is good.

T4 appreciated a different approach as a second-year teacher because it allowed him to focus on letting the students ask questions and solve problems.

Alignment to State and Local Expectations

Several teachers discussed how both the focus on science content and integration within the agricultural lessons in addition to inquiry-based instruction addressed local school and state expectations. T5, who teaches science, noted that "Inquiry is such a new, or big—huge part of the new standards and so, [I enjoy] facilitating the use of more of that in my classroom." Agriculture teachers agreed that they can help to meet state and local requirements, including local curricular requirements, including stated learning objectives (T6), approved teaching methods (T2), and helping prepare student for the ACT exam through the use of vocabulary (T7).

Value and Challenges of a 12-month Program

Multiple teachers cited the value of participating in a 12-month PD program, in particular the accountability and continued support aspect over a school-year. T1, T3 and T6 felt that the 12-month program encouraged accountability. T7 and T8 felt that a time period of 12 months allowed them flexibility to fit material into their curriculum. Others enjoyed the monthly Zoom group video calls between teachers, with T2 citing, "I like the Zoom [group video calls], the Zoom was easy, it was not a hard technology [service] so I liked that". T4 added their thoughts, stating,

> I was a first year teacher, going into my second year, so just having that basic feedback and bouncing ideas off of each other, I think was really good for me to hear especially for the [lessons] that I hadn't [taught] yet.

Many teachers emphasized the tangible benefits of the 12-month program, including lesson and laboratory plans, provided supplies, equipment, stipend, and optional graduate credit.

Additionally, many teachers commented on the difficulty of scheduling and attending the monthly video calls during the school year.

Challenges in Engaging Science Teachers

Given that the project was originally intended to engage science teachers in addition to agriculture teachers, many commented on the challenges related to science teacher involvement in PD. Many reasons surfaced, including that science teachers do not typically attend PD during the summer months (T1, T8), or that the agriculture teacher was new to the school and did not feel they were in a position to encourage the science teacher to attend (T4), or that the science teacher had changed from the previous year (T1).

Confidence in Teaching Technical Content

An increase in confidence when teaching technical content was expressed by several teachers. Teacher T1 initially stated, "I'll be the first one to tell you, muscle biology, I don't go there because I don't know enough," however, she continued by adding,

> But it helped kind of reopen my eyes to 'Oh, there's all these resources out there. T7 identified herself as a younger teacher who appreciated having laboratory activities that she could add to her courses rather than solely rely on "textbook learning."

Conversely, T5 identified herself and someone who's been teaching for a long time, stating, "You get really like, 'This is what I do to teach this' and it's always 'This is how I've done it.' To come up with a new idea is sometimes difficult, or you're like, 'I don't know where to start.'" She later added in reference to the provided curriculum, "[The materials are] already there for you, so that was helpful."

Integrating Science Concepts

Based on participation in the PD program, teachers described how they integrated science concepts into their classes. T7 stated, "It made me think a lot more about forcing students to [do] some research and come back with an answer the next day, … whereas sometimes I maybe struggled with that in the past." T1, stated, "…I knew how it connected to animals and, you know, digestion and this is how the stomach works, and this is how it breaks it down, but now I know more of the science behind it."

Others described how integrating science into their classes helped connect their content to that from other classes, including the scientific method (T6), independent/dependent variables and graphing (T2), and scientific vocabulary (T2, T6, T7).

Conclusions, Recommendations, and Implications

Based on the data collected, we recognize that teachers appreciated and valued the PD experience and provided materials. Teachers were optimistic about the impacts the PD program made in their classrooms and with their students. Generally, teachers seemed energized about how inquiry-based learning engaged students in technical and scientific content, supporting Washburn and Myers (2010) description of pressures on agriculture teachers to integrate these concepts from administrators and state education agencies. Lessons and methodology were described as supporting local expectations and state educational content standards. Participants

commented on the value of how inquiry-based learning addressed how students think about the content, supporting the work of Pedaste et. al. (2015) and the five phases of inquiry, which also connected to student engagement concerns by Abdi (2014) and Newman (1994). When considering the longitudinal nature of a 12-month program, teachers identified both positive and challenging aspects, including accountability and flexibility to implement the lessons in addition to difficulties involved in scheduling monthly group video calls. While the project was initially intended to involve an equal number of science and agriculture teachers, challenges and potential solutions were identified to entice more science teachers if a similar project were to be completed. Teachers described an increased confidence in their ability to teach technical content in agriculture, crediting access to prepared lesson materials and university expert support. Finally, teachers indicated an increased ability and appreciation for the integration of science concepts, including helping students connect to science content taught in other classes and the development of critical thinking skills, as previously supported by Warner and Myers (2011).

Should the researchers or other groups develop a similar PD training in the future, several modifications can be made in order to address challenges raised by teachers. Further emphasis on helping teachers to equip students to reflectively formulate explanations and utilize scientific literature can be added. Given the 12-month length of the program, the monthly group video meetings may be better timed to accommodate teachers' schedules. Additional efforts can be made to attract science teachers in future programs. Further research may be conducted to capture student perception of inquiry-based learning as a teaching method, challenges of using inquiry-based learning in classes with mixed grade levels, effect of inquiry-based learning on student learning compared to traditional methods, and the ability for inquiry-based learning to make science concepts relevant.

References

Abdi, A. (2014). The Effect of Inquiry-based Learning Method on Students' Academic Achievement in Science Course. Universal Journal of Educational Research, 2(1): 37-41. doi: 10.13189/ujer.2014.020104

Berg, B. L. (2001). Qualitative research methods for the social sciences. Needham Heights, MA: Allyn and Bacon.

Corbin, J. , & Strauss, A. (1990). Grounded theory research: Procedures, canons, and evaluative criteria. Qualitative Sociology, 13(1), 3-21.

Creswell, J. W., & Poth, C.N. (2018). Qualitative inquiry and research design: Choosing among five approaches (4th ed.). Thousand Oaks, CA: Sage.

Edwards, M. C. (2004). Cognitive learning, student achievement, and instructional approach in secondary agricultural education: A review of literature with implications for future research. Journal of Vocational Education Research, 29(3), 225-244.

Grbich, C. (2007). *Qualitative data analysis: An introduction.* Thousand Oaks, CA: Sage.

Lincoln, Y. S., & Guba, E. G. (1985). Naturalistic inquiry. Newbury Park, CA: Sage Publications.

Merriam, S., & Tisdell, E.J. (2016). Qualitative research: A guide to design and implementation (4th ed.). San Francisco: John Wiley and Sons.

Newmann, F. M. (1992). Student engagement and achievement in American secondary schools. New York: Teachers College Press.

Partnership for 21st Century Skills. (2008). 21st Century Skills, Education and Competitiveness: A Resources and Policy Guide. Retrieved from http://www.p21.org/storage/documents/21st_century_skills_education_and_competi tiven ess_guide.pdf.

Pedaste, M., Mäeots, M., Siiman, L. A., Jong, T. D., Riesen, S. A., Kamp, E. T., . . . Tsourlidaki, E. (2015). Phases of inquiry-based learning: Definitions and the inquiry cycle. Educational Research Review,14, 47-61. doi:10.1016/j.edurev.2015.02.003

Stake, R. E. (2005). Qualitative case studies. In N. K. Denzin & Y. S. Lincoln (Eds.), The Sage handbook of qualitative research (3rd ed.). Thousand Oaks, CA: Sage.

Nebraska Department of Education. (2015). Nebraska State Accountability (NeSA)-*Science.* Retrieved from http://reportcard.education.nebraska.gov/Default_State.aspx.

Warner, A. J., & Myers, B. E. (2011). What is inquiry-based instruction? Retrieved from https://edis.ifas.ufl.edu/pdffiles/WC/WC07500.pdf

Washburn, S. G., & Myers, B. E. (2010). Agriculture teacher perceptions of preparation to integrate science and their current use of inquiry based learning. Journal of Agricultural Education, 51(1), 88-98. doi: 10.5032/jae.2010.01088

Wells, T., Matthews, J., Caudle, L., Lunceford, C., Clement, B., & Anderson, R. (2015). The Infusion of Inquiry-based Learning into School-based Agricultural Education: A Review of Literature. Journal of Agricultural Education, 56(4), 169 - 181. doi: 10.5032/jae.2015.04170

Perceived Teaching Professional Development Needs and Self-Efficacy for Faculty at Non-Land-Grant Colleges of Agriculture

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Introduction and Framework

Non-Land-Grant Colleges of Agriculture (NLGCA's) award nearly half of all baccalaureate degrees in agriculture, food, and renewable resources in their respective states annually (Association of Public and Land-grant Universities, 2019). The faculty within these programs strive to provide students an education with "…real world, hands-on experiences in laboratories, undergraduate research, independent studies, and internships on campus farms and laboratories, with producers, in industry, and in government agencies" (2019). Although faculty members are often experts in their field, this does not mean they will be able to effectively transfer their knowledge to the students in their classrooms (Altany, 2011; Arreola, 2007; Entwistle, 2000). In fact, "university faculty do not receive much training in effective teaching, nor are they exposed to research in student learning" (National Research Council, 2009, p. 7). With increasing expectations of universities to meet the changing demands of society, the need for faculty members to have the necessary teaching abilities to fulfill their duties is also increasing.

The conceptual basis of this study focused on common strategies to improve teaching and learning. Three approaches for instructional improvement are often utilized by higher education campuses: faculty development, instructional development, and organizational development (Gillespie, 2002). Faculty development focuses efforts on the improvement of faculty teaching abilities. Instructional development shifts its focus from the individual faculty member to the student by improving actual courses and curriculums. Organizational development takes yet another approach to professional development by focusing efforts toward issues dealing with the overall structure of a department, college, or institution and its relationship to teaching and learning (Bond, 2015; Gillespie, 2002; Scott, Lemus, Knotts, & Oh, 2016; Weston, Ferris, & Finkelstein, 2017). The researchers utilized these major areas of instructional improvement to assess the current status of NLGCA faculty teaching needs and self-efficacy.

Purpose and Objectives

The purpose of this study was to describe faculty members' perceptions of and experiences with early career professional development at selected regional institutions. Further, the study examined the relationship between early career faculty members' personal and professional characteristics and their perceptions of professional development. The research specifically addressed the National Research Agenda Research Priority Area 2: New Technologies, Practices, Products Adoption Decisions (Roberts, Harder, & Brashears, 2016). The following research objectives were developed to guide the stated purpose.

1. Describe the personal and professional characteristics of NLGCA faculty at selected institutions.
2. Describe perceived areas of need for faculty development programming for NLGCA faculty members and their perceived self-efficacy for each area.

Methods and Procedures

The target population for this study was NLGCA faculty members in colleges of agriculture and related sciences at Non-Land-Grant Agriculture and Renewable Resources Universities (NARRU) institutions. The researchers obtained a list of all universities considered NARRU members ($N = 69$). From this list, the researchers identified all member institutions in Illinois and Tennessee ($N = 6$) based their relative regional proximity and similarities in program offerings. This accessible population was composed of 15 faculty members from Illinois State University, 39 faculty members from Southern Illinois University, 10 faculty members from Western Illinois University, 14 faculty members from Middle Tennessee State University, 13 faculty members from Tennessee Technological University, and 23 faculty members from the University of Tennessee at Martin.

Data collection was conducted using a researcher developed instrument based on university instructional improvement literature. Validity and reliability estimates were established using appropriate protocol (Huck, 2008). After receiving IRB approval, the instrument was delivered electronically using a four-contact email strategy (Dillman, 2007). Subjects in the study ($N = 114$) were contacted and asked to complete the questionnaire. Following this initial request, those individuals who had not responded received up to three follow-up emails with a link to the questionnaire asking them to participate in the survey. This study yielded a response rate of 47.37% ($n = 54$). One study found the average faculty response rates for email surveys to be 32% (Shannon & Bradshaw, 2002). Despite this study's nearly 50% response rate, it must be acknowledged that non-response error is present. This study used descriptive statistics such as means, frequencies, and standard deviations to describe early career faculty members' perceptions of their perceived areas of need for faculty professional development programming, and faculty self-efficacy for each need area.

Results

Table 1 displays selected personal and professional characteristics of early career faculty members. Of the 54 respondents, nearly three quarters were male ($n = 40$; 74.10%). The greatest number of respondents were in the 36–40 years of age range ($n = 9$; 16.70%), 46–50 years ($n = 8$; 14.80%), and 61–65 years ($n = 8$; 14.80%). The largest number of respondents held the rank of professor ($n = 27$; 50.00%), while the remaining 27.08% held the rank of assistant professor ($n = 15$) with the remaining 22.20 % holding the rank of associate professor ($n =12$). Regarding respondents' discipline, a majority of respondents worked in the natural sciences ($n = 30$; 55.55%) with 23.50% of respondents working in the social sciences ($n = 18$). The remaining 11.11% of respondents fell into the category of other ($n = 6$). The greatest number of respondents ($n = 14$; 25.90%) had been in a tenure track position for twenty or more years.

Table 1
NLGCA Faculty Respondents' Sex, Age, Rank, Discipline, and Years in a Tenure Track Position (*n* = 54)

Characteristic	*f*	%
Sex		
Male	40	74.10
Female	13	24.10
Prefer not to respond	1	1.90
Age		
25 or less Years	1	1.90
26–30 Years	2	3.70
31–35 Years	4	7.40
36–40 Years	9	16.70
41–45 Years	7	13.00
46–50 Years	8	14.80
51–55 Years	7	13.00
56–60 Years	5	9.30
61-65 Years	8	14.80
66-70 Years	2	3.70
70 or more Years	1	1.90
Rank		
Assistant professor	15	27.08
Associate professor	12	22.20
Professor	27	50.00
Discipline		
Natural science	30	55.55
Social science	18	33.33
Other	6	11.11
Years in a tenure track position		
1 year	4	7.40
2 years	4	7.40
3 years	1	1.90
4 years	2	3.70
5 years	2	3.70
6 years	2	3.70
7 years	3	5.60
8 years	0	0.00
9 years	2	3.70
10 years	1	1.90
11 years	4	7.40
12 years	1	1.90
13 years	1	1.90
14 years	2	3.70
15 years	1	1.90
16 years	2	3.70

17 years	1	1.90
18 years	4	7.40
19 years	2	3.70
20 + years	14	25.90

Means and standard deviations for selected personal and professional characteristics of early career faculty respondents are presented in Table 2. The average percentage of academic appointment in teaching was 70.19% (*SD* = 22.44). Respondents reported an average research appointment of 17.22% (*SD* = 17.04). Additionally, the average percentage of academic appointment devoted to extension/service/outreach was 8.52% (*SD* = 10.97).

Table 2
NLGCA Faculty Respondents Academic Appointments (*n* = 54)

Characteristic	*M*	*SD*	*Range*
Academic appointment			
Teaching percentage	70.19	22.44	80
Research percentage	17.22	17.04	65
Extension/service/outreach percentage	8.52	10.97	50

In Table 3, means, standard deviations, and ranges are presented for faculty responses regarding how helpful the topic area would be for their growth as a teacher. Respondents agreed that 21 of the topic areas would be helpful to their growth as a teacher. Regarding the remaining four topic areas, respondents were neutral in their perception of how helpful the topic would be to their growth as a teacher.

Table 1
NLGCA Faculty Respondents Perceived Areas of Need for Faculty Development (*n* = 54)

Area of need	*M*	*SD*	*Range*
Mentoring Graduate Students	4.22	1.17	4
Developing Non-traditional Instructional Approaches	4.17	1.00	5
Planning for Laboratory Instruction	4.17	1.12	5
Designing Visual Aids to Enhance Learning	4.13	0.84	4
Developing Non-traditional Evaluation Methods	4.04	0.86	4
Delivering Distance Education	4.00	1.25	5
Using a Variety of Teaching Approaches	4.00	0.86	4
Addressing Negative Student Behaviors	3.85	0.89	3
Developing Effective Lectures	3.83	1.06	4
Designing Course Content	3.81	1.08	4
Evaluating Learning	3.78	0.96	3
Understanding Learning Styles	3.70	0.96	4
Assessing Educational Resources	3.69	0.86	4
Using Learning Management Systems	3.67	1.00	4
Improving the Instructor-Student Relationship	3.67	1.16	4
Advising Undergraduate Student Organizations	3.67	1.09	5
Teaching in a Non-Traditional Setting	3.65	1.04	4
Understanding the Roles of a Faculty Academic Advisor	3.61	1.25	5
Developing Test Questions	3.57	1.03	4
Conducting Peer Evaluations of Teaching	3.54	1.05	4
Developing Learning Objectives	3.52	1.17	4
Developing a Teaching Dossier	3.41	1.12	5
Developing a Teaching Philosophy	3.39	1.05	5
Meeting a Class for the First Time	3.35	1.03	5
Developing Course Syllabi	2.83	1.16	4

Note. Coded: *Strongly Disagree* = 1.00–1.50, *Disagree* = 1.51–2.50, *Neutral* = 2.51–3.50, *Agree* = 3.51–4.50, *Strongly Agree* = 4.51–5.00.

Table 4 displays means, standard deviations, and ranges for faculty responses in regard to how confident they are in their current ability level for the topic area. In terms of self-efficacy for the topic areas, respondents agreed that they were confident in their ability levels for 19 of the topic areas. Respondents were neutral in their current ability level toward six of the topic areas.

Table 4
NLGCA Faculty Respondents Self-efficacy for Teaching Topics (*n* = 54)

Area of need	*M*	*SD*	*Range*
Developing Course Syllabi	4.43	0.71	3
Designing Course Content	4.20	0.73	3
Mentoring Graduate Students	4.20	1.18	4
Understanding the Roles of a Faculty Academic Advisor	4.11	1.09	5
Developing Test Questions	4.02	0.81	4
Improving the Instructor-Student Relationship	3.98	0.87	3
Developing Effective Lectures	3.96	0.95	4
Planning for Laboratory Instruction	3.96	1.18	5
Advising Undergraduate Student Organizations	3.93	0.88	4
Developing Learning Objectives	3.89	0.81	3
Meeting a Class for the First Time	3.83	1.07	5
Developing a Teaching Philosophy	3.81	1.01	4
Understanding Learning Styles	3.72	0.83	3
Using a Variety of Teaching Approaches	3.70	0.96	3
Designing Visual Aids to Enhance Learning	3.67	0.99	4
Using Learning Management Systems	3.65	1.08	4
Evaluating Learning	3.65	0.87	3
Teaching in a Non-Traditional Setting	3.61	1.07	5
Assessing Educational Resources	3.52	0.86	3
Delivering Distance Education	3.46	1.27	5
Conducting Peer Evaluations of Teaching	3.46	1.04	4
Addressing Negative Student Behaviors	3.41	1.03	4
Developing a Teaching Dossier	3.39	0.99	4
Developing Non-traditional Instructional Approaches	3.06	1.05	5
Developing Non-traditional Evaluation Methods	3.06	1.08	5

Note. Coded: *Strongly Disagree* = 1.00–1.50, *Disagree* = 1.51–2.50, *Neutral* = 2.51–3.50, *Agree* = 3.51–4.50, *Strongly Agree* = 4.51–5.00.

Conclusions, Implications, and Recommendations

The first objective of the study was to describe the personal and professional characteristics of NLGCA faculty at selected institutions. From the findings of the study, it is concluded that respondents were mostly male, ages 36-55, held the rank of Associate Professor or higher, were from a Natural Science discipline, and had 10 or more years in a tenure track positions. It can also be concluded that teaching was the largest academic appointment split, followed by research and extension/service. Data from the National Center for Education Statistics (2009) suggests that nearly 65% of full-time instructional faculty in the disciplines of agriculture and home economics are men. Given that nearly 75% of the respondents in the study were men, it is recommended that further study look at possible barriers that may exist for female faculty. Additionally, NLGCA's should examine hiring practices and make efforts to attract and hire a diverse group of faculty.

Objective two was to describe perceived areas of need for faculty development programming for NLGCA faculty members and their perceived self-efficacy for each area. From the findings of

the study, it is concluded that NLGCA faculty generally feel confident in their ability to perform most of the selected teaching tasks presented to them. It is further concluded that in spite of their level of confidence, faculty members agree that professional development in teaching related topics would still be beneficial to their growth and development. These conclusions imply that NLGCA faculty are concerned with their growth as teachers. It is recommended that NLGCA's provide professional growth opportunities in these teaching areas for faculty.

References

Altany, A. (2011). Professional faculty development: The necessary fourth leg. *The Teaching Professor*, 25(6), 5.

Arreola, R. (2007*). Developing a comprehensive faculty evaluation system: A guide to designing, building, and operating large-scale faculty evaluation systems* (3rd ed.). Bolton, MA: Anker Publishing Company.

Association of Public and Land-grant Universities. (2019). Non-land-grant agricultural and renewable resources universities. Retrieved from https://www.aplu.org/members/commissions/food-environment-and-renewable-resources/board-on-agriculture-assembly/narru/

Bond, N. (2015). Developing a faculty learning community for non tenure professors. *International Journal of Higher Education, 4*(4), 1–12. doi: 10.5430/ijhe.v4n4p1

Dillman, D. A. (2007). *Mail and internet surveys: The tailored design method* (2nd ed.). New York: Wiley.

Entwistle, N. (2000). Approaches to studying and levels of understanding: The influences of teaching assessment. In J. C. Smart (Ed.), *Higher education: Handbook of theory and research* (pp. 156–218). New York: Agathon Press.

Gillespie, K. H. (Ed.). (2002). A guide to faculty development: Practical advice, examples and resources. Bolton, MA: Anker Publishing Company, Inc.

Huck, S. W. (2008). *Reading statistics and research* (5th ed.). Boston, MA: Pearson Education, Inc.

National Center for Education Statistics. (2009). *Full-time and part-time instructional faculty and staff in degree-granting institutions, by field and faculty characteristics: Fall 1992, fall 1998, and fall 2003.* [Data File]. Retrieved from http://nces.ed.gov/programs/digest/d09/tables/dt09_255.asp.

National Research Council. (2009). *Transforming agricultural education for a changing world.* Washington DC: The National Academies Press.

Roberts, T. G., Harder, A., & Brashears, M. T. (Eds). (2016). *American Association for Agricultural Education national research agenda: 2016-2020.* Gainesville, FL: Department of Agricultural Education and Communication.

Scott, W., Lemus, D., Knotts, G., & Oh, J. (2016). Why learner-centered new faculty orientations matter: Organizational culture and faculty retention. *The Journal of Faculty Development, 30*(1), 15-22.

Shannon, D. M., & Bradshaw. C. C. (2002). A comparison of response rate, response time, and costs of mail and electronic surveys. *Journal of Experimental Education, 70*(1)*,* 179-192. doi: 10.1080/00220970209599505

Weston, C., Ferris, J., & Finkelstein, A. (2017). Leading change: An organizational development role for educational developers. *International Journal of Teaching and Learning in Higher Education, 17*(2), 270-280. doi: https://eric.ed.gov/?id=EJ1146158

Engaging Virtual Volunteers in Agricultural Teacher Education: The Volunteers' Perspective

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Introduction

Mentoring has long been a part of successful educational programs regardless of discipline to help students navigate from classes to careers. Participating in a mentoring community affords pre-service teachers the time and place to be in conversation with others who are holding their well-being at heart, who have no vested interest other than contributing to their success, and who help to create place of safety where mentees find acceptance and are listened to. Successful mentoring relationships are built around the tenants of role modeling, nurturing, and caring, with mentors and mentees engaging in experiences that promote teaching, sponsorship, encouragement, counseling, and friendship (Anderson & Shannon, 1988).

Traditional mentoring programs in teacher education involve face-to-face interaction where mentors and mentees communication in person. Fairbanks, Freedman and Kahn (2000) define mentoring in teacher preparation programs as the complex social interactions in which mentor teachers and pre-service teachers construct and negotiate for various professional purposes and in response to contextual factors. Through these interactions, pre-service teachers and mentors learn from each other, and improve their ability to identify and explain their teaching practices. These meaningful and collaborative relationships between pre-service teachers and their mentors allow for focused dialogue on teaching and learning (Liu, Tsai, & Huang, 2015).

The Pennsylvania State University sought to capitalize on mentoring relationships through a mentor team approach for their pre-service agriculture teacher candidates utilizing multiple digital communication platforms. The mentor team effort was piloted in 2017-2018 and has quickly become a staple of the capstone year of the program. Mentor teams are comprised the traditional triad of teacher candidate, cooperating teacher, and university supervisor, but also include a virtual team of three additional mentors. These additional mentors include a recent program graduate, an out-of-state thought leader in the agricultural education profession, and an in-state member agricultural educator not currently serving as a cooperating teacher.

Engaging in a virtual mentoring program offers mentors valuable time to interact meaningfully with pre-service teachers. It also affords them opportunities to contribute to pre-service teachers' development without the pressures they associated with having a student teacher, and a chance to develop teaching and mentoring skills to be successful mentors in the future (Reese, 2016). The experience offers mentees the chance to participate in a virtual community of practice with agricultural educators from a wide variety of backgrounds who share an interest in professional development and who can foster shared wisdom and operational knowledge (Carney, Dolan, and Seagle, 2015).

Having a mentor in a different region, institution, or area of practice on their virtual mentoring team encouraged mentees to consider alternative viewpoints and ways to accomplish tasks (Lewis & Flannery, 2016). Because the mentors are geographically dispersed and had varying levels of digital fluency, open communication with program leaders was critical throughout the

mentoring process. Program leaders purposefully engaged with mentor volunteers at regular checkpoints to identify best practices in virtual mentoring that could be applied future iterations of the virtual mentoring program and to other educational disciplines. Volunteers highlighted opportunities to give back, establishing early professional connections, and offering an additional connection to student teachers as integral to their desire to participate in the program. In addition, virtual mentors discussed various methods as essential to building and maintaining relationships with their virtual mentee.

Conceptual Framework

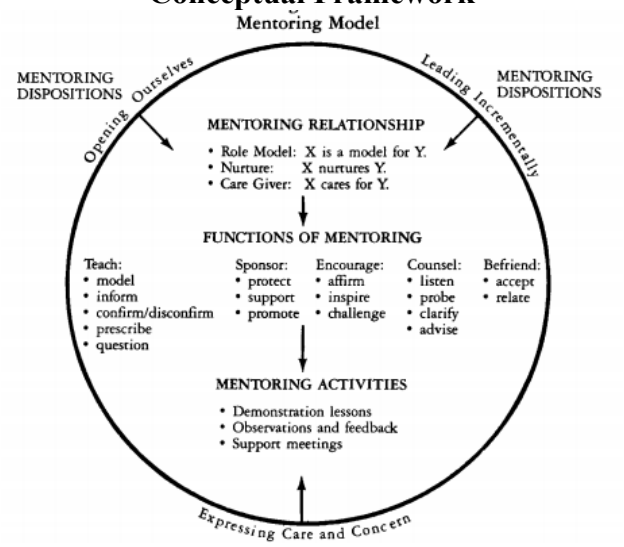

Figure 1: Mentoring Cycle

The framework for the virtual mentoring process is rooted in Anderson and Shannon's 1988 study in which they mapped out the many different aspects of the mentoring process, see *Figure 1*. Mentoring is not a linear process, but is a circle of a continuous series of behaviors and events centered on the tenants of mentoring relationships, functions of mentoring, and mentoring activities. Throughout the mentoring process, mentors and mentees take turns leading, expressing care and concern, and opening up to one another.

The virtual mentoring program recreates these crucial aspects of the mentoring process through the use of digital technology. Through the use of the carefully chosen communication platforms of Edthena, Blogger, and Twitter, mentors and mentees are able to engage in the functions of mentoring and build authentic mentoring relationships. Edthena is used by mentees to upload videos of their demonstration lessons for their mentors to observe and provide feedback on, while Blogger is used to share questions and concerns, while Twitter is a means for sharing resources and asking questions. This combination of digital communication platforms provides a unique virtual environment that fosters and promotes a virtual mentoring community.

Purpose

The purpose of this study was to gain information and insight on the perspectives of agricultural educators who volunteer in a virtual mentoring program, and what they experienced during participation in the program. The research questions that guided this study were:

1. What motivates agricultural educator volunteers to participate as virtual mentors?
2. What are the virtual mentors preferred methods for digital communication?
3. What do virtual mentors enjoy most about the mentoring experience?

Methodology

Mentors participated in the virtual mentoring program on a volunteer basis. Mentors were recruited through solicitation emails sent over the Listserv for The National Association of Agricultural Educators and were recommended by agricultural education professionals. Once involved in the mentoring program for a year, mentors were invited to continue serving if they chose to do so. They were also asked to suggest others who could serve as future mentors and to provide feedback on the mentor selection process.

Virtual mentoring teams for each student were set up in the spring prior to their final year in the pre-service agriculture teacher preparation program. All teams participated in norming protocol meetings via Zoom to review program expectations, communication platforms, and roles of team members. The meetings lasted approximately one-half hour and did not include information on mentoring protocols or procedures.

Participants in this study had or were currently serving as mentors in the virtual mentoring program at The Pennsylvania State University. The participants included one individual from each virtual mentor category: recent program graduate, out-of-state thought leader in the agricultural education profession, and an in-state member agricultural educator not currently serving as a cooperating teacher. Participants were recommended by the mentoring program coordinator, and self-selected by demonstrating their willingness to provide information on their experience as a virtual mentor. Participants engaged in individual video interviews conducted through Zoom. Interviews lasted one half hour, and were video recorded to the Zoom cloud. Participants were all asked the same four questions:

1. Why do you mentor?
2. How do you mentor and what are your preferred methods of communication?
3. What is your favorite mentoring activity?
4. What is your advice for future mentors?

As recommended by Krueger and Casey (2000), data were collected with video and field notes. The constant comparative method of coding, categorization, and generation of themes was used (Corbin & Strauss, 2015). The three-step coding process of open, axial, and selective coding was followed (Corbin & Strauss, 2015). The purpose of open coding was developing categories; the purpose of axial coding was to connect categories; and the purpose of selective coding was to create a story ending in a developed theory on the experiences of virtual mentors and their reasons for mentoring (Corbin & Strauss, 2015).

Findings

The findings from the mentor interviews were organized into five major themes that centered on different aspects of the mentoring process.

Theme 1: Volunteers mentor to give back to the profession.
The majority of mentors noted that giving back to the profession was their main reason for choosing to participate as a virtual mentor. Several had had mentors of their own and wanted to pay it forward. Other mentors were alumni of the teacher preparation program at The Pennsylvania State University and remembered being in the shoes of their mentees. Additional mentors cited wanting to help those preparing to enter the profession. This was important to them because their mentees would soon be their colleagues and the mentors wanted to make sure that the teachers of the future were ready to enter the classroom as a quality agricultural educator.

Theme 2: Volunteers virtually mentor as a more approachable means to stay connected.
Mentors found that it was easier and more realistic for them to regularly connect and engage in the mentoring process through the usage of digital communication platforms, specifically those use within the virtual mentoring program. They found that it was less of a hassle to connect digitally as opposed to in real life, and that the usage of technology allowed for flexibility in their mentoring relationship. Mentors said that it was a valuable experience for them to be able to connect with a pre-service agriculture teacher from a different institution and teacher preparation program than the one they attended. They also said mentoring at a distance allowed them to spread their influence beyond the area where they teach.

Theme 3: Volunteers engage across platforms, depending on what fits.
Mentors and mentees engaged with one another in a variety of ways. Some only used the digital platforms that were part of the mentoring program: Blogger, Twitter, and Edthena. Others branched out into other means of communication such as phone calls, text messages, Zoom video calls, and emails. Some mentors engaged with their mentees through traditional mail and sent goodie bags and survival kits throughout the school year. Certain mentors were able to capitalize on opportunities to make their mentees face to face through in-person activities like dinners and the National FFA and National Association of Agricultural Educators conferences.

Theme 4: Volunteers love the process and the multiples ways they can engage their mentees.
Mentors and mentee communication ranged from strictly digital communication to actually meeting in person when the opportunity presented itself. Multiple mentors cited Twitter and Edthena as their favorite ways to connect with their mentees to share advice and resources. Others enjoyed the ability to share in their mentee's final presentations through the use of video technology such as Zoom and FacebookLive. The shared professional development activities throughout the mentoring program were also popular and helped both mentors and mentees to experience different types of professional development situations together.

Theme 5: Volunteers see ways to learn and grow along with their mentees.
Mentors found that working with their mentees was a way for them to grow both personally and professionally. One mentor shared that the feedback shared by their mentee helped them to become a more effective mentor. Another said that as they became more comfortable in their role as a mentor, they were better able to connect their mentee to resources that they needed. Multiple responses centered around personal and professional growth, and how serving as a mentor helped participants step outside of their comfort zone to become better educators and people.

Conclusions

Participating in the virtual mentoring program was beneficial from the perspective of the mentors. They were able to provide feedback, guidance, and support to their mentees, while also being able to give back to the profession and participate in valuable professional development experiences. Together, mentoring teams were able to create the types of virtual communities of practice suggested by Carney et al. (2015) where they could discuss and exchange ideas and resources related to agricultural education.

Within the digital communities of practice, many different forms of communication occurred on multiple platforms. Geographical boundaries between mentors and mentees were crossed, and mentees were able to learn from agricultural educators from many different regions of the United States. This allowed mentees to experience new and innovative approaches to teaching agricultural education, and afforded mentors the change to become experts on agricultural education to future teachers from a different area (Lewis & Flannery, 2016).

Discussion

The Pennsylvania State University will continue to implement virtual mentoring practices with future cohorts of pre-service agricultural educators. Additional input from mentor volunteers will be solicited to help ensure that the digital technology being used accurately reflects that being used in the agricultural education classroom. New mentor volunteers will actively be recruited each year to aid in creating hybrid vigor of the mentoring teams. Not only will this afford more individuals the chance to participate as mentors, but it will assist more agricultural educators in developing their mentoring skills and giving them the opportunity to give back to the profession (Reese, 2016).

Preparing teachers for the classroom involves not only preparing for today, but also preparing for tomorrow. It is highly unlikely that society will ever become less digital and that individuals will not be required to use learning technology as a part of their role as educator (Lindner, Rodriguez, Strong, Jones, & Layfield, 2016). As such, mentoring programs in teacher education should reflect the need for digitally proficient educators, and should include the usage of digital technology in mentoring practices.

References

Anderson, E. M., & Shannon, A. L. (1988). Toward a conceptualization of mentoring. *Journal of Teacher Education, 39*(1), 38-42. doi:10.1177/002248718803900109

Carney, M., Dolan, D., & Seagle, D. (2015). Intentional collaborations: Building a virtual community of mentoring and practice. *Peer Review, 17*(4), 8.

Corbin, J., & Strauss, A. (2015). *Basics of qualitative research: Techniques and procedures for developing grounded theory*. Thousand Oaks, CA: Sage Publications.

Krueger, R. A. & Casey, M. A. (2000). *Focus groups: A practical guide for applied research* (3rd ed.). Thousand Oaks: CA: SAGE Publications, Inc.

Fairbanks, C. M., Freedman, D. & Kahn, C. (2000). The role of effective mentors in learning to teach. *Journal of Teacher Education*, 51(2), 102 -112.

Lewis, T. D., & Flannery, A. H. (2016). Advancing professional development through virtual mentoring. *Hospital Pharmacy, 51*(4), 277-278. doi:10.1310/hpj5104-277

Lindner, J. R., Rodriguez, M. T., Strong, R., Jones, D., & Layfield, D. (2016). Research Priority Area 2: New Technologies, Practices, Products Adoption Decisions. In T. Roberts, A.

Harder, & M. Brashears (Eds.), *American Association for Agricultural Education National Research Agenda* (pp. 37–40).

Liu, S., Tsai, H., & Huang, Y. (2015). Collaborative professional development of mentor teachers and pre-service teachers in relation to technology integration. *Journal of Educational Technology & Society, 18(3)*, 161-172.

Reese, J. (2016). Virtual mentoring of preservice teachers: Mentors' perceptions. *Journal of Music Teacher Education, 25*(3), 39-52. doi:10.1177/1057083715577793

The Dualism of Interdisciplinarity: A Model for Research and Practice

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Introduction

The term "interdisciplinary" has become increasingly associated with high quality education (Boix Mansilla, Feller, & Gardner, 2006). Defined as experiences which combine multiple disciplines to form an understanding of a phenomenon, or to solve a problem, interdisciplinary education represents a shift in traditional, disciplinary approaches (Boix Mansilla, Miller, & Gardner, 2000; Nikitina, 2006). The context of agriculture, food, and natural resources (AFNR) is inherently interdisciplinary (McKim, Velez, Lambert, & Balschweid, 2017). Within AFNR learning opportunities (e.g., secondary school classrooms, community workshops), the convergence of science, mathematics, social studies, ethics, English language arts, engineering, and other disciplines is expected in an effort to develop learner understanding of complex AFNR systems (Scherer, McKim, Wang, DiBenedetto, & Robinson, 2019). Research in interdisciplinarity suggests educational spaces which combine content from multiple disciplines better prepare learners to sustainably address complex problems like climate change, deforestation, hunger, and water scarcity (Borrego & Newswander, 2010; Jacob, 2015; Klein, 2008). Therefore, preparing learners to think in an interdisciplinary way is critical to giving current and future generations the best chance to address these wicked problems (Newell, 2010).

The concept "interdisciplinary," however, is not reserved for learning experiences which meld multiple disciplines (Huutoniemi, Klein, Bruun, & Hukkinen, 2010). Interdisciplinary also refers to collaborations among individuals representing multiple disciplines (e.g., communications, animal sciences, economics, and engineering represented among team members collaborating to develop and disseminate a new technology). Funding opportunities and research featuring interdisciplinary collaborations have grown in tandem with awareness that interdisciplinary teams are essential to addressing problems which transcend traditional disciplinary boundaries (Bossio, Loch, Schier, & Mazzolini, 2013; Klein, 2008; Petri, 2010). Therefore, in addition to the need for interdisciplinary thinking, interdisciplinary collaborations are essential to solving complex and wicked problems.

The dual use of "interdisciplinary" to represent both thinking and collaboration presents challenges and opportunities. As examples, a potential for ambiguity exists regarding the term interdisciplinary, but, an opportunity for increased support exists for interdisciplinary work. In this theoretical manuscript, interdisciplinary thinking and interdisciplinary collaboration are delineated and their relationship modeled. By modeling their relationship, interactions between the two concepts are explored and practical strategies uncovered to develop both interdisciplinary thinking and collaboration among learners in AFNR contexts.

Purpose

Acknowledging the need to bring together concepts related to interdisciplinarity, the current theoretical abstract proposes and describes a model for research and practice which brings into alignment interdisciplinary thinking and interdisciplinary collaboration. As a theoretical abstract, traditional paper sections (e.g., methods, findings) are not included.

Model of Dualistic Interdisciplinarity

The model of dualistic interdisciplinarity, pictured in Figure 1, combines interdisciplinary collaboration and interdisciplinary thinking. Each element of the model is described below the figure.

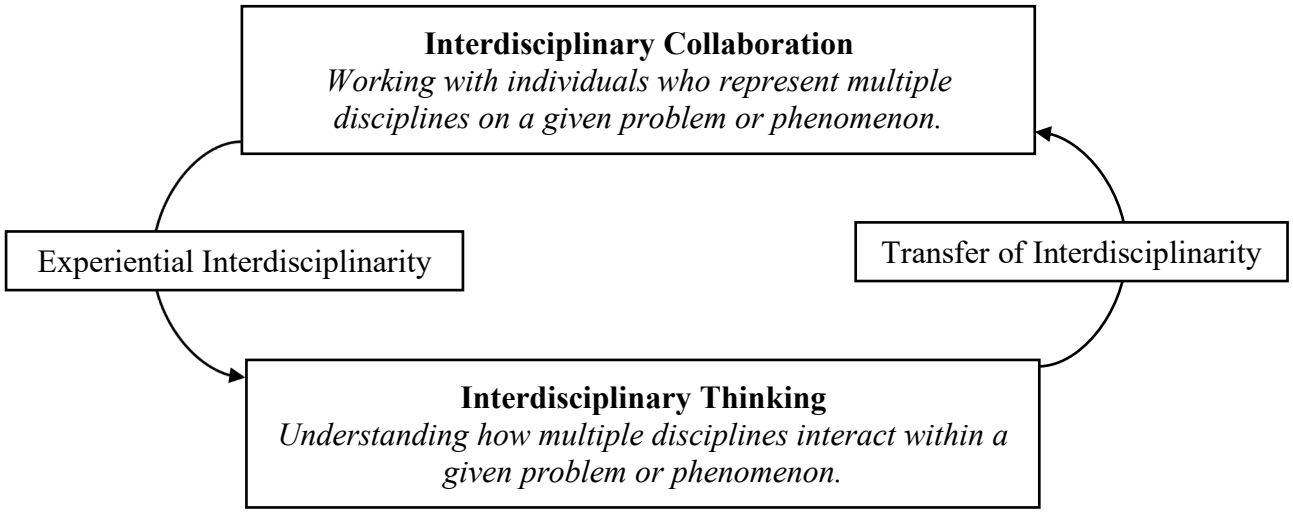

Figure 1. Model of Dualistic Interdisciplinarity

Interdisciplinary Thinking

Interdisciplinary thinking is defined as *understanding how multiple disciplines interact within a given problem or phenomenon* and refers to the individual learner element of the model. Interdisciplinary thinking represents the foundation of the model, as an individual's understanding of multiple disciplines is required to engage in collaborative work with individuals representing those disciplines (Bossio et al., 2013). Importantly, however, interdisciplinary thinking does not suggest an individual become an expert in all disciplines; instead, interdisciplinary thinking requires an individual acknowledge the contributions, or potential contributions, of multiple disciplines on a given problem of phenomenon. Pragmatically, the development of interdisciplinary thinking requires learners be engaged in experiences which continually illuminate the multitude of disciplines which contribute to, or could contribute to, a holistic understanding of a problem of phenomenon (McKim et al., 2016; Scherer et al., 2019).

Interdisciplinary Collaboration

Interdisciplinary collaboration is defined as *working with individuals who represent multiple disciplines on a given problem or phenomenon* and refers to the social element of the model. Interdisciplinary collaboration represents the operationalization of interdisciplinary thinking; recognizing collaboration is essential for complex problem solving, the ability to utilize interdisciplinary thinking within collaborative teams is essential (Bossio et al., 2013; Newell, 2010). Pragmatically, interdisciplinary collaboration requires learning opportunities whereby individuals representing diverse disciplines are brought together to collaborate on a problem or phenomenon.

Transfer of Interdisciplinarity

Existing research provides the foundation of knowledge from which interdisciplinary thinking and interdisciplinary collaboration are explored. However, when combined within the Model of

Dualistic Interdisciplinarity, the transitions between these two elements are foregrounded. Importantly, these transitions provide the novelty and utility of this new way of thinking about interdisciplinarity. The first of these transitions is shifting from interdisciplinary thinking to interdisciplinary collaboration. *Transfer of interdisciplinarity* is defined as *the ability to utilize interdisciplinary thinking within collaborative groups* and represents the shift from an individual to social context within the model. Pragmatically, transfer of interdisciplinarity requires educational experiences which attend to four outcomes (see Table 1 for descriptions): (a) the ability to work in teams, (b) an appreciation for diversity, (c) an understanding of the problem or phenomenon, and (d) an awareness of individual expertise related to the problem or phenomenon.

Table 1
Transfer of Interdisciplinarity Skills

Pragmatic Skill	Description
The ability to work in teams.	A range of knowledge (e.g., stages of team development, member roles) and skills (e.g., emotional intelligence, conflict management) are associated with working in teams. Learning experiences must include opportunities for learners to construct this knowledge and develop these skills through content and practice.
An appreciation for diversity.	In preparation for working in interdisciplinary teams, individuals should engage in learning experiences which highlight the essential nature, and utility, of diverse perspectives, values, and backgrounds coming together.
An understanding of the problem of phenomenon.	Transitioning from an individual to collaborative context, learners must have a robust understanding of the problem of phenomenon in which they will be contributing ideas.
An awareness of individual expertise related to problem of phenomenon.	Interdisciplinary collaborations require each individual have an area of expertise they contribute to the problem of phenomenon. Therefore, the transition to collaboration requires individuals are aware of the expertise they bring to the collaboration.

Experiential Interdisciplinarity

The second transition is from interdisciplinary collaboration to interdisciplinary thinking. *Experiential interdisciplinarity* is defined as *the ability to utilize interdisciplinary collaborations to inform interdisciplinary thinking* and represents the shift from the social to individual context within the model. Pragmatically, experiential interdisciplinarity requires educational experiences which attend to three outcomes (see Table 2 for descriptions): (a) the ability to develop knowledge through reflection upon experiences, (b) an ability to process through cognitive disequilibrium, and (c) an understanding of how to operationalize diverse ideas.

Table 2
Experiential Interdisciplinarity Skills

Pragmatic Skill	Description
The ability to develop knowledge through reflection upon experiences.	As informed by the experiential learning theory (Kolb, 1984), learning emerges from making meaning out of experience. Therefore, learning experiences must develop learners' ability to construct knowledge as lived experiences are reflected upon.
An ability to process through cognitive disequilibrium.	When working in interdisciplinary teams, knowledge is gained through the synergy of different disciplinary perspectives coming together. This melding of perspectives often juxtaposes a singular (i.e., individual or discipline) viewpoint; thus, individuals must cope with, and leverage, the resulting cognitive disequilibrium.
An understanding of how to operationalize diverse ideas.	In concert with cognitive disequilibrium, individuals must be prepared to incorporate the melded perspectives resulting from interdisciplinary collaborations into their own interdisciplinary thinking, including understanding how this new viewpoint changes their interaction with, and understanding of, problems and phenomena.

Conclusions and Discussion

With increasing momentum, "interdisciplinary" is becoming part of educational nomenclature (Boix Mansilla et al., 2006; Klein, 2008). However, evaluation of the concept yields two ways of conceptualizing the term: (a) a characteristic of an individual's thinking and (b) a feature of a collaborative group. This theoretical abstract provides a model which delineates these two features while also showcasing their relationship and transitions between the two concepts of interdisciplinarity. The resulting model can be used by researchers, teachers, and other stakeholders to increase the interdisciplinarity, both thinking *and* collaboration, of AFNR education.

In addition to defining and differentiating interdisciplinary thinking and interdisciplinary collaboration, the model highlights two transitionary processes, transfer of interdisciplinarity (i.e., shifting from interdisciplinary thinking to interdisciplinary collaboration) and experiential interdisciplinarity (i.e., shifting from interdisciplinary collaboration to interdisciplinary thinking). These transitionary processes transform the Model of Dualistic Interdisciplinarity from a theoretical conceptualization to a practical tool for AFNR educators to encourage learners to be more individually and collaboratively interdisciplinary. Furthermore, the identification of outcomes (see Tables 1 and 2) associated with both transfer of interdisciplinarity and experiential interdisciplinarity provide a roadmap for preparing learners to shift between interdisciplinary thinking and interdisciplinary collaboration.

The transitionary processes found within the model also illuminate the cyclical nature of interdisciplinary learning. The cyclical nature implies individuals must navigate transitions between individual and social learning opportunities, wherein individual experiences strengthen disciplinary perspective while acknowledging the value, or potential value, other disciplines provide to a phenomenon or problem. Likewise, collaborative experiences provide learners with opportunities to cross disciplinary boundaries in collaboration with individuals diverse in background, knowledge, and perspectives to meld ideas, understanding, and solutions on a

phenomenon or problem. Throughout the interdisciplinary cycle, educators should facilitate transitions between individual and collaborative experiences while also attending to transfer of interdisciplinarity and experiential interdisciplinarity.

Recommendations

As a "draft" model of the relationship between interdisciplinary thinking and interdisciplinary collaboration, continued work is needed to strengthen the ideas presented. Therefore, recommendations emerging from this work favor research over practice. Scholars are encouraged to challenge, critique, and expand upon the Model of Dualistic Interdisciplinarity using theoretical, conceptual, and/or empirical approaches. Additionally, pragmatic evaluations of the model within aligned educational spaces are encouraged alongside evaluations of educators who have implemented these approaches. Finally, from a holistic perspective of AFNR Education, our discipline should be actively seeking opportunities to emerge as a leader in the scholarship and practice of interdisciplinary thinking and interdisciplinary collaboration. The interdisciplinary context of AFNR systems provides a valuable head start to inform education, as a whole, on these important topics.

References

Boix Mansilla, V., Feller, I., & Gardner, H. (2006). Quality assessment in interdisciplinary research and education. *Research Evaluation, 15*(1), 69-74. https://doi.org/10.3152/147154406781776057

Boix Mansilla, V., Miller, W. C., & Gardner, H. (2000). On disciplinary lenses and interdisciplinary work. In S. Wineburg & P. Grossman (Eds.). *Interdisciplinary curriculum: Challenges of implementation.* New York, NY: Teachers College Press.

Borrego, M., & Newswander, L. K. (2010). Definitions of interdisciplinary research: Toward graduate-level interdisciplinary learning outcomes. *The Review of Higher Education, 34*(1), 61-84. https://doi.org/10.1353/rhe.2010.0006

Bossio, D., Loch, B., Schier, M., & Mazzolini, A. (2013). A roadmap for forming successful interdisciplinary education research collaborations: A reflective approach. *Higher Education Research & Development, 33*(2), 198-211. https://doi.org/10.1080/07294360.2013.832167

Huutoniemi, K., Klein, J. T., Bruun, H., & Hukkinen, J. (2010). Analyzing interdisciplinarity: Typology and indicators. *Research Policy, 39*(1), 79-88. https://doi.org/10.1016/j.respol.2009.09.011

Jacob, J. W. (2015). Interdisciplinary trends in higher education. *Palgrave Communications*, *1*, https://doi.org/10.1057/palcomms.2015.1

Klein, J. T. (2008). Evaluation of interdisciplinary and transdisciplinary research: A literature review. *American Journal of Preventive Medicine, 35*(2), 116-123. https://doi.org/10.1016/j.amepre.2008.05.010

Kolb, D. A. (1984). *Experiential learning: Experience as the source of learning and development*. Englewood Cliffs, N.J.: Prentice-Hall.

McKim, A. J., Velez, J. J., Lambert, M. D., & Balschweid, M. A. (2017). A philosophical review of science and society within agricultural education. *Journal of Agricultural Education, 58*(2), 98-110. https://doi.org/10.5032/jae.2017.02098

Newell, W. H. (2010). Educating for a complex world: Integrative learning and interdisciplinary studies. *Liberal Education, 96*(4), 6-11.

Nikitina, S. (2006). Three strategies for interdisciplinary teaching: Contextualizing, conceptualizing, and problem-centering. *Journal of Curriculum Studies, 38*(3), 251-271. doi:10.1080/00220270500422632

Petri, L. (2010). Concept analysis of interdisciplinary collaboration. *Nursing Forum. 45*(2), 73-82. https://doi.org/10.1111/j.1744-6198.2010.00167.x

Scherer, H. H., McKim, A. J., Wang, H., DiBenedetto, C. A., & Robinson, K. (2019). Making sense of the buzz: A systematic review of "STEM" in agriculture, food, and natural resources education literature. *Journal of Agricultural Education, 60*(2), 28-53. https://doi.org/10.5032/jae.2019.02028