Journal of Agricultural Education
A Publication of the American Association for Agricultural Education
Volume 59, Issue 1, 2018

Editing Managing Board
(Terms end on December 31)

<table>
<thead>
<tr>
<th>Member</th>
<th>Region</th>
<th>University</th>
<th>Term Ends</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ryan G. Anderson</td>
<td>North Central</td>
<td>Iowa State University</td>
<td>2019</td>
</tr>
<tr>
<td>Marshall Baker</td>
<td>Western</td>
<td>Oklahoma State University</td>
<td>2020</td>
</tr>
<tr>
<td>Joey Blackburn</td>
<td>Southern</td>
<td>Louisiana State University</td>
<td>2020</td>
</tr>
<tr>
<td>Chris Estepp</td>
<td>Southern</td>
<td>Sul Ross State University</td>
<td>2018</td>
</tr>
<tr>
<td>Neil Knobloch (Chair)</td>
<td>North Central</td>
<td>Purdue University</td>
<td>2018</td>
</tr>
<tr>
<td>Misty Lambert</td>
<td>North Central</td>
<td>Iowa State University</td>
<td>2020</td>
</tr>
<tr>
<td>Dustin Perry</td>
<td>Western</td>
<td>Montana State University</td>
<td>2019</td>
</tr>
<tr>
<td>Ryan Saucier</td>
<td>Western</td>
<td>Sam Houston State University</td>
<td>2018</td>
</tr>
<tr>
<td>Chris Stripling</td>
<td>Southern</td>
<td>University of Tennessee</td>
<td>2019</td>
</tr>
</tbody>
</table>

Editorial Staff

Harry N. Boone, Jr., Ph.D., Editor (2016-2018)
Department of Agricultural and Extension Education, West Virginia University
4417 Agricultural Sciences Building, P.O. Box 6108
Morgantown, WV 26506
Phone: (304) 293-5451 Email: harry.boone@mail.wvu.edu

Catherine Shoulders, Editor Elect, University of Arkansas
D. Barry Croom, Past Editor, University of Georgia
Tyson Sorensen, Utah State University, Assistant Editor

Editorial Review Board
(Terms end on December 31)

<table>
<thead>
<tr>
<th>Member</th>
<th>Region</th>
<th>University</th>
<th>Term Ends</th>
</tr>
</thead>
<tbody>
<tr>
<td>James Christiansen</td>
<td>Western</td>
<td>Texas A&amp;M</td>
<td>2018</td>
</tr>
<tr>
<td>Catherine A. DiBenedetto</td>
<td>Southern</td>
<td>Clemson University</td>
<td>2018</td>
</tr>
<tr>
<td>John Ewing</td>
<td>North Central</td>
<td>Pennsylvania State University</td>
<td>2019</td>
</tr>
<tr>
<td>Alexa Lamm</td>
<td>Southern</td>
<td>University of Florida</td>
<td>2019</td>
</tr>
<tr>
<td>Jason McKibben</td>
<td>North Central</td>
<td>West Virginia University</td>
<td>2018</td>
</tr>
<tr>
<td>OP McCubbins</td>
<td>Southern</td>
<td>Tennessee State University</td>
<td>2020</td>
</tr>
<tr>
<td>Steve Rocca</td>
<td>Western</td>
<td>California State University Fresno</td>
<td>2018</td>
</tr>
<tr>
<td>Eric Rubenstein</td>
<td>Southern</td>
<td>University of Georgia</td>
<td>2019</td>
</tr>
<tr>
<td>Travis Park</td>
<td>Southern</td>
<td>North Carolina State University</td>
<td>2020</td>
</tr>
<tr>
<td>Annie Specht</td>
<td>North Central</td>
<td>The Ohio State University</td>
<td>2018</td>
</tr>
<tr>
<td>Debra Spielmaker</td>
<td>Western</td>
<td>Utah State University</td>
<td>2019</td>
</tr>
<tr>
<td>Kasee Smith</td>
<td>Western</td>
<td>University of Idaho</td>
<td>2019</td>
</tr>
<tr>
<td>Scott Smalley</td>
<td>North Central</td>
<td>Iowa State University</td>
<td>2019</td>
</tr>
<tr>
<td>Andrew Thoron</td>
<td>Southern</td>
<td>University of Florida</td>
<td>2018</td>
</tr>
</tbody>
</table>

2020
2020
2020
2020
The Journal of Agricultural Education Editing Managing Board thanks the following individuals for their service as reviewers for Volume 58.

Reviewers for Articles Published in Volume 58

Akers, Cindy  Johnson, Donald  Seevers, Brenda
Anderson, Ryan  Jones, David  Shinn, Glenn
Baker, Marshall  Jones, Wash  Shoulders, Catherine
Baker, Matt  Kaufman, Eric  Simonsen, Jon
Barrick, Kirby  Knobloch, Neil  Smalley, Scott
Bellah, Kimberly  Lambert, Misty  Smith, Amy
Blackburn, Joey  Lambeth, Jeanie  Smith, Kasee
Byrd, Alex  Lavergne, Douglas  Spielmaker, Debra
Christiansen, James  Lawver, Becki  Stair, Kristin
Chumbley, Steven (Boot)  Leggette, Holli  Stewart, Josh
Conner, Nathan  Linder, James  Stripling, Christopher
Croom, D. Barry  Martin, Michael  Strong, Robert
Curry, Kevin  Martin, Robert  Swafford, Marshall
DeLay, Ann  Marx, Adam  Swan, Benjamin
DiBenedetto, Catherine  Myers, Brian  Swortzel, Kirk
Dooley, Kim  Odom, Summer  Talbert, Brian
Edney, Kirk  Osborne, Edward  Terry, Jr., Robert
Edwards, Michael Craig  Park, Travis  Thoron, Andrew
Edwards, Stephen  Paulsen, Thomas  Ulmer, Jonathan
Estepp, Christopher  Radhakrishna, Rama  Velez, Jonathan
Ewing, John  Ramsey, Jon  Warner, Laura
Faulkner, Paula  Retallick, Michael  Washburn, Shannon
Flowers, Jim  Rice, Amber  Wells, Kevin
Friedel, Curtis  Ritz, Rudy  Whittington, M. Susie
Garton, Bryan  Roberts, T. Grady  Yawson, Robert
Harbstreit, Steven  Robinson, Jeremy
Haynes, J. Chris  Rocca, Steve
Hock, Gaea  Rubenstein, Eric
Joerger, Richard  Sandlin, M’Randa

Additional Individuals Completing Reviews in 2017

Arnold, Shannon  McKibben, Jason  Ricketts, John
Bristers, Mary  McKim, Aaron  Scherer, Hannah
Everett, Michael  Meyers, Courtney  Settle, Quisto
Greiman, Brad  Park, Travis  Spindler, Matt
Lamm, Alexa  Perry, Dustin  Warner, Wendy
Layfield, Dale  Rayfield, John  Warnick, Brian
Table of Contents
Journal of Agricultural Education
Volume 59 * Issue 1* 2018

Why?
J. Scott Vernon.................................................................................................................. 1

Can Dissatisfaction Relative to Perceived Importance Affect Extension Clients’ Landscape Management Practices?
Laura A. Warner, Amanda D. Ali, & Anil Kumar Chaudhary ............................... 7

A Capstone Experience: Impacts of a Behavioral Style Learning Unit on Soft Skill Development and Team Dynamics
M’Randa R. Sandlin, Melissa R. Price & Kauahi Perez ........................................ 21

Measuring Optimal Experiences of CANR Undergraduates in a Leadership Course
Michael W. Everett & Matt R. Raven ................................................................. 35

Agriculture Teachers’ Integrated Belief Systems and its Influence on their Pedagogical Content Knowledge
Amber H. Rice & Tracy Kitchel ............................................................................. 51

A National Analysis of School-Based Agricultural Education Involvement, Graduation, STEM Achievement, and Income
Aaron J. McKim, Jonathan J. Velez & Tyson J. Sorensen .................................... 70

Lessons Learned: Describing the Preservice Preparation Experiences of Early-Career Award-Winning Agricultural Educators
Lockie Breeding, John Rayfield & Kasee L. Smith .............................................. 86

The Effect of Two Different Pedagogical Delivery Methods on Students’ Retention of Knowledge Over Time
Marshall A. Baker & J. Shane Robinson ................................................................. 100

Personal Resilience as a Predictor of Professional Development Engagement and Career Satisfaction of Agriscience Teachers
R. G. (Tre) Easterly III & Brian E. Myers .............................................................. 119

Examining Student Perceptions of Their Experience in a TBL Formatted Capstone Course
OP McCubbins, Thomas H. Paulsen & Ryan Anderson ....................................... 135

A Measure of Self-Regulated Learning in Online Agriculture Courses
Steven “Boot” Chumbley, J. Chris Haynes, Mark S. Hainline & Tyson Sorensen ...................................................... 153
Predicting Consumers’ Local Food Attitude with Personal Values and Local Food Online Videos
Shuyang Qu, Alexa Lamm, Joy Rumble & Ricky Telg................................................. 171

National Participation in School-Based Agricultural Education: Considering Ethnicity, Sex, and Income
Jonathan J. Velez, Haley Q. Clement & Aaron J. McKim................................. 189

Organizational Change in the Land-Grant System: A Qualitative Evaluation
Kevan W. Lamm, L. Rochelle Sapp & Alexa J. Lamm................................. 204

Agriscience Education Through Inquiry-Based Learning: Investigating Factors that Influence the Science Competence of Middle School Students
Peter Skelton, J. Joey Blackburn, Kristin S. Stair, Natalie Levy & Thomas J. Dormody................................................................. 223

Is There an App for That?: Describing Smartphone Availability and Educational Technology Adoption Level of Louisiana School-Based Agricultural Educators
H. Eric Smith, Kristin S. Stair, J. Joey Blackburn & Madelyn Easley .......... 238

The Motivational Changes Pre-Service Agricultural Education Teachers Endure while Facilitating Quality Supervised Agricultural Experiences: A Six-Week Project-Based Learning Experience
Richie Roberts & J. Shane Robinson................................................................. 255

Reflective Journeys of Five Women Agriculturists in Australia: A Qualitative Study
Carrie A. Stephens, Shelby Brawner, Amanda Dean, Christopher T. Stripling, & Danielle Sanok................................................................. 271

Beginning SBAE Teachers’ Metal Fabrication Knowledge Needs: Implications for Teacher Preparation
Marshall Swafford & Paden Hagler................................................................. 287

STEM Education at the Nexus of the 3-Circle Model
Marshall Swafford ............................................................................................. 297
Why?
J. Scott Vernon

Abstract

Dr. J. Scott Vernon presented the 2017 AAAE Distinguished Lecture at the Annual Meeting of the American Association for Agricultural Education in San Luis Obispo, California in May, 2017. The article is a philosophical work based upon the author’s experiences in the agricultural education profession.

“The two most important days in your life are the day you are born and the day you find out why.”— Mark Twain

It was a hot day in July, I was irrigating corn in Hanford, California, a small farming town in the Central Valley. I was two months away from entering high school. With a shovel in my hand I looked up to see an old crew cab pick-up coming down the dusty dirt road. When it stops a man with a walrus like mustache and a big smile gets out and heads towards me. It was Mr. Loya, the local agriculture teacher. He was my older sister’s teacher. He had been to our house so I already knew him.

“Hello Scott,” he said, “looks like a great stand of corn!”

“Thank you Mr. Loya,” I said, curious as to why he was there with me.

He told me, “You are going to be on the livestock judging team next year when school starts.” It was not a question.

“I have never been on a livestock judging team Mr. Loya.”

“No worries, I will teach you,” he said.

For the next 43 years he taught me more than I could ever imagine. He died on February 1st of this year. I was humbled to be asked by the family to give his eulogy. The church was overflowing and I relied on the skills he taught me to honor his life. I did the best I could. That is what he always wanted from his students – their best.

When people pass we often ask why? Why did they leave us so soon? We miss them. We often wish we could have had one last goodbye.

Why is an important question.

Good afternoon. I am honored to deliver the Distinguished Lecture to such an esteemed group of teachers, communicators, extensionists and scholars. I am humbled. When Rob Terry asked me if I would give this speech, I was privately reluctant. I asked myself why? Why me? Hell, many of you don’t even now who I am. I am not the AAAE member of the year by any stretch of

1 J. Scott Vernon is a Professor in the Agricultural Education & Communication Department, California Polytechnic State University, San Luis Obispo, svernon@calpoly.edu.
the imagination. I am not the most prolific researcher. I am not at a Land Grant Institution. My vita is not up-to-date. I am an agriculture teacher – an anecdotal scholar.

As I wrestled with the why, it hit me. I know why Rob asked me. He values teaching and he is a master teacher, a creative mind and an accomplished scholar. And possibly because I’m local, so there are no travel expenses against the association! Also, because we are friends, colleagues and brothers, of sorts. We get each other.

He knows I am not knee deep in ANOVAS and Chi Squares. My analysis of variance runs the gamut.

Why me? Because like Mr. Loya, I am an agriculture teacher. I love what I do. Thanks Dr. Terry.

Why?

Two reason, really: first, I love agriculture, our nation’s most vital industry. Second, I love my students – young and old.

My first reason was easy, I grew up on a cattle and horse ranch. I learned the value of hard work and pride that comes with producing a quality product. I also enjoy the people involved in the industry. They are family farmers and ranchers who share common values of honesty, integrity and a strong work ethic. People in agriculture are some of the kindest, most sincere people on the planet. Good and decent people.

My second reason, my students, took me some time to understand. When I was young I did not particularly like kids. I was not the most patient person. I had little use for games and adolescent stupidity. I loved agriculture and by gosh, I was going to teach them what I loved. Along the way, I realized it isn’t really about agriculture at all; it is about people. We are in the people business. It has been said that they do not care how much you know, until they know how much you care. I care.

But these are not the only reasons.

The other reasons included Mr. Loya, Mr. DeRuiter, Mr. Hill, Mr. Brandt, Mr. Mann, Mr. Lunstad and Dr. Joe Sabol.

My agriculture teachers.

Each day they demonstrated the knowledge and skills necessary to inspire and motivate young people to be the best they could be. I admired that in these men. They were masters in and out of the classroom. They worked hard, drove fast and liked winning. I did too. I wanted to be like them.

When I was young I did not know what a Ph.D. was. I was the first in my family to graduate from college. I went to Cal Poly. I was not surrounded by doctoral students and many of my professors were “Misters” – experts in their fields who used their strong industry experiences to relay their knowledge in the classrooms and labs. They were respected by family farmers and ranchers and were often leaders in industry organizations. Some were “Doctors,” although I wasn’t sure just what kind of doctors they were; I was naïve, but impressed nonetheless. I admired them as well. Again, I wanted to be like them.
I wanted to be a teacher. And, in following that dream it occurred to me that if I wanted to do it at the university level, I needed a Ph.D. So I got one. Big deal. I chased some grants. I did some research. Asked some good questions. Published some results. Boom. I got tenured and promoted. I did okay. I am a teacher.

So my question is this…why do you do what you do? Is it your passion? Is it your calling? Is it just your job?

Is your research useful? Do you solve problems – real problems? Does it serve agriculture? Our students? Our citizens?

Is your teaching engaging? Creative? Informed? Varied? Do your students know how much you care? Or are they simply a grade in the gradebook?

Please understand, I appreciate sound research. I value outstanding teaching. But there are times I wonder if we can be our best if we try to be “all things, to all people.”

Your “why” will change, evolve and mature. It has to for you to survive and thrive.

I know the environment we work in – The Ivory Towers of Higher Education; that lofty, sometimes ridiculous place where our actions are not always driven by our passions, but instead by our committees. Peer reviewed or otherwise. We all have our “why?” Tenure and promotion. Publish or perish. I get it. I did it. Many of you have as well. It is what it is.

At this point you are probably thinking, “this guy isn’t very distinguished at all!!” How could he be so ignorant about what we do to “further knowledge and discovery?” After all we are at a research conference.

Good question. Maybe I am ignorant, but I am certain – I am an agriculture teacher. I am confident that is why I was placed on this earth. It has been my calling. And at the risk of sounding arrogant…I am good at it. Why? Because I focused my attention on being the kind of teacher I want my two sons, Conner and Kyler to have in school. I want them to have excellent teachers. I want their teachers to know who my boys are and work to meet their educational needs in and out of the classroom. Wouldn’t you want that for your kids?

When I die nobody will wax poetic in an eulogy about how many papers I published or how much grant money I secured. No, I hope they will share how I made a difference in the lives of my family, friends and students. I want people to know that I was an agriculture teacher who loved the industry and his students.

You see, that is my passion. What is your passion? Are you asking the right questions? Are you enjoying your work? Do you make a difference…really? Is your scholarship useful, relevant and are you growing as a professional?

I’ll be honest, I haven’t heard many distinguished lectures. Well, maybe one and it was 30 years ago. I forgot who gave the lecture or the point of the message. I apologize. But this I know, each of you in this room today are working to distinguish yourselves on your campus. Your lectures are distinguished. You are working hard and making a difference. You are agriculture teachers, communicators and extensionists. You are scholars. I admire and respect you for your dedication.
to this profession. It is honorable. It is needed. You matter. Your work is important. Your intellect
is sharp.

There will be days when you question your “why?” Why me? Why here? Why now?

Please know that your “why” is critical to your success. It is what keeps you moving
forward in your profession. It is what keeps you focused in times of adversity (and budget cuts).
Your why may not be like everyone else’s why. That is okay. But you must know why!

Each day I remember my why in the students who have touched my life.

It was a cool winter day and I was at my desk at Cal Poly. Brad, a 6'2” young man with
muscles built on his northern California farm and a head full of brown hair walked into my office.
He was a freshman and a long way from home. He asked, “Do you have a minute to talk?”

“Sure.” He was visibly shaken and needed to talk.

“I just got back from Sierra Vista Hospital,” he said as he began to cry.

“They told me I have cancer and I should probably go home and get my things in order.”

My heart sunk. My first thought was how is it possible that the doctors could be so cruel
as to tell this young man he has cancer while he is all alone and his family was hundreds of miles
away?

I stood. He stood. We hugged. I didn’t know what else to do. I could feel the weight of his
world in my arms.

I tried to comfort him and then went into teacher mode. “Let’s figure this out and get you
to your family,” I said. That is what teachers do. We solve problems. We care about kids.

“Thank you Dr. Vernon,” he said softly.

We got him home to his family and he kept in touch over the next quarter and the summer.
He returned in the fall and came to see me.

“It’s great to be back! I have some catching up to do,” he exclaimed.

“No worries, we’ll help you.” And we did…for a few months.

He became ill again. This time it was worse. His cancer had returned. He returned to his
family farm. Later that quarter Brad died.

I took the news pretty hard. I cried for him, his family and myself. I could not fix it, no
matter what I did. I lost another student. A good one. A great kid.

Some would think I made a difference in Brad’s life as a teacher. Perhaps, but the reality
is Brad made a difference in my life. He made me a better teacher.

I am an agriculture teacher. That is why I do it. To make a difference.
I advise senior projects at Cal Poly. A capstone experience with a five chapter write-up much like a thesis. Students mostly hate them.

Holly had an idea. Holy was weird. Her wild hair was died jet black. She wore all black clothes. Her make-up was pasty white. Her lips were black. Her fingernails were black. She was a Goth.

One day in my office she said, as her hands flew in wild gestures, “There is this whole web of connectivity in the world, it is like veins running through our soul, it’s in the cyberworld and I want to harness its power and rule the planet!”

“That’s nice Holly,” I said as I was thinking earth to Holly, “but let’s figure out what you want to do for a senior project.”

She said, “That is what I want to do, I want to put agriculture in cyberspace.”

We worked together and she completed a senior project, but I talked her out of ruling the world.

I was wrong. I should have listened to Holly. If so, I would not be here giving you this lecture. The year was 1992. We all know what happen to the world wide web in the 90’s. Holly was right. She could have ruled the world. She went on to be successful in the Silicon Valley. I will never forget Holly.

In that instance I was the student. Holly was the teacher. I learned. I grew as a teacher. Sometimes our students know more than we do. We need to listen.

Back in the day when I was a high school agriculture teacher I coach the livestock judging team. Once when we were getting ready for a big contest at the Cow Palace in San Francisco, Billy, a freshman student came to me and said he he didn’t think he could judge in the contest.

“Mr. Vernon, I’m scared, I don’t think I can judge at the Cow Palace,” he said.

“Sure you can Billy,” I insisted.

“I don’t think I’m ready,” he continued.

Like any good teacher I employed the Socratic Method of questioning. We try to make the hard things easy.

“Billy, listen, you come from a purebred cattle ranch, right?”

“Yes,” he admitted.

“You and your daddy raise some of the best Limousin cattle in the country, right?”

“Yes,” he said again.

“You sell cattle all over the United States, right?”

“Yes,” he said with more excitement.
“You and you dad buy some of the best genetics in the world, right?”

“Yes,” he smiled.

“Well Billy, then it is easy. When you get to Cow Palace, just place them like you and your daddy would buy them and you’ll be okay.”

“Okay, I’ll go,” he committed.

We went to the contest and the kids all participated in the contest. I had them write their placings and after the contest we went over how they placed the classes. I looked at Billy’s placings on a class of Hereford bulls. He had it completely backwards.

“Billy, why did you place the Hereford class backwards? Didn’t you see the number one bull? He is one of the best bulls in the country. He would be a herd sire in anybody’s herd. He is probably worth $250,000,” I pleaded.

“But, but, Mr. Vernon, I was just doing what you told me to do,” he said.

“What?”

“I just placed like you told me. You said, place ‘em like me and my daddy would buy them and I knew we couldn’t afford the number one bull so I put him last,” he said confused.

Brad, Holly and Billy are just a few examples of why I teach. Over the past 34 years there are hundreds of stories, memories and students who made a difference in my life and my career. They are my why. I trust each of you have similar stories and experiences that help validate what you do each day.

As you participate in this conference and return home, it is my hope that you will reflect on your why. And, when you do, you will be energized to carry on or perhaps make changes that will resonate in your hearts and minds.

Again, I am humbled to deliver the Distinguished Lecture. It has been the highest honor of my career. My Loya would be proud.

Mr. Loya was one of my teachers, a mentor and ultimately a friend. He was an agriculture teacher. I was his why. I am grateful.

Mark Twain once said, “The two most important days in your life are the day you are born and the day you find out why.”

I hope you find your why.

Thank you and God bless you.
Can Dissatisfaction Relative to Perceived Importance Affect Extension Clients’ Landscape Management Practices?

Laura A. Warner1, Amanda D. Ali2, & Anil Kumar Chaudhary3

Abstract

Water quality and availability are critical issues currently addressed by agricultural education professionals. Extension professionals need to employ innovative approaches to help residents adopt practices and technologies to reduce the impact of urban landscapes on water resources. This study explored how individuals’ dissatisfaction relative to their perceived importance of either clean water for large and local water bodies or plentiful water for local water bodies related to their intent to engage in landscape best management practices following a tailored message. Individuals were randomly assigned to receive a message appealing to improving water quality through good fertilization practices or a message appealing to improving water availability through good irrigation practices. Those who assigned higher importance but perceived lower satisfaction with clean water had greater likelihood of engaging in most fertilizer best practices after receiving a tailored message compared to those who assigned lower importance and perceived higher satisfaction with clean water. Those who assigned higher importance but perceived lower satisfaction with plentiful water were more likely to engage in one of the five irrigation best practices compared to those who assigned lower importance and perceived higher satisfaction with plentiful water after receiving the message. Agricultural education programs should tailor messages to dimensions clientele perceive as important but with which they are unsatisfied, especially when intent is lower.

Keywords: dissatisfaction, home irrigation users, importance-performance analysis, targeted programs, water conservation, water quality protection

Author Note: This work was supported by the University of Florida Early Career Scientist Seed Fund.

Introduction

In 2007, the number of people living in urban areas worldwide exceeded the number living in rural areas (United Nations, 2014). The urban growth rate is increasing, and the rising number of urban residents will continue to increase the demand on limited water resources (McDonald et al., 2014). Increases in urbanization and a growing population have led to more areas with turfgrass and greater numbers of urban landscapes that receive supplemental fertilizers and irrigation (Bremer, Keeley, Jager, Fry, & Lavis, 2012; Shober, Denny, & Broschat, 2010). Urban irrigated

1 Laura A. Warner is an Assistant Professor of Extension Education in the Department of Agricultural Education and Communication and the Center for Landscape Conservation and Ecology at the University of Florida, PO Box 112060, Gainesville, FL, 32611, lsanagorski@ufl.edu.
2 Amanda D. Ali is a doctoral student and graduate assistant in the Department of Agricultural Education and Communication at the University of Florida, PO Box 115040, Gainesville, FL, 32611, amanda.ali@ufl.edu.
3 Anil Kumar Chaudhary is an Assistant Professor of Agricultural Extension and Education in the Department of Agricultural Economics, Sociology, and Education at the Pennsylvania State University, 204A Ferguson Building, University Park, PA, 16802, auk259@psu.edu
areas are estimated to cover between 4.5 and 9.5 million hectares in the United States, which would “rank turfgrass as the single largest irrigated crop in the country” (Milesi, Elvidge, & Nemani, 2009, p. 231). Notably, 50 to 80% of the United States’ turfgrass areas are in home landscapes, and the “greatest opportunity for conserving water and minimizing runoff and leaching in urban areas may be in residential lawns” (Bremer et al., 2012, p. 651).

Clean and plentiful water supports a variety of purposes including food production, human health and hygiene, economic development, environmental health, infrastructure, and daily life (McDonald et al., 2014; St. Hilaire, 2009). Water quality risks in rivers and lakes, droughts, and water scarcity are all projected to intensify in some parts of the United States (Georgakakos et al., 2014; Sauri, 2013). Home landscape irrigation represents a large, and sometimes the largest, share of a household’s water use (DeOreo, Mayer, Dziegieleski, & Kiefer, 2016). In addition to directly impacting water availability (Fulcher, LeBude, Owen, White, & Beeson, 2016), home landscaping practices can affect water quality. Improper irrigation or fertilizer practices can introduce excess nutrients to water bodies which results in reduced water quality (Carey et al., 2012).

There is a need for agricultural education professionals, such as those working in Extension, to focus on water issues (Roberts, Harder, & Brashears, 2016) and encourage behavior changes that help urban residents reduce their landscape’s impact on water resources (Kotler & Lee, 2005). It is challenging to elicit landscape management changes among residents, yet these practices directly affect water quality and quantity. Extension professionals can explore and employ strategic approaches to help residents adopt these practices and technologies.

**Conceptual Framework**

Extension professionals can increase their efficacy by tailoring water conservation programs based on the needs of their specific audiences (Mahler et al., 2013; McKenzie-Mohr, 2011). To engage Extension stakeholders in information exchange around important science related topics, Extension educators need to present only that information which is relevant and important to the audience (Robinson, 2013). Educational approaches tailored to individuals can be more successful in encouraging water protection behaviors than a mass appeal (Landers, Mitchell, Smith, Lehman, & Conner, 2006).

To target programs addressing a specific issue, some agricultural educators have incorporated the audience’s perceived importance of issues specifically in the context of water. Lamm, Lundy, Warner, and Lamm (2016) found perceived importance of plentiful water can guide water conservation behaviors among high water users. The authors suggested there was an opportunity to focus on individuals who assigned high importance to plentiful water but who were unengaged in conservation practices (Lamm et al., 2016). In another study, Adams et al. (2013) found people who perceived water quality, water conservation in residential landscapes, and water for other purposes as being important were more likely to engage in water conservation behaviors outside their homes. Other researchers found individuals responded more positively to assertive requests if the topic of the message was important to them (Kronrod, Grinstein, & Wathieu, 2012). These studies exhibit empirical support for the opportunity to incorporate the audience’s perceived importance of an issue into targeted programs and message design.

Other agricultural educators have proposed considering satisfaction along with perceived importance to target educational programs (Warner, Kumar Chaudhary, & Lamm, 2016; Warner, Kumar Chaudhary, Lamm, Rumble, & Momol, 2017). Warner, Kumar Chaudhary, et al. (2016) proposed considering perceived satisfaction along with perceived importance to effectively guide Extension educators’ communication strategies. For example, the authors recommended Extension
educators spend more time and resources on those water related issues where Extension clients felt that a specific issue (e.g., clean water for recreation) was important but where they were less satisfied with it (Warner, Kumar Chaudhary, et al., 2016). In another study, Warner et al. (2017) considered perceived satisfaction along with perceived importance of water for different purposes and found vital differences with perceived water issues among three target areas (Florida, California, Chesapeake Bay).

Perceived importance and satisfaction with a topic affects how programming resonates with an audience. Therefore, a concept which can help target programs is the gap between perceived satisfaction and perceived importance (Levenburg & Magal, 2004; Warner et al., 2017). For the purpose of this study, we operationalized a satisfaction-importance gap as the difference between perceived importance of a specific water issue/dimension and perceived satisfaction of the same water issue/dimension. A negative satisfaction-importance gap indicates low satisfaction with something that is more important while a positive satisfaction-importance gap indicates high satisfaction with something that is less important (Warner et al., 2017). Warner et al. (2017) compared satisfaction-importance gaps associated with water for different purposes among Florida, California, and Chesapeake Bay area residents. Based on these gaps the authors provided implications for agricultural educators focusing on specific water issues to encourage water protection behaviors among residents. This approach can be effective because people may be motivated to act when they are not satisfied with something they think is important (Festinger, 1957). In the context of home landscapes, residents may “change their yards to reflect environmental concerns, or they may change their beliefs about the ecological impacts of yards to match their choices” (Larson, Casagrande, Harlan, & Yabiku, 2009, p. 924).

The concept of satisfaction-importance gaps can be useful in changing behaviors. We undertook this study to determine if messages could play a role in engaging individuals in landscape best management practices when targeted to negative satisfaction-importance gaps. Applied to water issues, when a specific dimension of water is important to someone but they are unsatisfied with its current status (e.g., a negative satisfaction-importance gap), they may either perceive it to be of lesser importance or take action to improve its performance. For example, when residents feel that plentiful water for recreation is highly important, but are not satisfied with the availability of plentiful water for recreation, there is a negative satisfaction-importance gap which may be used to motivate water conservation behavior.

**Purpose**

The purpose of the study was to examine how satisfaction-importance gaps might relate to tailored appeals so impactful Extension programs could be developed. Because people should be more motivated to act when they can help resolve a problem that is important to them, we sought to determine whether people with greater negative satisfaction-importance gaps surrounding a dimension of water resources responded differently to messages tailored to that dimension. By exploring possible relationships between satisfaction-importance gaps and behaviors specific to home landscape practices, we examined how reducing inconsistencies surrounding different dimensions of water could be part of best landscape management extension programs.

The specific objectives were to a) compare responses to a clean water message on fertilizer intent between two groups with low or high satisfaction-importance gaps; and b) compare responses to a plentiful water message on irrigation intent between two groups with low or high satisfaction-importance gaps. We tested the following null hypotheses:
HO1: Among those who receive a tailored water quality message (landscape fertilization message), there is no difference in intent to adopt good fertilization practices between the High Importance/Low Satisfaction with Clean Water group and the Low Importance/High Satisfaction with Clean Water group.

HO2: Among those who receive a tailored water quantity message (landscape irrigation message), there is no difference in intent to adopt good irrigation practices between the High Importance/Low Satisfaction with Plentiful Water group and the Low Importance/High Satisfaction with Plentiful Water group.

Method

Data for this national study were collected in May 2016 to identify water conservation and quality protection behaviors and perceptions among residents nationwide. The target audiences for this study were national residents who control their landscape irrigation because this audience has the potential to positively affect water resources by changing their landscape management behaviors (Warner, Rumble, Martin, Lamm, & Cantrell, 2015; Warner, Lamm, Rumble, Martin, & Cantrell, 2016). Prior to data collection the study was approved by the University of Florida Institutional Review Board.

Sampling and Data Collection

There was no existing sampling frame of national residents who control their landscape irrigation (Warner, Lamm, et al., 2016), and we secured the sample for this study using non-probability opt-in panel sampling techniques from a web-based survey sampling company. We recruited participants who met screening criteria that defined the target population. The specific screening criteria used in this study were: no less than 18 years of age, had a lawn or landscape with an irrigation system, and had control over their landscape irrigation. Non-probability opt-in panels are often used in the absence of a sampling frame to make inferences about the target audience (Baker et al., 2013). Various studies have shown non-probability opt-in panels can produce comparable or even better results compared to probability based panels (Abate, 1998; Twyman, 2008; Vavreck & Rivers, 2008).

After the screening questions, there were 1,692 participants eligible to complete the survey. We also incorporated a few quality control questions in the survey to ensure responses were only collected from respondents who were answering thoughtfully (Lavrakas, 2008). From the eligible respondents, there were 1,080 complete responses, which corresponded to a 63.8% participation rate (Baker et al., 2016).

Just over half of the respondents (54.8%, n = 592) were female and the mean age was 40 years. Most respondents (85.7%, n = 926) were white and just over half (51.5%, n = 556) had a four-year college degree or higher education. The most common total family income category for the respondents was $50,000 to $74,999 (22.4%, n = 242) followed by $75,000 to $99,999 (20.3%, n = 219). The majority of respondents (85.3%; n = 921) indicated they were homeowners.

Instrumentation

We collected data using a researcher-developed web survey. The dependent variables of interest were intent to engage in four proper fertilization practices and intent to engage in five proper irrigation practices. For both variables, we asked participants to indicate their likelihood of adopting several best management practices in the future.
We measured intent to engage in proper fertilization practices using four statements measured on a five-point Likert scale (1 = very unlikely, 2 = unlikely, 3 = undecided, 4 = likely, 5 = very likely). We excluded respondents who selected not applicable from this analysis. The specific proper fertilization practices were: apply fertilizers carefully to prevent their leaching, reduce the application of fertilizers to lawn, engage in good lawn fertilization practices, and prevent spilling of fertilizers on paved surfaces.

We measured intent to engage in individual proper irrigation practices using five statements measured on a five-point Likert scale (1 = very unlikely, 2 = unlikely, 3 = undecided, 4 = likely, 5 = very likely). Again, we excluded any respondents who selected not applicable from further analysis. The specific proper irrigation practices were: prevent irrigation when it is raining, conserve water by reducing irrigation, follow good irrigation practices, irrigate only when needed, and irrigate properly to reduce water use.

We used importance-performance analysis (IPA; Martilla & James, 1977) to measure the satisfaction-importance gap for clean water for local and large water bodies and plentiful water for local water bodies. We selected these two dimensions from several water dimensions, which a previous study revealed had the greatest difference between satisfaction and importance nationwide (Warner et al., 2017). The respondents were asked to indicate the level of importance they associate with three clean water statements and three plentiful water statements and in separate questions they were asked to indicate their satisfaction with same three clean water and three plentiful water statements (see Table 1).

Table 1

Clean and Plentiful Water Indices in a Study to Assess the Effect of Different Messages on Fertilization and Irrigation Intent among Residents Who Control their Landscape Irrigation in the United States

<table>
<thead>
<tr>
<th>Index Name</th>
<th>Individual Statements in Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Importance of clean water for local and large water bodies⁹</td>
<td>Clean lakes, springs, rivers</td>
</tr>
<tr>
<td>Satisfaction with clean water for local and large water bodies¹⁰</td>
<td>Clean oceans</td>
</tr>
<tr>
<td></td>
<td>Clean bays and estuaries</td>
</tr>
<tr>
<td>Importance of plentiful water in local water bodies⁹</td>
<td>Plentiful water in aquifers and springs</td>
</tr>
<tr>
<td>Satisfaction with plentiful water in local water bodies¹⁰</td>
<td>Plentiful water in rivers</td>
</tr>
<tr>
<td></td>
<td>Plentiful water in lakes</td>
</tr>
</tbody>
</table>

Note: ⁹Importance question stem: Please identify the level of importance you associate with each of the following water-related items. ¹⁰Satisfaction question stem: Please indicate how satisfied you are with the availability of clean/plentiful water for each of the following items. Each respondent was presented with individual importance and satisfaction items.

We measured the importance of clean water using a five-point Likert scale (1 = not at all important; 2 = slightly important, 3 = fairly important; 4 = highly important; 5 = extremely important), and we also measured satisfaction with availability of clean and plentiful water on a five-point Likert scale (1 = not at all satisfied; 2 = slightly satisfied; 3 = fairly satisfied; 4 = highly satisfied; 5 = extremely satisfied). We created a clean water importance index, clean water satisfaction index, plentiful water importance index, and plentiful water satisfaction index by
averaging three clean water importance statements, three clean water satisfaction statements, three plentiful water importance statements, and three plentiful water satisfaction statements, respectively.

We calculated the clean water satisfaction-importance gap by subtracting the clean water importance index score from the clean water satisfaction index score, and the plentiful water satisfaction-importance gap by subtracting the plentiful water importance index score from the plentiful water satisfaction index score. We standardized these satisfaction-importance gaps, and then divided them each into two groups for clean water and two groups for plentiful water (see Table 2). Larger negative values were associated with high importance and low satisfaction while smaller negative values or positive values were associated with low importance and high satisfaction. Thus, people in the low importance/high satisfaction groups were satisfied enough to match the perceived level of importance they associated with a particular water issue. Conversely, people in the high importance/low satisfaction groups perceived high importance associated with a particular water dimension, but their satisfaction with that dimension was low.

Table 2

<table>
<thead>
<tr>
<th>Water Dimension</th>
<th>Group</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clean water for local and large water bodies</td>
<td>High importance/low satisfaction</td>
<td>Consider clean water for local and large water bodies overall very important, but dissatisfied with the availability of clean water for local and large water bodies</td>
</tr>
<tr>
<td></td>
<td>Low importance/high satisfaction</td>
<td>Consider clean water for local and large water bodies less important, and are satisfied with the availability of clean water for local and large water bodies</td>
</tr>
<tr>
<td>Plentiful water in local water bodies</td>
<td>High importance/low satisfaction</td>
<td>Consider plentiful water in local water bodies overall very important, but dissatisfied with the availability of plentiful water for local water bodies</td>
</tr>
<tr>
<td></td>
<td>Low importance/high satisfaction</td>
<td>Consider plentiful water in local water bodies less important, and are satisfied with the availability of plentiful water in local water bodies</td>
</tr>
</tbody>
</table>

We used a print-based message treatment, and one-half of respondents randomly received a message appealing to clean water (By responsibly using fertilizer in your home landscape, you will ensure there is clean water in our oceans) and other one-half of respondents randomly received plentiful water message (By conserving water through good irrigation practices, you will ensure there is plenty of water in our rivers).
The face and content validity of the instrument was established using a panel of experts specialized in water conservation outreach programming, survey methodology, and agricultural and biological engineering. Next, we pilot tested our instrument and based on the results of the pilot test we revised our final instrument. The reliability of the instrument was established by calculating Cronbach’s alpha and post-hoc Cronbach’s alpha values were found satisfactory (0.84 and higher) for all the study variables including intent to engage in proper fertilization practices, intent to engage in proper irrigation practices, clean water importance index, clean water satisfaction index, plentiful water importance index, and plentiful water satisfaction index (Santos, 1999).

Data Analysis

To test the null hypotheses, we used Chi-square analyses to determine if there was a relationship between: (a) fertilization intent and the high importance/low satisfaction with clean water group and the low importance/high satisfaction with clean water group who received a tailored clean water message, and (b) irrigation intent and the high importance/low satisfaction with plentiful water group and the low importance/high satisfaction with plentiful water group who received a tailored plentiful water message. Prior to conducting the Chi-square analysis, we normalized each index using z-scores for ease of categorization into groups. We used the normalized index to separate respondents into two groups (high importance/low satisfaction and low importance/high satisfaction) for each dimension.

Results

We found a significant difference in fertilizer intent between the high importance/low satisfaction and low importance/high satisfaction with clean water for local and large water bodies groups on three of the four individual fertilizer intent statements after receiving the message (see Table 3). Following the message treatment, 66.4% of those in the high importance/low satisfaction with clean water for local and large water bodies group were very likely to engage in good lawn fertilizer practices, while only 46.8% of those in the low importance/high satisfaction with clean water for local and large water bodies group were very likely to do so. Additionally, 56.5% of those in the high importance/low satisfaction with clean water for local and large water bodies group were very likely to engage in reducing fertilizer application to lawns, while only 36.1% of those in the low importance/high satisfaction with clean water for local and large water bodies group were very likely to do so. Because there was a statistically significant relationship for the majority of the practices, we rejected null hypothesis HO1.

After the message treatment, we found a statistically significant difference in irrigation intent between the high importance/low satisfaction and low importance/high satisfaction with plentiful water in local water bodies groups for only one of the five practices, irrigating only when needed (see Table 4). Among those in the high importance/low satisfaction with plentiful water in local and large water bodies group, 71.5% were very likely to conserve water by irrigating only when needed while 66.8% of those in the low importance/high satisfaction group indicated they were very likely to do so. Because there was only a significant relationship on one of the items, we did not reject the null hypothesis HO2.
Table 3

Chi-square analysis comparing residents’ intent to engage in good fertilization practices as a function of the gap between satisfaction and importance of clean water for large and local water bodies (n = 540)

<table>
<thead>
<tr>
<th>Fertilizer Intent Statement</th>
<th>Clean water group*</th>
<th>Very unlikely % (n)</th>
<th>Unlikely % (n)</th>
<th>Undecided % (n)</th>
<th>Likely % (n)</th>
<th>Very likely % (n)</th>
<th>$\chi^2$</th>
<th>$p$</th>
<th>Cramer’s $V$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduce application of fertilizers to lawn</td>
<td>LI/ HS</td>
<td>3.0 (8)</td>
<td>5.6 (15)</td>
<td>21.1 (56)</td>
<td>34.2 (91)</td>
<td>36.1 (96)</td>
<td>23.64</td>
<td>&lt;.001</td>
<td>.214</td>
</tr>
<tr>
<td></td>
<td>HI/ LS</td>
<td>1.6 (4)</td>
<td>2.0 (5)</td>
<td>13.7 (34)</td>
<td>26.2 (65)</td>
<td>56.5 (140)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engage in good lawn fertilizer practices</td>
<td>LI/ HS</td>
<td>1.1 (3)</td>
<td>0.4 (1)</td>
<td>11.4 (30)</td>
<td>40.3 (106)</td>
<td>46.8 (123)</td>
<td>20.49</td>
<td>&lt;.001</td>
<td>.200</td>
</tr>
<tr>
<td></td>
<td>HI/ LS</td>
<td>1.2 (3)</td>
<td>0.4 (1)</td>
<td>6.9 (17)</td>
<td>25.1 (62)</td>
<td>66.4 (164)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apply fertilizers carefully to prevent their leaching</td>
<td>LI/ HS</td>
<td>1.5 (4)</td>
<td>1.5 (4)</td>
<td>11.6 (31)</td>
<td>37.7 (101)</td>
<td>47.8 (128)</td>
<td>11.55</td>
<td>.021</td>
<td>.150</td>
</tr>
<tr>
<td></td>
<td>HI/ LS</td>
<td>1.6 (4)</td>
<td>0.8 (2)</td>
<td>7.7 (19)</td>
<td>27.5 (68)</td>
<td>62.3 (154)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prevent spilling of fertilizers on paved surfaces</td>
<td>LI/ HS</td>
<td>1.5 (4)</td>
<td>1.1 (3)</td>
<td>9.5 (25)</td>
<td>31.6 (83)</td>
<td>56.3 (148)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>HI/ LS</td>
<td>1.3 (3)</td>
<td>0.4 (1)</td>
<td>5.0 (12)</td>
<td>25.8 (62)</td>
<td>67.5 (162)</td>
<td>8.35</td>
<td>.080</td>
<td></td>
</tr>
</tbody>
</table>

Note. *LI/HS – Low importance/high satisfaction with clean water group (n = 278); HI/LS – High importance/low satisfaction with clean water group (n = 262)
Table 4

Chi-square analysis comparing residents’ intent to engage in good irrigation practices as a function of the gap between satisfaction and importance of plentiful water for local water bodies (n = 540)

<table>
<thead>
<tr>
<th>Irrigation intent statement</th>
<th>Plentiful water group*</th>
<th>Very unlikely % (n)</th>
<th>Unlikely % (n)</th>
<th>Undecided % (n)</th>
<th>Likely % (n)</th>
<th>Very likely % (n)</th>
<th>$\chi^2$</th>
<th>p</th>
<th>Cramer’s V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irrigate only when needed</td>
<td>LI/HS</td>
<td>0.9 (2)</td>
<td>0.0 (0)</td>
<td>5.6 (12)</td>
<td>26.6 (57)</td>
<td>66.8 (143)</td>
<td>10.70</td>
<td>.030</td>
<td>.143</td>
</tr>
<tr>
<td></td>
<td>HI/LS</td>
<td>0.6 (2)</td>
<td>0.3 (1)</td>
<td>1.0 (3)</td>
<td>26.5 (82)</td>
<td>71.5 (221)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Follow good irrigation</td>
<td>LI/HS</td>
<td>0.5 (1)</td>
<td>0.9 (2)</td>
<td>4.1 (9)</td>
<td>32.9 (73)</td>
<td>61.7 (137)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>practices</td>
<td>HI/LS</td>
<td>0.6 (2)</td>
<td>0.0 (0)</td>
<td>1.9 (6)</td>
<td>26.8 (83)</td>
<td>70.6 (219)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conserve water by reducing</td>
<td>LI/HS</td>
<td>0.9 (2)</td>
<td>2.2 (5)</td>
<td>5.4 (12)</td>
<td>43.0 (96)</td>
<td>48.4 (108)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>irrigation</td>
<td>HI/LS</td>
<td>0.6 (2)</td>
<td>1.3 (4)</td>
<td>6.4 (20)</td>
<td>32.5 (102)</td>
<td>59.2 (186)</td>
<td>7.79</td>
<td>.100</td>
<td>.100</td>
</tr>
<tr>
<td>Irrigate properly to reduce</td>
<td>LI/HS</td>
<td>0.9 (2)</td>
<td>1.4 (3)</td>
<td>3.2 (7)</td>
<td>29.6 (64)</td>
<td>64.8 (140)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>water use</td>
<td>HI/LS</td>
<td>0.7 (2)</td>
<td>0.0 (0)</td>
<td>2.0 (6)</td>
<td>28.1 (86)</td>
<td>69.3 (212)</td>
<td>5.68</td>
<td>.224</td>
<td>.224</td>
</tr>
<tr>
<td>Prevent irrigation when it</td>
<td>LI/HS</td>
<td>1.8 (4)</td>
<td>1.8 (4)</td>
<td>4.4 (10)</td>
<td>24.0 (54)</td>
<td>68.0 (153)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>is raining</td>
<td>HI/LS</td>
<td>1.0 (3)</td>
<td>1.3 (4)</td>
<td>3.5 (11)</td>
<td>25.3 (79)</td>
<td>68.9 (215)</td>
<td>1.27</td>
<td>.866</td>
<td>.866</td>
</tr>
</tbody>
</table>

Note. * LI/HS – Low importance/high satisfaction with plentiful water group (n = 225); HI/LS – High importance/low satisfaction with plentiful water group (n = 315)
Discussion and Conclusions

Those who place higher importance and lower satisfaction on clean water are more likely to intend to adopt fertilizer best management practices after receiving a message tailored toward clean water, compared to those who assign lower importance and perceive higher satisfaction to clean water. This implies tailored clean water messages could play a role in encouraging good fertilizer practices among agricultural education clientele who are unsatisfied with the availability of clean water but consider it highly important.

Those who place higher importance and lower satisfaction on plentiful water are not more likely to intend to adopt irrigation best management practices after receiving a message tailored toward plentiful water, compared to those who assign lower importance and perceive higher satisfaction to plentiful water. This implies among agricultural education clientele who are unsatisfied with the availability of plentiful water but consider it highly important, tailored water conservation messages may not play as large a role in encouraging them to adopt good irrigation practices. Intent to engage in good irrigation practices was overall much higher than intent to engage in good fertilization practices, and there were more differences between the high importance/low satisfaction and low importance/high satisfaction groups for fertilizer. It is possible appealing to satisfaction-importance gaps is more effective when overall motivation is low. This aligns with the recommendations from Lamm et al. (2016), who proposed agricultural education professionals should target individuals who assign high importance to plentiful water but who were unengaged in conservation practices.

Providing a mass message to remedy a complex problem is not effective as it may create message fatigue or simply not be noticeable to recipients. Tailoring or reframing the message based on target audience needs, such as the identified satisfaction-importance gaps used in this study, is a way to overcome potential message fatigue and enhance use of information presented in the message (Landers et al., 2006; Robinson, 2013). When people receive a message tailored to water dimensions they find important but with which they are unsatisfied, they are more likely to adopt a best practice that could remedy the gap.

Our findings align with those of Robinson (2013) and Kronrod et al. (2012) that designing scientific information messages based on their relevancy and importance to target audiences can promote higher engagement in using the information to make necessary changes. There is a need to engage clientele by appealing to dimensions of water with which there is a satisfaction-importance gap (Levenburg & Magal, 2004; Warner et al., 2017). This study provided evidence that good landscape management behaviors can be promoted by using print media to promote a reduction in the satisfaction-importance gap among target audiences. Agricultural education clientele may have more motivation to act when there is a potential to reduce this gap (Festinger, 1957; Larson et al., 2009).

The use of satisfaction-importance gaps in this study (considering joint importance of and satisfaction with an issue) can help to focus agricultural educational programs and guide Extension programming and communications (Warner et al., 2017; Warner, Kumar Chaudhary, et al., 2016). Agriculture education professionals should explore possible satisfaction-importance gaps surrounding specific dimensions among clientele and conduct targeted communications with their audiences to promote behaviors that reduce impact on water resources. We also recommend that agricultural education professionals consider conducting satisfaction-importance gap analysis as an additional step or as a part of their needs assessment prior to designing educational programs to promote positive behavior changes, such as adopting conservative landscape water-use behaviors.
This study employed print-based messages, and because videos may be more effective, future research should examine the effect of short video messages, along with a combination of tailored print and video messages, on irrigation and fertilization intent (Perrin, 2011). Future research should also be conducted in an authentic agricultural education environment with repeated exposures. Our study examined the relationship between satisfaction-importance gaps and response to a targeted message, and a future replication of this study should also consider perceived responsibility as a variable. Future researchers can also consider exploring whether the relative strength of a target audience’s satisfaction and importance relates to their landscape water protection behaviors.

References


A Capstone Experience: Impacts of a Behavioral Style Learning Unit on Soft Skill Development and Team Dynamics

M’Randa R. Sandlin¹, Melissa R. Price² & Kauahi Perez³

Abstract

The integration of hard and soft skills has become increasingly important to employers. Colleges of agriculture and natural sciences can facilitate the development of these skills in their students. The purpose of this study was to explore impacts of a behavioral style learning unit on soft skill development with 15 students enrolled in a senior-level undergraduate capstone course. The research objectives were to (a) explore students’ preflections and reflections for indications of soft skill development, (b) explore team dynamics, and (c) identify best practices for integrating a behavioral style learning unit into a capstone course. Qualitative content analysis methods and basic quantitative methods were used to examine the preflections and reflections of the students. Students found the behavioral assessment improved understanding of their own behavioral needs, and allowed them to flex their style to meet the needs of team members. Relationship compatibility, based on behavioral styles within teams, correlated with the ability of team members to accurately perceive their contributions to tasks, relative to peer-based perceptions of contributions. Based on these results, it is recommended that a behavioral style learning unit, or a similar psychological type unit, be integrated into courses where soft skills are a desired student learning outcome.

Keywords: behavioral style; soft skills; capstone course; team dynamics; team project

Introduction

Now more than ever, employers are searching for applicants who possess soft skills—sometimes called 21st century, interpersonal, or transferable skills (Bennett, 2002; Jones, 1996; National Research Council, 2012)—in addition to technical competencies. These 21st century skills include critical thinking, problem solving, teamwork, collaboration, effective communication, and self-management (Crawford, Lang, Fink, Dalton, & Fielitz, 2011; Jones, 1996; Roberts, Harder, & Brashears, 2016). Soft-skill competencies once expected of seasoned employees are now the expected norm of graduates when they enter the workforce (Clem, Doerfert, Akers, Burris, & Brigham, 2014; Connaughton, 2015; Crawford et al., 2011; Hart Research Associates, 2015), yet employers believe the interpersonal skills of current graduates are poorer than in previous generations (Bennett, 2002).

1 M’Randa R. Sandlin is an Assistant Researcher of Public Issues Education in the Department of Tropical Plant and Soil Sciences at the University of Hawai‘i at Mānoa, 3190 Maile Way, St. John 102, Honolulu, HI 96822, msandlin@hawaii.edu
2 Melissa R. Price is an Assistant Professor of Wildlife Management in the Department of Natural Resources and Environmental Management at the University of Hawai‘i at Mānoa, 1910 East-West Road, Sherman 118, Honolulu, HI 96822, pricemel@hawaii.edu
3 Kauahi Perez is a Doctoral Candidate in the Department of Tropical Plant and Soil Sciences at the University of Hawai‘i at Mānoa, 3190 Maile Way, St. John 102, Honolulu, HI 96822, bronsonp@hawaii.edu
Despite the importance of effective collaboration to professional advancement, many natural science degree programs (i.e., hard sciences or technical sciences) lack learning units aimed at soft skill development (Sample, Bixler, McDonough, Bullard, & Snieckus, 2015; Scanlon, Bruening, & Cordero, 1996). Crawford et al. (2011) identified seven soft skills clusters—including teamwork and communication skills—deemed important for recent graduates to be successfully competitive for employment in agriculture, natural resources, and related careers. These same soft skill competencies were again identified in 2015 as critical for successful employment in natural resource management (Sample et al., 2015), as employability skills for graduates of a college of agriculture (Robinson & Garton, 2008), and as important training requirements for in-service agriculture teachers (Davis & Jayaratne, 2015). Thus, 21st century students must be equipped with these competencies upon graduation if they expect to be competitive in the workforce (Bennett, 2002; Connaughton, 2015; Dunne & Rawlins, 2000).

Instructors in colleges of agriculture and natural resources can facilitate the development of soft skills in their students by incorporating them into existing learning experiences, including field experiences, in-service training, study abroad, and service learning (Bennett, 2002; Lamm, Carter, & Melendez, 2014; Mars, 2015; McCubbins, Paulsen, & Anderson, 2016). Team-based projects are one of the most common educational experiences (Dunne & Rawlins, 2000; Herreid, 1998; McCubbins et al., 2016; National Research Council, 2012; Perry, Paulsen, & Retallick, 2015) and may facilitate students’ understanding of interpersonal communication, self-management, teamwork, and collaboration skills (Dunne & Rawlins, 2000; Lamm et al., 2014; Mars, 2015; McCubbins et al., 2016).

When team-based projects are utilized as an instructional method, instructors and students benefit from an awareness of team composition and the behavioral or psychological types of each team member. Research on psychological type and team composition has shown that, while personality cannot predict team effectiveness or performance, it is an influencing factor (Varvel, Adams, Pridie, & Ulloa, 2004). Further, these authors found that students’ awareness of their team members’ psychological type allowed for “effective communication, trust, and interdependency” (p. 146) and students were able to better tolerate types that were unlike their own. In terms of specific aspects of personality, a meta-analysis conducted by Peeters, van Tuijl, Rutte, and Reymen (2006) found that the presence of higher levels of agreeableness and conscientiousness in teams resulted in higher performance.

Behavioral style assessment, an assessment used to identify one’s observable behavior profile (i.e., whether a person exhibits high or low dominance, influence, steadiness, and compliance behaviors), is another tool that can enhance collaboration and teamwork, improve communications, and facilitate overall improvement in team performance (Bonnstetter & Suiter, 2011; McKenna, Shelton, & Darling, 2002). Information on team dynamics can also prove beneficial for instructors when managing teams, as “ineffective teams may be the product of inappropriate team composition” (Bradley & Hebert, 1997, p. 1).

Context of the Study

The Department of Natural Resources and Environmental Management (NREM) at the University of Hawai‘i at Mānoa teaches a natural science-based curriculum and is working to integrate social science components to produce holistically prepared graduates. Capstone courses require students to integrate and apply material from their discipline (Hauhart & Grahe, 2015) and offer learning experiences wherein social science components can be incorporated. The undergraduate capstone course, NREM 494, integrates a project to allow students to apply the
The students in NREM 494 self-selected teams based on topic interest, including wastewater mitigation, food waste reduction, management of marine wildlife-human conflicts, management of an invasive pest species, and sea level rise adaptation for a coastal city. The teams identified a project mentor at the city, county, state, or federal management level, and defined a problem of interest that was under the jurisdiction of the mentor. The students framed their projects using the structured decision-making process, as described by Conroy and Peterson (2013). Through this process, students were to engage decision makers and stakeholders, work with stakeholders to identify fundamental objectives and potential solutions, gather available information from peer-reviewed literature and subject experts to weigh potential solutions, and identify an optimal solution for the set of defined objectives (Conroy & Peterson, 2013).

A behavioral style learning unit was included in the curriculum of NREM 494 to support social content integration and facilitate soft skill development and team dynamics. In this unit students took the DISC Behavioral Style Assessment (DISC), participated in a lecture with a certified DISC practitioner who interpreted the individual results and integrated lessons for teamwork and general interpersonal interaction, and provided written responses to prelection and reflection prompts regarding integration of behavioral style knowledge into the capstone course. The behavioral style learning unit was incorporated to help students (a) understand personal motivations, strengths, and areas where growth was needed; (b) recognize and avoid the potential for negative interactions among student team members; and (c) increase students’ abilities to understand others’ behavioral styles and flex (i.e., temporarily alter) their own behavioral styles to create effective working relationships with team members and decision makers.

Although this study is a content analysis of the student prelections and reflections, we believe it is important for the reader to have a basic understanding of the DISC model and instrument. The DISC model is often used to improve team dynamics and understand communication styles in team situations (Bonnstetter & Suiter, 2011). The DISC model categorizes how people behave into the four dimensions of Dominance (D); Influence (I); Steadiness (S); and Compliance (C) for how one behaves naturally (Natural) and how one behaves in a particular setting, for instance, at work (Adaptive). The students were asked to focus on their adaptive style during the prelection and reflection. The dimensions are on a continuum from low to high expression of each dimension’s characteristics. Individuals are a combination of all four dimensions; a person’s dimension combination results in a unique behavioral pattern, also called the behavioral profile (Bonnstetter & Suiter, 2011). The letters are listed in descending order of a person’s behavioral dimension scores. It should be noted that although individuals may have the same behavioral profiles (order of letters), each profile is unique in terms of expression level in each of the dimensions, as well as characteristics not measured by this instrument (e.g., personality, culture, environmental conditions, life events, etc.).

The DISC instrument is validated and published by Target Training International, Ltd. (TTI). The online instrument is comprised of 24 items. Each item presents respondents with four behavioral phrases and asks them to rank the behavior from 1 = Most like you to 4 = Least like you. Upon completion, a personalized computer-generated report is sent to a certified DISC practitioner for review. This allows the practitioner to check for any abnormalities and/or errors before distributing the profiles to the participants in a workshop setting. A database of 16,950 responses was used to run the reliability and validity statistics (TTI, 2012). The internal reliability was found to be good for each of the four scales: Adaptive D ($\alpha = .89$); Adaptive I ($\alpha = .85$); Adaptive S ($\alpha = \ldots$)
Content validity, criterion-related validity, and construct validity tests were used to establish instrument validity (TTI, 2012).

Theoretical Framework

The framework for this study was Kolb’s theory of experiential learning (Kolb, 1984) with the addition of preflection (Jones & Bjelland, 2004). Experiential learning, the process of learning through structured and/or unstructured experiences, facilitates concept internalization, application, and concept use in future situations (Dewey, 1938; Kolb, 1984). Preflection, as defined by Jones and Bjelland (2004), is the “process of being consciously aware of the expectations associated with the learning experience” (p. 963). Facilitated preflection primes students to learn from their experiences, and thus increases their capacity to reflect upon their experience. Consequently, this enhances students’ overall learning experience. When used as a starting point in Kolb’s theory of experiential learning, preflection enables students to “reflect upon concrete learning experiences in a greater degree than will those students who receive no preflective facilitation” (Jones & Bjelland, 2004, p. 963).

When applied to this study, facilitated preflection allowed students to be cognizant of the expectations regarding the application of their behavioral profiles in the context of their capstone projects. The students were then guided through their capstone project with the stages of Kolb’s theory of experiential learning (Kolb, 1984). Students implemented their capstone project (concrete experience) and reflected on their project experiences (reflective observation), learned from their experiences (abstract conceptualization), and conceptualized the learned information for future interactions (active experimentation). These principles also align with andragogical learning, as adults prefer to learn information that is relevant to their situation and prefer to learn through hands-on activities (Knowles, Holton, & Swanson, 2011).

Purpose and Objectives

The purpose of this study was to explore impacts of a behavioral style learning unit on soft skill development in a team project. The research objectives that guided this study were to (a) explore students’ preflections and reflections for indications of soft skill development through the inclusion of a behavioral style learning unit in a capstone course and project, (b) explore team dynamics in the capstone project, and (c) identify best practices for integrating a behavioral style learning unit into a capstone course.

According to the 2016-2020 American Association for Agricultural Education’s National Research Agenda, Research Priority 3 aims to develop a sufficient scientific and professional workforce that addresses the challenges of the 21st century, and Research Priority 4 is concerned with meaningful, engaged learning in all environments (Roberts et al., 2016). Our study aligns with these two priorities by examining needed competencies for an agriculture and natural resource workforce; testing effective methods, models, and programs in preparing people to work in a global agriculture and natural resource workforce; and identifying how we can make team-based learning more relevant and contemporary in agriculture and natural resources.

Methods

In this mixed-methods study, qualitative content analysis methods were used to examine the preflections and reflections of the study participants. Participants were purposefully selected (Merriam, 2009) based on their enrollment in NREM 494. These students were in their last semester in the NREM Department. All 15 students who were enrolled in the course gave consent to analyze...
their responses. Names were redacted from the documents and coded (S1-S15) to ensure confidentiality. Since the preflection and reflection prompts were given as course assignments, consent was obtained during the last class period, after all assignments were submitted, so as not to influence their responses. There were two researchers, including the course instructor and the DISC practitioner, who is a faculty member in a different department in the college that provided an impartial perspective of the students’ responses.

Each student completed a DISC Behavioral Style Assessment in the first week of the course. Table 1 shows the behavioral profiles for each student in the context of their self-selected teams.

Table 1

*Team Assignments and Team Member Behavioral Profiles*

<table>
<thead>
<tr>
<th>Team</th>
<th>Behavioral Profile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Team 1</td>
<td></td>
</tr>
<tr>
<td>S1</td>
<td>ISCD</td>
</tr>
<tr>
<td>S5</td>
<td>CSDI</td>
</tr>
<tr>
<td>S6</td>
<td>DICS</td>
</tr>
<tr>
<td>Team 2</td>
<td></td>
</tr>
<tr>
<td>S2</td>
<td>SICD</td>
</tr>
<tr>
<td>S4</td>
<td>CISD</td>
</tr>
<tr>
<td>S8</td>
<td>CSID</td>
</tr>
<tr>
<td>S11</td>
<td>SCDI</td>
</tr>
<tr>
<td>Team 3</td>
<td></td>
</tr>
<tr>
<td>S10</td>
<td>CSDI</td>
</tr>
<tr>
<td>S13</td>
<td>SICD</td>
</tr>
<tr>
<td>S15</td>
<td>IDSC</td>
</tr>
<tr>
<td>Team 4</td>
<td></td>
</tr>
<tr>
<td>S7</td>
<td>CSID</td>
</tr>
<tr>
<td>S9</td>
<td>CSID</td>
</tr>
<tr>
<td>S12</td>
<td>ISDC</td>
</tr>
<tr>
<td>Team 5</td>
<td></td>
</tr>
<tr>
<td>S3</td>
<td>ISCD</td>
</tr>
<tr>
<td>S14</td>
<td>ISCD</td>
</tr>
</tbody>
</table>

Students then participated in a lecture that interpreted their results and presented information as to how behavioral styles interact with one another to create team dynamics. After the lecture, students preflected on the potential impacts of their behavioral styles on team project success by responding to four prompts. The prompts asked students to describe their behavioral style and their personal reaction to the results, describe how they could potentially use the
information from their profile and the lecture in their project, consider how their behavioral style
could contribute to the success of the project, and consider how they may need to flex their style to
promote project success. After the preflection was completed, there was no further incorporation
of the behavioral style learning unit content into the course until the reflection at the end of the
semester.

After completing the team project, students reflected on their experience by responding to
give prompts. The prompts guided students to reflect on how the information from their behavioral
profiles and the lecture was used during their projects; describe which aspects of their profile were
most useful in their team efforts; if they had to flex their style, describe how they did so and why;
project how information from the behavioral style learning unit could be applied in a future career;
and provide recommendations for the use of the behavioral style learning unit in future iterations
of NREM 494. As previously indicated, because the prompts were course assignments, consent
was obtained during the last class period, after all assignments were submitted, so as not to
influence their responses. The University of Hawai‘i at Mānoa IRB approved this study.

The data were analyzed for indications of soft skill development by categorizing student
responses (Glaser & Strauss, 1967; Merriam, 2009). Lincoln and Guba’s (1985) standards of
trustworthiness were used to establish rigor. Trustworthiness was upheld through credibility,
transferability, dependability, and confirmability. Credibility was established through triangulation
of the data between sources and by incorporating participant quotes (Lincoln & Guba, 1985),
transferability was established by using a purposive sample (Dooley, 2007) and thick description
(Geertz, 1973), and a dependability audit and a reflexive journal were used to ensure dependability
and confirmability (Lincoln & Guba, 1985).

Team Dynamic Analysis

At the end of the course, we conducted an analysis of the students’ peer evaluations in
comparison with behavioral style compatibility information found in the DISC training materials
(Leadership Resources and Consulting, n.d.). For the peer evaluations, students had to distribute a
total of 100 points among all of the members of their team based on how they perceived each
member contributed to the team. Calculations were then conducted to identify the difference
between each student’s self-score and the average of their peer’s scores of their performance.
Negative values indicated that individuals overestimated their own contribution to team tasks when
compared to the perception of the rest of the team, positive values indicated that individuals
underestimated their own contribution relative to the perception of the rest of the team, and a zero
indicated that individuals scored their contribution equally to the perception of the rest of the team.

The behavioral style compatibility materials (Leadership Resources and Consulting, n.d.)
show the anticipated work relationships between two individuals based on their primary behavioral
style. The relationships are categorized as Great Relationship, Requires Effort, or Requires Work.
For example, an S - C pairing is anticipated to have a Great Relationship while an I - I pairing is
anticipated to Require Work. We identified the anticipated style compatibility pairings in each team
(see Table 2).
Table 2

Anticipated Working Relationships Between Team Members of Each Team

<table>
<thead>
<tr>
<th>Teams</th>
<th>Great Relationship</th>
<th>Requires Effort</th>
<th>Requires Work</th>
</tr>
</thead>
<tbody>
<tr>
<td>Team 1</td>
<td>XXX</td>
<td>XXX</td>
<td>XXX</td>
</tr>
<tr>
<td>Team 2</td>
<td>XXXX</td>
<td>XXX</td>
<td>XXX</td>
</tr>
<tr>
<td>Team 3</td>
<td>XX</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Team 4</td>
<td>X</td>
<td>XX</td>
<td></td>
</tr>
<tr>
<td>Team 5</td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

The peer evaluation scores in combination with the anticipated working relationships in each team were used to draw conclusions about team dynamics.

Findings

Soft Skill Development

Students’ preflections and reflections were explored for indications of soft skill development. In preflection, the students were found to be generally self-aware of their soft skills (S1-S15). It reinforced (S1, S3, S5, S11, S13) or put into words (S2, S8) what they already knew about themselves and provided students with the language to describe their soft skill abilities. For example, Student S2 stated, “It was insightful to see all of the words that the assessment used, because it is sometimes hard to find the right words to describe yourself.” To this same point, there were some instances of disagreement with the DISC assessment. Student S1 disagreed with the assessment of her ability to be organized and students S2 and S12 disagreed with the assessment’s description of their communication abilities. “According to the assessment…there is a likely chance that I would chat rather than get work done. However, I like to believe that I have a little bit more self-control than that” (S12).

Students were also able to identify areas for development in their soft skills. Areas of improvement were in reference to how they receive/react to feedback (S3, S5, S15); their potential display of emotions (S1, S5, S6); or their confidence (S12), or lack, thereof. “The hardest thing for me to read was essentially that I am a doormat…. I don’t like making people upset or causing unpleasant situations” (S12).

In terms of the team project, the students preflected that they would use their soft skills to create a conducive environment by leveraging and/or accommodating each member’s skill set (S4-S5, S7, S9, S13-S15). Student S15 stated, “With my ability to motivate and inspire urgency, I hope to encourage my team to make consistent and meaningful progress, while also having fun along the way.” Student S14 indicated, “The positivity I bring can keep the mood up when things aren’t exactly going our way and no dream is too big for us to try and achieve.”
Other comments were about improving communication and interaction with their team and with their project stakeholders. For example, knowing about behavioral styles will “give me insight to knowing how to communicate better with [my team members] in order to make better more efficient use of our time and resources” (S13). Students S4, S9, and S15 also wrote that understanding their behaviors and being able to read the behaviors of others would help in their stakeholder interactions. “It will help when reaching out to prospective decision makers to be able to relate to them to form a good professional relationship” (S9). Student S15 wrote, “In facilitating stakeholder discussion, I will be careful not to manipulate the conversation.”

Reflectively, the students found that the combination of the behavioral style learning unit and the capstone project gave them an opportunity to purposefully practice their soft skills. Students were able to identify how their behavioral characteristics contributed to the capstone project processes (S1-S15), and found the DISC assessment helped them to understand their own behavioral needs (S1-S15) and flex their style to meet the needs of their team members (S2-S3, S8-S9, S11, S15) as they engaged in their projects. The students found that they were more aware of team dynamics (S1-S15) and therefore able to recognize areas to improve project efficiencies (S8, S10) and to create an environment conducive to project success through improved communications with their teammates and stakeholders (S1-S15). Student S10 wrote, “It helped me prepare and adapt to potential situations” (S10), and student S4 wrote, “Compared to the beginning of the semester… I now know how to actually use [behavior-specific] methods of communications. I learned and applied [the taught] communication skills.” Similarly, the students were able to recognize behavioral styles and cues in their teammates and stakeholders (S1, S2, S4, S5, S9, S10, S13, S14) and adjust their message and/or flex their behavioral style to achieve desired outcomes and positively impact work efficiency (S1, S4, S5, S6, S11, S13-S15). “By strategically using the information from the assessment, I was able to meet certain demands in my personal and work environment for the project” (S4). Student S9 wrote the following.

I was able to analyze [teammates’ and stakeholders’] behavior to understand how to communicate effectively with them. It also helped me to figure out my role in the group and where I could play up my strengths if one of my group members was lacking in that area. (S9)

In reflection, the students also identified areas where they could use further improvement. Students S3, S5, and S12 found that the combination of the behavioral style learning unit and the capstone project helped them realize they need more development in their communication skills. Student S12 wrote, “During this project I learned that I am definitely a poor listener (I didn’t believe the DISC assessment at the beginning of the semester).” Student S7 and S12 realized they need more opportunities and training to develop their team member motivation skills.

Team Dynamics

For the second research objective, team dynamics were explored relative to the peer evaluation scores and the anticipated working relationships of the team members predicted by DISC training materials (see Table 2). Teams in which a majority of the relationship pairings were predicted to be in the Great Working Relationships category (Team 2 and Team 3) had individuals that perceived their contributions to team tasks similarly to other team members in the peer evaluation, with differences in perceived contribution ranging from -3 to 6 points. Teams in which a majority of relationships were predicted to be in the Requires Effort category (Team 1 and Team 4) consistently overestimated their own contributions to team tasks compared with other team members’ perceptions in the peer evaluation, with differences in perceived contribution ranging.
from -2 to -15 points. Team 5 was excluded from this set of analyses as there were two team members and one student did not return the peer evaluation.

**Best Practices**

The third research objective aimed to identify best practices for incorporating a behavioral style learning unit to facilitate students’ soft skill development. While the students in this study suggested that other students engage in a similar learning experience (S1-S15), they did identify areas of improvement when incorporating a behavioral style learning unit. They suggested that the experience be offered earlier in students’ academic careers (S8, S15) to allow more time to “refine my strengths and better my weaknesses before entering the professional work environment” (S8). In terms of process and structure, they wrote that the interpretation lecture given by the DISC practitioner should resemble a workshop with a teamwork focus (S9) and focus on how to deal with behavioral gaps in teams (S5). Lessons from the behavioral style learning unit should also be incorporated and referenced throughout the semester (S1, S12, S13, S15).

For future instructors, I would advise having an assignment in between the first reflection and the last, asking the students to identify as best they can the behavioral profile of their stakeholders. Or at least some sort of assignment to keep the students thinking about the DISC assessment throughout the course of the project. (S13)

The students suggested the course instructor also take the DISC assessment and share his/her experiences in relation to his/her profile so students can understand how DISC is relevant to someone they know in the professional world (S10, S15). Student S4 suggested that instructors use the knowledge of their own DISC profile and the profiles of their students to improve teaching, learning, and general communication in the classroom.

In addition to best practices, the students identified disadvantages of incorporating a behavioral style learning unit into a capstone course. The most frequently mentioned disadvantages had to do with self-analyzing. Students wrote that knowing your behavioral style makes you aware of your weaknesses, and this can lead to using them as a crutch (S1, S7). “If we knew we were not strong in a certain area, we would almost use that ‘weakness’ as an excuse...instead of working on the areas [of the project] that we needed to work on” (S7). Being aware of their weaknesses could also contribute to negative self-analyzing (S12) and lead to altering a personal characteristic that does not need to be changed (S3, S11).

The drawback to knowing my [profile] from the DISC assessment was constant self-analyzing and being petrified that my behavior was coming off badly on other people. At first, I was just worried about in person interactions, but then I started worrying that my email interactions were too dominant or that my fear of conflict was showing to all the professionals I emailed. (S12)

Students S3, S7, S8, S10, and S14 reflected that the DISC behavioral style profile summary should be “taken with a grain of salt” (S8), noting that the document is a summary, not a rulebook. When referencing their team and stakeholder interactions, students realized that they could incorrectly read people (S9, S14) and that they could use behavioral style as an expectation of team role (S6) instead of a pattern of behavioral norm.

Overall, the students (S1-S15) wrote that the experience and information prepared them to be more successful in a working environment. They indicated it would be a reference tool for...
understanding others (S9, S13, S15), improving collaboration skills (S7), and would help them better communicate to create a positive working environment (S3-S4, S6-S7, S13).

Conclusions, Implications, and Recommendations

The first objective was to explore students’ preflections and reflections for indications of soft skill development through the inclusion of a behavioral style learning unit in a capstone course and project. Soft skills, including teamwork, collaboration, effective communication, and problem solving (Crawford et al., 2011; Jones, 1996; Roberts et al., 2016), are an expected skill set of graduates (Clem et al., 2014; Connaughton, 2015; Crawford et al., 2011; Hart Research Associates, 2015) upon entering the agriculture and natural resource workforce (Crawford et al., 2011; Sample et al., 2015). Based on the findings of this study, it can be concluded that the inclusion of a behavioral style learning unit in a capstone course and project was an effective platform for teaching students soft skills. The team capstone project was a way to facilitate the development of soft skills (Dunne & Rawlins, 2000; Lamm et al., 2014; Mars, 2015; McCubbins et al., 2016) by giving students a venue to purposefully experiment with them and experience successes, failures, and problem solving in a relevant situation (Knowles et al., 2011; Kolb, 1984).

More specifically, the behavioral style learning unit impacted team and stakeholder communications and general teamwork in the capstone projects in NREM 494. Davis and Jayaratne (2015) and Robinson and Garton (2008) identified that students in agriculture and natural resources need training for communication skills. In accordance with the findings of previous studies using similar psychological and behavioral assessments (Bonnstetter & Suiter, 2011; McKenna et al., 2002; Peeters et al., 2006; Varvel et al., 2004), the students in this study reported improved team and stakeholder communication and provided evidence of team member consideration and/or accommodation as a result of their contact with the information from the behavioral style learning unit. There were three points of contact with the information: (a) the lecture; (b) the preflection; and (c) the reflection. As an extension of recommendations made by the students, we recommend increased points of contact with the information from the behavioral style learning unit throughout the learning experience.

It should be pointed out that, while few, some students found some aspects of their behavioral profiles difficult to read. A behavioral style profile belongs to the individual who completed the assessment and, therefore, their sharing the information is a voluntary decision. We recommend that instructors who incorporate this or a similar assessment into a team project situation make clear the students’ ability to withhold or share information. The lesson should also be structured so students do not feel pressured to share if they do not wish to do so.

The second objective was to explore team dynamics based on peer evaluation scores and the behavioral styles of team members. Previous studies found that teams comprised of diverse psychological types were more effective (Neuman, Wagner, & Christiansen, 1999; Peeters et al., 2006). In accordance with the DISC behavioral style compatibility information (Leadership Resources and Consulting, n.d.) and the findings of this study, it can be concluded that team dynamics can also be related to team member behavioral style compatibility. Teams that had a majority of their members’ relationship pairings in the Great Working Relationships category had accurate self-perceptions of their project contributions. Teams with a majority of relationship pairings in the Requires Effort category all overestimated their contribution in relation to their peers’ perceptions of their contributions; this may be an indication of dysfunctional team communication and a lack of clear team member expectations. DISC is an ideal tool to help team members communicate and collaborate efficiently (Bonnstetter & Suiter, 2011; McKenna et al., 2002); therefore, we recommend that team members use DISC to create a team performance plan.
This plan should identify how the team will communicate with each other and their stakeholders, role/involvement expectations, etc. We also recommend that instructors use DISC for team management. Instructors can use DISC to help teams identify their performance issues and inform their solution strategy.

The third objective was to identify best practices for integrating a behavioral style learning unit into a capstone course. Based on the findings, it is recommended that a behavioral style learning unit, or a similar psychological type unit, be integrated into courses where a group-based project is the learning method and the development of soft skills is a desired student learning outcome. Similar to the findings of Varvel et al. (2004) and Peeters et al. (2006), this study finds that, while behavioral style does not necessarily predict team effectiveness, it does foster the development of soft skills. In terms of process, it is recommended that, after the initial lecture, the content be threaded throughout the course. While Jones and Bjelland (2004) encourage prereflection before an experience and Kolb (1984) places reflection after the experience in the theory of experiential learning, the students in this study suggested that periodic reflection points on the behavioral style learning unit throughout the semester would be beneficial to keep the information current in their minds. Similarly, we recommend that instructors relate the content from the behavioral style learning unit to team-specific situations throughout the learning experience because team dynamics contribute to the desire to learn, peer motivation, critical thinking, and communication (McCubbins et al., 2016).

Employers from various fields seek to hire employees with hard and soft skills. Sample et al. (2015) and Scanlon et al. (1996) identified that natural science degree programs, including fields of study associated with agriculture and natural resources, lack learning units to develop students’ soft skills. In response to this identified deficit and the overall findings of this study, we recommend that instructors in natural science degree programs investigate their curriculum to identify where a similar behavioral style learning unit could be incorporated to develop students’ employability skills upon graduation. This study demonstrates successes and provides suggestions to address the need for students in the natural sciences to gain experience in developing soft skills through the deliberate incorporation of a behavioral style learning unit in a capstone course.

References


of forestry employers, graduates, and educators. *Journal of Forestry, 113*(6), 528-537. doi:http://dx.doi.org/10.5849/jof.14-122


Measuring Optimal Experiences of CANR Undergraduates in a Leadership Course

Michael W. Everett1 & Matt R. Raven2

Abstract

Many universities integrate leadership as a core component of agricultural education. Interestingly, little research has been conducted on the impact of leadership courses comparing the perceived leadership skills and abilities of students with and without prior leadership experience. Socio-psychological measures of flow or optimal experience during an undergraduate leadership course were used to compare and contrast sample groups within course teaching techniques. Flow theory was used to compare and contrast: 1) Student demographics in an undergraduate leadership course; 2) students with various leadership experiences; and 3) optimal experiences and leadership experiences using different teaching techniques. Results indicated that overall, students within an undergraduate leadership course are more likely to have optimal experiences during experiential learning activities and reflecting on learning. Similar results exist with undergraduate leadership students having prior leadership experience (non-FFA) and FFA experience. This research suggests that utilizing experiential learning activities in classroom learning and reflecting on those experiences may have the highest potential for producing optimal experiences in the context of undergraduate leadership education. Finally, using the experience sampling method to compare and contrast prior leadership, optimal experiences, and teaching approaches has merit and expands the suite of instruments available to understand undergraduate leadership experiences and learning.

Keywords: optimal experience; leadership; experiential learning; reflection; flow theory

Introduction

Leadership is a highly sought-after and valued commodity in today’s ever-changing society (Northouse, 2016). University agricultural education faculty have recognized this and as a result, leadership courses and programs are an important component in university curricula across the United States (Birkenholz & Schumacher, 1994; Schumacher & Swan, 1993; Velez, McKim, Moore, & Stephens, 2015). Shifting leadership education from working with youth to developing leadership potential provides the impetus for educating undergraduate and graduate students on empowerment of community members to effect positive change (Velez et al., 2015). The National Research Council (2009) has issued a call for post-secondary agricultural curricula and teaching to utilize dynamic approaches to learning for post-secondary students. Approaches suggested by the National Research Council (2009) should leverage experiences that provide students with “real-world” interpretation of ideas, concepts, and skills that will in turn create learners and leaders who are successful in their future careers. It is important that faculty responsible for leadership courses and programs understand how future leaders learn (Everett & Raven, 2015). Further, it is important to understand optimal learning conditions for undergraduates to develop needed leadership skills and apply those skills to transfer to real-world application (Everett & Raven, 2015). Flow theory,

1 Michael W. Everett is an Academic Specialist in the Department of Community Sustainability at Michigan State University, 480 Wilson Road Room 140, East Lansing, MI 48824, everettm@msu.edu.
2 Matt R. Raven is a Professor in the Department of Community Sustainability at Michigan State University, 480 Wilson Road Room 310A, East Lansing, MI 48824, mraven@msu.edu
as a socio-psychological approach, has the potential to leverage “real-world” concepts in the context of teaching and learning.

Leadership is a valued commodity within FFA and 4-H, providing a medium that fosters growth during a young person’s (ages 9 to 18) formidable years (Parks & Dyer, 2005). Parks and Dyer (2005) suggest that individuals who have previous leadership experiences are more likely to participate in leadership roles at the collegiate level than their counterpart non-FFA and non-4-H peers. Although participation in organizations at the collegiate level is important (Connors, Velez, & Swan, 2006), research by Schumacher and Swan (1993) suggest that undergraduate classroom learning of leadership provides a forum for the development of efficient and effective leaders.

Conversely, Rosch and Coers (2013) suggest that even though students with prior leadership experiences continue to participate at the collegiate level, these same students do not exhibit similar leadership outcome gains during their college leadership experiences. Students with prior FFA and 4-H experiences were less likely to participate in leadership training events on campus than their peer counterparts (Rosch & Coers, 2013). Rosch and Coers (2013) suggest that increasing cognitive complexity of activities and leadership capacity through incorporation of social issues-based cases studies into classroom learning may encourage differing viewpoints and engagement in learning.

Undergraduate students need to have an understanding of the important traits of a leader (Ricketts, Bruce, & Ewing, 2008), however transference of knowledge through experiential learning teaching techniques provide a medium for learners to acquire knowledge that reinforces processes related to hands-on application (Brown & Terry, 2013; Mazurkewicz, Harder, & Roberts, 2012). Kolb (1984) suggests that student academic success is directly related to learning environments that match a student’s personal learning style to the activity. Hooker and Csikszentmihalyi (2003), suggest that interaction among students and peers is a critical component for group activities that lead to experiences. Further, if a leader is necessary for the activity to occur, positive experiences most likely occur when the leader treats the group as a team (Hooker & Csikszentmihalyi, 2003).

Engagement in an activity (Shernoff, Csikszentmihalyi, Schneider, & Shernoff, 2003) and intrinsic motivation to participate in the activity (Csikszentmihalyi & Csikszentmihalyi, 1988) are important fundamental aspects related to optimal conditions for learning (Vygotsky, 1978). Engagement of students through experience (Kolb, 1984; Kolb & Kolb, 2005), and an individual’s desire to learn from an intrinsic perspective provide an accumulation of organizational experiences critical to the formation of perceptions about what makes a leader (Kouzes & Posner, 2002). Further, a critical part of the experiential learning cycle is the reflective process associated with experiential learning (Kolb, 1984). Roberts (2008) suggests that the value of reflective capacity in learning is critical to meeting challenges and creating “reflective leaders” at the undergraduate level. Varying teaching styles and utilization of dynamic approaches in leadership education curricula may provide an opportunity for students to create and reflect upon optimal experiences through differing levels of engagement in learning.

**Theoretical Foundation**

**Flow Theory**

From a teaching and learning perspective, Vygotsky (1978) operationalized flow or the optimal experience in the context of learning in terms of the **zone of proximal development**. In Vygotsky’s (1978) definition, the **zone of proximal development** was characterized by providing...
students with a task that challenges an individual while falling just beyond an individual’s skill level in that activity (Csikszentmihalyi & Csikszentmihalyi, 1988; Massimini & Carli, 1988) (see Figure 1). The four-channel model of flow is generally based on Vygotsky’s zone of proximal development by the following assumptions framed within Csikszentmihalyi’s flow theory (1975) including: a) Control of the experience; b) attention during the experience; c) curiosity about the experience; and d) an intrinsic interest to perform the experience.

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

Flow or optimal experience research has often been cited in the context of physical activities such as hiking (Wöran & Arnberger, 2012), mountain climbing (Bassi & Delle Fave, 2004; Csikszentmihalyi, 1975), hunting (Everett & Gore, 2015), and kayaking and rafting (Jones et al., 2000). Additionally, flow has been applied to the context of secondary (Bassi & Delle Fave, 2004; Shernoff et al., 2003) and post-secondary education (Asakawa, 2010; Asakawa, 2004; Everett & Raven, 2015, 2016; Rogatko, 2009). However, little attention has been given to the utilization of flow theory with respect to leadership in an undergraduate education classroom context.

Shernoff et al. (2003) defined flow theory as a symbiotic relationship between challenges and skills to meet a particular task. For example, flow was used with college students (Asakawa, 2010; Asakawa, 2004; Everett & Raven, 2015, 2016; Rogatko, 2009) and high school students (Bassi & Delle Fave, 2004; Shernoff et al., 2003) to understand perceived enjoyment, interest, and
concentration levels of individuals during specific activities. According to Asakawa (2010), students who experienced flow on a regular basis were more likely to be actively engaged in the activity as well as having goals and expectations consistent with learning. Asakawa (2010) aimed to determine if college students’ flow experiences led to individuals that do things for their own sake or are intrinsically motivated in their tasks. Finally, research by Everett and Raven (2015) indicated that flow experiences in pre-service AFNRE students were directly related to motivation when pre-service undergraduates were instructing high school students in an FFA Career Development Event (CDE) activity. According to Senge (1990), learning and engagement is strongly associated with intrinsic motivation and interest. Engagement of learners provides opportunity for student-centered approaches to achieve success in individual and group work versus traditional aspects of learning while providing students with an appropriate level of challenge that meets a student’s skill level (Shernoff et al., 2003).

The Experience Sampling Method (ESM) is the methodological approach used to measure flow (Csikszentmihayli, 1975), intrinsic motivation (Csikszentmihalyi & Csikszentmihalyi, 1988), and engagement (Shernoff et al., 2003). ESM in itself is unique in that it utilizes survey questionnaire techniques with additional mixed-mode applications to measure flow, intrinsic motivation, and engagement (Hektner, Schmidt, & Csikszentmihalyi, 2007). According to Zirkel, Garcia, and Murphy (2015), ESM approaches are an enriching and innovative way to implement educational research by enabling the researcher to ask new and interesting questions about how students, teachers, and administrators engage with education while shaping learning and outcomes for success.

**Purpose and Research Questions**

The purpose of this study was to describe students’ optimal level of experience determined by flow theory during different teaching techniques in an undergraduate leadership course. The following research questions were used to guide this descriptive study:

1. What were the prior leadership experiences (no prior leadership experience, non-FFA leadership experience, and prior FFA leadership experience) of students in an undergraduate leadership course?
2. Were there differences in students’ optimal experiences between students with no prior leadership experience, prior leadership non-FFA experience, and prior FFA leadership experience?
3. Were there differences in students’ optimal experiences depending on what teaching technique was being used in an undergraduate leadership course?

**Methods**

**Population**

Data were collected at Michigan State University during the fall semester of 2014 in a leadership course provided by the Department of Community Sustainability in the College of Agriculture and Natural Resources. There were 29 undergraduates enrolled in the course and 28 (n = 28) students participated in the study, however students that were absent did not provide an Experience Sampling Form (ESF) on a given class. Over the course of the semester the ESF was provided to students during 14 different classes using teaching techniques ranging from guest speakers to experiential learning activities designed to reinforce theories of leadership. Where experiential learning techniques are defined as engaging students in activities that combine experience, perception, cognition, and behavioral aspects through process (Kolb, 1984; Kolb &
Kolb, 2005). Classes were selected to represent the range of teaching strategies used within the course. Treatment categories of teaching techniques were reviewed by two master teachers for validity. For this study, twenty-eight participants completed a total of 325 ESF’s ($n = 325$), which amounts to a response rate of 82.9% (14 classes x 28 students = 392 total potential responses). Five ESF’s included incomplete data for analysis. By comparison, Asakawa (2004) had a response rate of 73% for a sample of undergraduate students with the ESM. Thus, the response rate of the present study was deemed acceptable by the researchers. The Experience Sampling Form research instrument for this study was a modified paper-pencil version of the Experience Sampling Method (ESM) (Hektner et al., 2007). Previous research suggests that the ESM scale is a valid and reliable measure of optimal experience (Hektner et al., 2007). Scale reliability was conducted on the ESF items and yielded a Cronbach’s alpha of .71. Hektner et al. (2007) found that scale reliability of ESM instrument measures ranged from .70 to .94. The Michigan State University Institutional Review Board deemed this study exempt.

Data Collection and Sample

This study used event-contingent sampling (i.e., taken immediately following the teaching technique to be measured using the ESF) and a modified ESM to capture individuals’ representations of experiences as they occurred within the context of everyday life activities (Hektner et al., 2007). Participants were provided with instructions at the initial class session by the researcher prior to taking the first Experience Sampling Form (ESF) survey. At the initial class session, participants were provided with a consent form and ESF and asked to fill out the survey based on a specific event during class. The ESF was designed to elicit information related to participants’ demographics (age and gender), whether they had previous FFA experience, whether they held a leadership role in the FFA (e.g., chapter officer, committee chair, etc.), and questions related to flow theory as they were reflecting on the activity that they were being asked to provide information about (e.g., challenge, skill, interest, happiness, enjoyment, and concentration).

Respondents were asked to participate by filling out an ESF paper-pencil survey immediately following a specific teaching technique during the course. Classes were categorized into five specific teaching techniques. The teaching techniques included: a) Guest speakers; b) student led instruction; c) experiential activities; d) reflections on learning; and e) traditional assessment (see Table 1).
Table 1

Teaching Techniques, Example(s) of Technique, and Frequency of Measurement of Undergraduate Leadership Students During an Experience Sampling Method (ESM) Activity Fall Semester 2014 (n = 325 responses)

<table>
<thead>
<tr>
<th>Teaching Techniques</th>
<th>Example(s)</th>
<th># of Sessions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guest Speakers</td>
<td>Government official</td>
<td>2</td>
</tr>
<tr>
<td>Student Led Instruction</td>
<td>Student presentations about leadership content</td>
<td>4</td>
</tr>
<tr>
<td>Experiential Activities</td>
<td>Group activities, collaborative learning</td>
<td>4</td>
</tr>
<tr>
<td>Reflections on learning</td>
<td>Mind Map assignment after an activity</td>
<td>3</td>
</tr>
<tr>
<td>Traditional Assessment</td>
<td>Leadership Content Quiz</td>
<td>1</td>
</tr>
</tbody>
</table>

Guest speakers consisted of industry professionals providing leadership perspectives from their respective organizations. Student led instruction included presentations and observations by students throughout the semester. Students were asked to fill out the ESF based on their perceived challenge and skill when presenting or observing other students presenting. No distinction was made between a student filling out the ESF when presenting or observing. Experiential activities included group activities and collaborative learning including a Lego activity where students had to use managerial skills within specific job tasks to complete and build a Lego structure using communication and leadership skills; and a parliamentary procedure activity where students were grouped and asked to solve a problem using Robert’s Rules of Order. Examples of reflecting on learning included development of a mind map after an activity was completed in the course and reflecting on the course and course content. One class consisted of a traditional test in the form of a quiz where students were assessed over leadership course content (see Table 1).

Instrumentation and Variables

**Dependent Variable.** The dependent measure of flow was categorized into four-channels (anxiety, apathy, boredom, and flow) measuring the level of challenge and skill, as well as associated indicators of interest. Flow was measured by the quotient of challenge to skill levels perceived by respondents in the ESF surveys. Flow statements were adapted from previous instruments by Hektner et al. (2007). Responses for both challenge and skill survey items were based on a 5-point modified Likert scale ranging from *Not at all* to *Very much*. A 5-point modified Likert scale interval was utilized with this undergraduate sample as a way to simplify options for filling out the instrument (Hektner et al., 2007). Average challenge and skill levels among respondents were calculated as the intersection of the four constructs in determining whether flow was occurring and at what level (see Figure 1).

**Independent Variables.** There were two independent variables of interest for this analysis. The first independent variable was students’ previous leadership experience with the levels being FFA leadership experience, non-FFA leadership experience or no leadership experience. The other
independent variable was teaching techniques with five levels; guest speakers, student led instruction, experiential learning activities, reflections on learning and traditional assessment.

**Data Analysis**

Data were analyzed using the SPSS 24.0 statistical software package. Descriptive statistics were used to determine frequencies and percentages. Average challenge and skill measures were calculated for each student to determine channels for individual experiences (i.e., anxiety, apathy, boredom, and flow) as cited in Table 1 and within the four-channel model (Csikszentmihalyi & Csikszentmihalyi, 1988, Massimini & Carli, 1988) (see Figure 1). Students indicating instances in the anxiety or flow channel were considered to be having a more optimal experience than students indicating instances in the boredom or apathy channels.

**Findings**

The average age of respondents in this study was 22.5 (SD = 7.9) with five (18%) respondents (n = 28) having prior experience in leadership through the National FFA Organization, while 11 (39%) respondents indicated having another type of leadership experience other than FFA (e.g., 4-H, school-related leadership, and work-related leadership experiences). Three respondents did not report their age. Additionally, 21 (75%) respondents in this study were female with an average age of 22.6 (SD = 9.3), whereas the average age of males (f = 7) in the class was 20.9 (SD = 1.3). The average age of respondents with prior FFA experience was 19.8 (SD = 1.3), whereas the average age of students in the course with non-FFA leadership experience (f = 12) was 20.1 (SD = 1.9) and no prior leadership experience was 24.8 (SD = 11.4). Females made up four (80%) of the respondents with prior FFA experience, eight (73%) of the respondents with non-FFA leadership experience, and nine (75%) of the respondents with no leadership experience. Additionally, all students who indicated having prior FFA experience had leadership roles at their local regional, and/or state level (e.g., chapter officers, committee chairs, regional officers, state officers). Two female outliers contributed to the high standard deviation in age (36 & 59) for the class, female categories, and no prior leadership experience categories.

Data provided by the 28 respondents (n = 325 responses) and summarized in Table 2 indicated that most students with no prior leadership (78%) or prior FFA leadership (90%) had instances of either boredom or apathy during classes taught by guest speakers. Only one student that had FFA leadership experience and one student without leadership experience indicated flow during a class involving a guest speaker. However, six (29%) students with non-FFA leadership experience did indicate instances of flow during classes with guest speakers.
Table 2

Frequency of Flow Channel Experiences and Utilizing Guest Speakers for Classroom Instruction as Compared to Previous Leadership Experience of Undergraduate Leadership Students During an Experience Sampling Method (ESM) Study (n = 49)

<table>
<thead>
<tr>
<th>Previous leadership experience</th>
<th>Anxiety</th>
<th>Flow</th>
<th>Boredom</th>
<th>Apathy</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Leadership Experience</td>
<td>3 (16.7%)</td>
<td>1 (5.5%)</td>
<td>4 (22.2%)</td>
<td>10 (55.6%)</td>
<td>18 (36.7%)</td>
</tr>
<tr>
<td>Leadership Experience (non-FFA)</td>
<td>5 (23.8%)</td>
<td>6 (28.6%)</td>
<td>4 (19.0%)</td>
<td>6 (28.6%)</td>
<td>21 (42.9%)</td>
</tr>
<tr>
<td>Leadership Experience (FFA)</td>
<td>0 (0.0%)</td>
<td>1 (10.0%)</td>
<td>5 (50.0%)</td>
<td>4 (40.0%)</td>
<td>10 (20.4%)</td>
</tr>
<tr>
<td>Total Frequency</td>
<td>8 (16.3%)</td>
<td>8 (16.3%)</td>
<td>13 (26.6%)</td>
<td>20 (40.8%)</td>
<td>49 (100%)</td>
</tr>
</tbody>
</table>

Note. Data are from two class sessions, with seven missing observations.

Data presented in Table 3 showed that nearly two-thirds of students (55, 64.2%), regardless of their leadership experience, indicated instances of boredom or apathy when responding about classes using student led instruction. Students with no previous leadership experience (7, 18.9%) were slightly less likely to experience instances of flow during these classes than students with either non-FFA leadership (8, 20.0%), or prior FFA leadership experience (3, 20.0%) who indicated instances of flow.

Table 3

Frequency of Flow Channel Experiences and Student Led Instruction as Compared to Previous Leadership Experience of Undergraduate Leadership Students During an Experience Sampling Method (ESM) Study (n = 92)

<table>
<thead>
<tr>
<th>Previous leadership experience</th>
<th>Anxiety</th>
<th>Flow</th>
<th>Boredom</th>
<th>Apathy</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Leadership Experience</td>
<td>5 (13.5%)</td>
<td>7 (18.9%)</td>
<td>14 (37.9%)</td>
<td>11 (29.7%)</td>
<td>37 (33.7%)</td>
</tr>
<tr>
<td>Leadership Experience (non-FFA)</td>
<td>7 (17.5%)</td>
<td>8 (20.0%)</td>
<td>15 (37.5%)</td>
<td>10 (25.0%)</td>
<td>40 (48.2%)</td>
</tr>
<tr>
<td>Leadership Experience (FFA)</td>
<td>3 (20.0%)</td>
<td>3 (20.0%)</td>
<td>4 (26.7%)</td>
<td>5 (33.3%)</td>
<td>15 (18.1%)</td>
</tr>
<tr>
<td>Total Frequency</td>
<td>15 (16.3%)</td>
<td>18 (19.5%)</td>
<td>33 (35.9%)</td>
<td>26 (28.3%)</td>
<td>92 (100%)</td>
</tr>
</tbody>
</table>

Note. Data are from four class sessions, with 20 missing observations.

Figures contained in Table 4 show students with prior leadership experiences, either FFA or non-FFA, were more likely to have instances in the flow (22) or anxiety channels (12) during classes using experiential learning activities. A high number of students with non-FFA leadership
experiences had instances of flow (14, 35%) with an even higher number of students with prior FFA experiences (8, 44.5%). Conversely, over half of students with no prior leadership training indicated being bored (12, 35%) or apathetic (9, 26.5%) during classes using active learning activities and reflecting on the experience as defined by experiential learning.

Table 4

*Frequency of Flow Channel Experiences and Experiential Learning Activities as Compared to Previous Leadership Experience of Undergraduate Leadership Students During an Experience Sampling Method (ESM) Study (n = 92)*

<table>
<thead>
<tr>
<th>Previous leadership experience</th>
<th>Anxiety</th>
<th>Flow</th>
<th>Boredom</th>
<th>Apathy</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Leadership Experience</td>
<td>6 (17.6%)</td>
<td>7 (20.6%)</td>
<td>12 (35.3%)</td>
<td>9 (26.5%)</td>
<td>34 (37.0%)</td>
</tr>
<tr>
<td>Leadership Experience (non-FFA)</td>
<td>10 (25.0%)</td>
<td>14 (35.0%)</td>
<td>8 (20.0%)</td>
<td>8 (20.0%)</td>
<td>40 (43.5%)</td>
</tr>
<tr>
<td>Leadership Experience (FFA)</td>
<td>2 (11.1%)</td>
<td>8 (44.5%)</td>
<td>6 (33.3%)</td>
<td>2 (11.1%)</td>
<td>18 (19.5%)</td>
</tr>
<tr>
<td>Total Frequency</td>
<td>18 (19.5%)</td>
<td>29 (31.5%)</td>
<td>26 (28.3%)</td>
<td>19 (20.7%)</td>
<td>92 (100%)</td>
</tr>
</tbody>
</table>

*Note.* Data are from four class sessions, with 20 missing observations.

Table 5 reports that there were 30 instances of students being in flow during classes where they reflected on their learning experiences, regardless of their prior leadership experience. Additionally, students reported 14 instances of being in the anxiety channel. Collectively, there were 44 (66.7%) instances where optimal experiences or instances where students perceived themselves in the anxiety channel. On the other hand, there were five instances of students reporting being in the channel of apathy during classes where they were asked to reflect on their learning.
Table 5

Frequency of Flow Channel Experiences and Reflection on Learning as Compared to Previous Leadership Experience of Undergraduate Leadership Students During an Experience Sampling Method (ESM) Study (n = 66)

<table>
<thead>
<tr>
<th>Previous leadership experience</th>
<th>Anxiety</th>
<th>Flow</th>
<th>Boredom</th>
<th>Apathy</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Leadership Experience</td>
<td>5 (20.0%)</td>
<td>12 (48.0%)</td>
<td>6 (24.0%)</td>
<td>2 (8.0%)</td>
<td>25 (37.9%)</td>
</tr>
<tr>
<td>Leadership Experience (non-FFA)</td>
<td>6 (21.4%)</td>
<td>12 (42.9%)</td>
<td>8 (28.6%)</td>
<td>2 (7.1%)</td>
<td>28 (42.4%)</td>
</tr>
<tr>
<td>Leadership Experience (FFA)</td>
<td>3 (23.1%)</td>
<td>6 (46.1%)</td>
<td>3 (23.1%)</td>
<td>1 (7.7%)</td>
<td>13 (19.7%)</td>
</tr>
<tr>
<td>Total Frequency</td>
<td>14 (21.2%)</td>
<td>30 (45.5%)</td>
<td>17 (25.7%)</td>
<td>5 (7.6%)</td>
<td>66 (100%)</td>
</tr>
</tbody>
</table>

Note. Data are from three class sessions, with 18 missing observations.

Examination of Table 6 discloses that students, regardless of prior leadership experience, reported eight instances of being in the flow channel and 15 instances of being in the anxiety channel during an assessment experience. Students with non-FFA leadership experience were the most likely to indicate that they were anxious during the assessment experience (7, 70.0%). There was one reported instance of a non-leadership student being in the apathy channel during the assessment and no students with previous leadership experience. There were two instances of students being in the boredom channel.

Table 6

Frequency of Flow Channel Experiences and Traditional Assessment as Compared to Previous Leadership Experience of Undergraduate Leadership Students During an Experience Sampling Method (ESM) Study (n = 26)

<table>
<thead>
<tr>
<th>Previous leadership experience</th>
<th>Anxiety</th>
<th>Flow</th>
<th>Boredom</th>
<th>Apathy</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Leadership Experience</td>
<td>6 (54.6%)</td>
<td>4 (36.4%)</td>
<td>0 (0.0%)</td>
<td>1 (9.1%)</td>
<td>11 (42.3%)</td>
</tr>
<tr>
<td>Leadership Experience (non-FFA)</td>
<td>7 (70.0%)</td>
<td>2 (20.0%)</td>
<td>1 (10.0%)</td>
<td>0 (0.0%)</td>
<td>10 (38.5%)</td>
</tr>
<tr>
<td>Leadership Experience (FFA)</td>
<td>2 (40.0%)</td>
<td>2 (40.0%)</td>
<td>1 (20.0%)</td>
<td>0 (0.0%)</td>
<td>5 (19.2%)</td>
</tr>
<tr>
<td>Total Frequency</td>
<td>15 (57.7%)</td>
<td>8 (30.8%)</td>
<td>2 (7.7%)</td>
<td>1 (3.8%)</td>
<td>26 (100%)</td>
</tr>
</tbody>
</table>

Note. Data are from one class session, with 2 missing observations.
Conclusions, Implications, and Recommendations

Understanding previous student leadership skills and abilities within the context of learning is critical to the development of future leaders (Northouse, 2016). This study sought to add to optimal experience research in an undergraduate setting (Asakawa, 2010, Asakawa, 2004; Everett & Raven, 2015; Rogatko, 2009), established theory (Csikszentmihalyi, 1975), and methodological approaches in the context of leadership education (Rosch & Coers, 2013).

An undergraduate leadership course within the College of Agriculture and Natural Resources at Michigan State University was used to better understand flow channels of students with no prior leadership, prior leadership not including FFA (e.g., 4-H, school-related leadership, or work-related leadership experiences), and of students who had prior FFA leadership experience. Demographic results among categories indicate that students in this undergraduate leadership class were largely female (75%) and were about 22.5 years of age. These numbers support similar gender trends of previous research in high school agricultural education (Rosch, Simonsen, & Velez, 2015) and university undergraduate leadership courses (Lamm, Carter, & Melendez, 2014) where the majority of students are female. This is especially true in terms of females participating in areas of leadership that have additional responsibilities such as serving on an officer team. There is a continuing trend in agricultural education where chapter, regional, state, and National level programs often have a higher percentage or females serving on leadership teams. There was a notable difference between the average age of students with prior FFA leadership experience (19.8 years of age) and those with no prior leadership experience (24.8 years of age). This was due to the two outlier respondents in the non-leadership category. Also, all students with prior FFA leadership experience also indicated having held a leadership position during their FFA experience (chapter officers, committee chairs, regional officers, state officers). As other subject matter areas have opportunities for students to test or place out of specific courses based on previous experience, is there a need to develop a similar mechanism for students with extensive leadership experience (e.g., FFA) to be afforded this same opportunity? Those students with prior non-FFA leadership included experiences in 4-H, school-related (e.g., National Honor Society, student council, athletics), and work related (e.g., management or other leadership position). There is a need to better understand the various types of leadership undergraduate students bring to a college of agriculture. The question also arises why there were such low numbers of male students participating in this undergraduate leadership course. Are female students more likely to seek out leadership education due to higher maturity levels? More research is needed to better understand gender differences and rationale as to why a specific gender is more likely to seek out leadership education opportunities.

Optimal experience instances as defined by students being in flow occurred with greater frequency within the teaching techniques of experiential learning activities and reflections on learning. Instances of optimal experience within the teaching technique of experiential learning activities occurred nearly a third (31.5%) of the time with all students. Optimal experience instances occurred nearly half (44.5%) of the time in students with prior FFA experience and a third (35%) of the time and with students having non-FFA leadership experience. These results suggest that students who are engaged in a specific activity are more likely to have control, attention, curiosity, and intrinsic interest in the activity while performing the learning experience (Csikszentmihalyi, 1975). This result also indicates that experiential learning activities in the context of a leadership course have important instructional value while providing students an opportunity to gain knowledge through application. Students with prior FFA experience may be able to apply previous knowledge of their FFA experience and enhance their learning while having those optimal experiences during experiential activities. Perhaps the reason the number of students without any prior leadership experience were less likely to have a given optimal experience was due to the lack of necessary knowledge and skills to fully take advantage of activities. Consequently, students with...
prior leadership experience (both FFA and non-FFA) may be able to leverage their previous leadership experiences to support and provide context to those with no prior leadership experience in an effort to amplify the frequency of optimal experiences for all students. This result is consistent with previous research by Everett and Raven (2015) that teaching and learning experiences through the context of experiential education are important to the overall learning and providing optimal experiences for all students. Instructors should consider utilizing students with prior leadership experience to assist students that do not have prior experience when incorporating experiential learning activities into their classes.

A high percentage of instances of optimal experiences occurred within the teaching technique of reflection on learning (45.5%). This result supports Csikszentmihalyi’s (2014) relationship between the learning experience while also supporting reflection as a significant component of the experiential learning cycle (Kolb, 1984). Instances of optimal experience during reflection of learning were highest among all channels measured for all students and among individual groups including students with prior FFA experience (46.1%). Therefore, students having prior FFA and students with non-FFA leadership experience (42.9%) may have more perceived control, attentiveness, curiosity, and intrinsic interest and motivation while participating in experiential activities and reflecting on learning as they have prior experiences in FFA or other leadership-based activities. This result suggests that reflection is important to an individual’s perceived control, attention, curiosity, and intrinsic interest (Csikszentmihalyi, 1975) in the context of reflection within undergraduate leadership course and the use of mind maps or similar exercises as a reflective tool may be more likely to provide students with optimal experiences. These data also support Roberts’ (2008) research that becoming a reflective leader is critical to the development of leaders at both the individual and group level.

Teaching techniques utilizing guest speakers and student led instruction were more likely to produce instances of boredom and apathy. During class sessions where a guest speaker was a central feature for learning, students may not have been engaged with the speaker based on interest level of the topic or engagement by the speaker with the students. These results may also indicate that overuse of guest speakers may negatively affect the learning experience by undergraduate students in a leadership course. One potential way to amplify optimal experiences while still using industry professionals is to have students interview professionals in an area of interest and develop a mind map or utilize another reflective tool as a way for students to synthesize the experience. This would combine an experiential learning activity with a reflective activity, both teaching techniques that this study indicated were more likely to provide students with optimal experiences during learning, while still leveraging industry professionals’ practical leadership knowledge.

A high percentage of students also indicated instances of being in the channels of boredom or apathy during student led instructional experiences. Conversely, a third of instances students reported having an optimal experience during learning. It is possible that the students having an optimal experience during learning were the student presenting during a given class session while the ones not presenting reported instance in the boredom and apathy channels. Student presentations and development of oral communications skills are an important function of any leadership develop course or program (Morgan, King, Rudd, & Kaufman, 2013) and engaged students may be more likely to have optimal experiences (Everett & Raven, 2015, 2016), however students receiving instruction from other students may not be engaged in learning. Bumguardner, Strong, Murphrey, and Dooley (2014), suggest that utilizing technology may enhance agricultural leadership learning in undergraduate students. One recommendations by the authors would be for students to create YouTube videos outside of class and have students watch those videos and reflect on the content. Students may create optimal experiences by using experiential learning to create the videos (learning by doing), and reflecting on the experiences by viewing others students’
videos. Furthermore, it is recommended that additional data points be added to the ESM so researchers are able to distinguish if students had different responsibilities during a specific course. In this case whether students were presenting (active learning) or listening (passive learning).

During the measured assessment, students exhibited instances of optimal experience, with a vast majority of instances being reported either in the channel of flow or anxiety during a traditional paper-pencil assessment. This result supports the work of Newcomb, McCracken, Warmbrod, and Whittington (2004) where a level of anxiety is an important part student learning. For example, Newcomb et al. (2004) cite in Principle 6 that students are motivated when they attempt tasks that fall in their range of challenge where success is perceived, but not certain. However, if students are having incidences of high anxiety in traditional assessments there may be cause for concern. Students may be challenged by material and not perceive themselves as being skilled in the content, whereas students having flow channel experiences may have adequately prepared for the assessment and feel a high level of both challenge and skill, hence creating conditions for flow. The authors recommend further research in better understanding preparation and ability of students in traditional assessments as this relates to optimal experiences in both the flow and anxiety channels.

According to Baker, Robinson, and Kolb (2012), quality undergraduate classroom learning is characterized by teaching approaches that utilize students’ learning styles to provide individual student-centered opportunities for cognitive growth. The authors suggest that additional research be conducted to better understand students with no leadership experience as well as why those with and without prior FFA experience respond well with respect to teaching techniques that utilize reflective practices in the classroom (Kolb, 1984). Measuring optimal experience of various reflective exercises is one potential avenue for future research. Additionally, the authors also suggest that further measurement occur using the ESM approach to compare different forms of experiential learning in the context of classroom instruction and learning spaces (Kolb & Kolb, 2005) as a way to better understand optimal conditions for undergraduate learning of leadership principles. Due to the small sample size of this undergraduate course, caution should be taken when making generalizations about the results of this study across a larger population. The authors recommend further research using a larger sample of students with varying levels of leadership experience.

This study explored differences in optimal experiences of students with previous FFA experience, and their peers with leadership experience (non-FFA) and no leadership experience in an undergraduate leadership course in the College of Agriculture and Natural Resources at Michigan State University. The course also sought to understand optimal experiences of undergraduates with using different teaching techniques. This research provides support that students have optimal experiences during experiential learning activities (Kolb, 1984) and reflection of their learning (Boyd & Fales, 1983; Dewey, 1933). This study supports similar research that optimal experiences are important to learning and provides the impetus for further research using socio-psychological approaches to understand leadership experiences of students and teaching techniques that support those experiences.

References


Agriculture Teachers’ Integrated Belief Systems and its Influence on their Pedagogical Content Knowledge

Amber H. Rice¹ & Tracy Kitchel²

Abstract

This grounded theory study explored the pedagogical content knowledge (PCK) of experienced agriculture teachers in the plant sciences. The central phenomenon that emerged during data collection and analysis was the influence of beliefs on shaping participants’ PCK. This finding guided subsequent collection and analysis that resulted in the following central research question: what shapes experienced agriculture teachers’ PCK in plant sciences? The data presented here focused on the most emergent category shaping PCK, integrated belief systems, which included participants’ beliefs about the purpose of agricultural education, beliefs about plant science education, and beliefs about teaching and learning in agricultural education. A substantive level theory was developed that illustrated the relationships between the three belief components on participants’ PCK. These findings support further investigation into how beliefs are shaping agriculture teachers’ PCK in plant sciences and other agriculture content areas.

Keywords: Agriculture teacher beliefs; teacher knowledge; teacher beliefs; pedagogical content knowledge; agriculture teacher PCK

Introduction

Effective agriculture teachers need to be able to determine students’ learning needs, plan for and evaluate instruction, utilize a variety of teaching techniques, demonstrate knowledge of the teaching and learning process, and possess excellent knowledge of subject matter (Roberts & Dyer, 2004). Among other traits and skills, these teaching tasks require both content knowledge and pedagogical content knowledge (PCK) in agriculture topics. PCK is a professional knowledge base held by teachers that encompasses how they understand content and deliver that content to students (Shulman, 1986). Instructional tasks such as redirecting discussion and engaging in effective classroom discourse depend on teachers’ PCK (Walshaw & Anthony, 2008). Teacher educators not only recommend agriculture teachers have PCK, but identify this knowledge base as essential to their success in the classroom (Roberts & Kitchel, 2010).

Despite its espoused importance in the literature, research in PCK specific to agricultural education have been limited to a handful of studies. Rice and Kitchel (2015a) explored preservice agriculture teachers’ acquisition of agriculture content knowledge and how they planned to use that knowledge in their future teaching, within the contextual framework of PCK. They discovered that preservice agriculture teachers perceived their content knowledge preparation as inadequate and felt there was a lack of application of their content courses to teaching, which is imperative for PCK development (Rice & Kitchel, 2015a). A subsequent study examined beginning agriculture

¹ Amber H. Rice is an Assistant Professor in the Department of Agricultural Education in the College of Agriculture and Life Sciences at The University of Arizona, 1110 E. South Campus Drive, Tucson, AZ, 85721, amrice@email.arizona.edu
² Tracy Kitchel is a Professor and Chair in the Department of Agricultural Communication, Education, and Leadership in the College of Food, Agricultural, and Environmental Sciences at The Ohio State University, 208 Ag Admin Building, 2120 Fyffe Road, Columbus, OH, 43210, kitchel.2@osu.edu
teachers’ deconstruction of content knowledge for teaching and revealed that beginning teachers struggled to break down content knowledge for their students because of a self-identified content knowledge deficiency (Rice & Kitchel, 2016). This finding had direct implications to agriculture teachers’ PCK development because content knowledge is the foundation for PCK (Ball, Thames, & Phelps, 2008). A model was developed that illustrated coping strategies for teachers when they are deficient in content and described the influencers that led them to choose specific strategies (Rice & Kitchel, 2016). Researchers recommended additional exploration into one specific influencer, the impact of teachers’ personal philosophies and beliefs regarding agricultural education (Rice & Kitchel, 2016). Due to the content knowledge deficiency barrier, it was also recommended future research focus on experienced agriculture teachers’ PCK (Rice & Kitchel, 2016), a recommendation which guided this study.

The lack of PCK conceptualization for agriculture teachers at any career stage, supports the focus on experienced teachers. While experience in the classroom does not guarantee an individual will possess PCK, it does play an active role in PCK development (Hashweh, 2005). Furthermore, teaching experience was perceived to be the most effective source of agriculture content knowledge for Missouri agriculture teachers and revealed a significant relationship with their PCK (Rice & Kitchel, 2015b). Research in PCK can inform strategies for how teachers are taught at the preservice level and increase the likelihood teachers will use that knowledge once they enter the classroom (Ball et al., 2008). For teaching to be better valued as a profession, PCK research is necessary to elucidate the complexity of teaching and further establish the importance of teachers’ professional knowledge (Phelps & Schilling, 2004). Conceptualizing PCK for a specific topic in agriculture can provide a foundation for future research and inform agriculture teacher preparation programs nationwide.

Review of Literature

PCK can be further delineated into sub-components to provide a more detailed description of this elusive knowledge base. The Magnusson, Krajcik, and Borko (1999) framework for science PCK, one of the more prevalently utilized frameworks in the literature (Kind, 2009; Lannin et al., 2013; Padilla & Van Driel 2011), included four primary components that continuously appear in other studies and frameworks, though often under slightly different terms. The components included: knowledge of learners, knowledge of assessment, knowledge of instructional strategies, and knowledge of curriculum, all within a subject matter context. In their framework, orientations to teaching science was presented as influencing and being influenced by these four components of PCK (Magnusson et al., 1999). Orientations referred to a teachers’ conceptualization, viewpoint, or overarching guide for teaching and learning a particular subject. Magnusson et al. (1999) described nine orientations specifically for teaching science including: process, academic rigor, didactic, conceptual change, activity-driven, discovery, project-based, inquiry, and guided inquiry. These orientations vary according to the characteristics of instruction (e.g. more teacher centered vs. student centered) and the goals for teaching science (e.g. scientific inquiry vs. transmission of information).

In more recent studies, orientations have become a central component of PCK frameworks and subsequently lines of inquiry. Padilla and Van Driel (2011) addressed orientations and their importance to teachers’ overall PCK in their research in quantum chemistry, and Lee (2011) reinforced the view that orientations are a significant component to PCK in their research examining inquiry-based science teaching. In PCK literature, orientations are described differently depending upon the framework, and many researchers have expanded on Magnusson’s et al. (1999) original description to include teacher beliefs about learning, approaches to teaching in general, specific approaches to subject matter, and teacher epistemologies. Grossman (1990) described
orientations as the purposes and overall goals for teaching a particular subject. The lack of consistency with terms and definitions for what is influencing PCK has revealed many issues surrounding orientations in the literature (Friedrichsen & Berry, 2015). Concerns raised by Friedrichsen, Van Driel, and Abell (2010) included: various definitions and meanings behind the word orientations, weak or non-existent relationships between orientations and PCK, researchers simply assigning teacher orientations, and researchers simply not addressing orientations.

The role of teacher orientations, in addition to all of the previously described PCK components, are also reflected in the most current science PCK framework developed at the science PCK summit (Carlson, Stokes, Helms, Gess-Newsome, & Gardner, 2015). This consensus framework attempted to combine previous PCK frameworks from a variety of studies and included the knowledge of assessment, students, instruction, and curriculum, in addition to orientations, beliefs, and context. Their framework described influencers of PCK as amplifiers and filters for teachers’ topic specific professional knowledge. These amplifiers and filters included orientations, beliefs, and context that directly influenced both the topic-specific professional knowledge of teachers (instructional strategies, content representations, student understandings, etc.) and classroom practice (Carlson et al., 2015). Due to the lack of common language (Friedrichsen et al., 2010), for the purposes of this study, influencers of PCK will be described more broadly as teacher beliefs, taking into account the concepts of orientations, beliefs, goals, and purposes for teaching. Hashweh (2005) claimed PCK is influenced heavily by teachers’ beliefs, and there is evidence that these beliefs can even emerge and develop prior to entrance in a teacher preparation program (Kapyla, Heikkinen, & Asunta, 2009), further justifying their exploration in this study.

In summary, possessing PCK enables teachers to unpack content into usable forms for student learning, requiring a knowledge base different from content experts (Phelps & Schilling, 2004). Components of PCK are still widely disputed, but popular frameworks often include five components: knowledge of students, knowledge of instruction, knowledge of curriculum, knowledge of assessment, and orientations (Kind, 2009). The teachers’ individual contexts, prior experiences, and content areas also impact their PCK (Gess-Newsome & Lederman, 1999). PCK develops continually over time (Lee, 2011) through experience (Baxter & Lederman, 1999; Hashweh 2005; Kind, 2009; Lee, Brown, Luft, & Roehrig, 2007; Van Driel, De Jong, & Verloop, 2002). PCK research in agricultural education is virtually non-existent, yet it is regarded as an important knowledge base for agriculture teachers to possess by teacher educators (Roberts & Kitchel, 2010). The topic specific and highly specialized nature of PCK (Etkina, 2010; Carlson et al., 2015; Van Driel & Berry, 2012) warrants further examination of PCK, specifically in agricultural education.

**Purpose of Study**

The purpose of this grounded theory study was to both conceptualize PCK for a specific topic in agriculture and develop a model for the investigation and conceptualization of additional topics. The guiding question aligns with priorities four and five of the 2016-2020 National Research Agenda- meaningful and engaged learning in all environments and efficient and effective agricultural education programs (Roberts, Harder, & Brashears, 2016): What is experienced agriculture teachers’ PCK related to the plant sciences? Exploration of experienced agriculture teachers’ PCK will not only illuminate the current knowledge base for practicing teachers, but can also lead to more meaningful teacher preparation and curriculum development, ultimately strengthening agricultural education programs and increasing student learning.
The data analyzed were part of a larger study; therefore, many of the methods will be consistent or identical to the larger study. I chose grounded theory as the research design due to the exploratory nature of the guiding research question and the paucity of research in PCK within the agricultural education discipline. Additionally, PCK is the knowledge teachers use during the process of teaching (Kind, 2009) and investigating a process that shapes a phenomenon is a key component of grounded theory methodology (Corbin & Strauss, 2008). Specifically, this study was guided by the work of Corbin and Strauss (2008), who view grounded theory as a way to understand complex social situations and experiences.

In qualitative inquiry, the researcher is the instrument through which data is interpreted (Creswell, 2013); therefore, it is also important to disclose my epistemological lens and positionality as it pertains to this study. Pragmatists view reality as an interaction between the actor and the environment because reality exists as experienced through people (Corbin & Strauss, 2008). Historically, significant assumptions of grounded theory such as the importance of action and interactions in developing meaning have origins in the work of early pragmatist philosophers (Corbin & Strauss, 2008), further substantiating the fit between my epistemological lens and the research design. I identify as a former high school agriculture teacher and current agriculture teacher educator at a large land-grant university. I believe knowledge of content, and most importantly knowledge about how to teach content, is a crucial part of teacher effectiveness. The goal of my research is to conceptualize the PCK of expert agriculture teachers so this information can be used to better prepare future teachers and assist practicing teachers. My desire is for more agriculture teachers to feel they have the skills necessary to adequately understand and effectively teach agriculture content.

Participants and Data Collection

Eight high school agriculture teachers in Missouri with a minimum of eight years teaching experience as of the 2014-2015 school year were selected as participants in this study. Experienced teachers are more likely to possess PCK (Hashweh, 2005) and expertise begins after approximately five to eight years in the classroom (Darling-Hammond & Bransford, 2005). I utilized recommendations from teacher educators in the purposeful selection of teachers to insure possession and quality of PCK in the plant sciences. All selected teachers were teaching a plant science unit in the fall of 2014, had professional development experiences related to plant science, a reputation as an effective teacher by teacher educators, and were located within a 120-mile radius of the university for observations and field work. The topic specific nature of PCK (Carlson et al., 2015; Etkina, 2010; Magnusson et al., 1999; Van Driel & Berry, 2012) created a need to examine one particular area of agriculture for this study. Plant science was chosen because it was a commonly taught content area by experienced agriculture teachers across the state, and I had the appropriate content knowledge to recognize PCK in my participants.

I collected the following six sources of qualitative data: pre-observation interviews, field notes, classroom teaching observations, lesson artifacts, teacher journal reflections, and post-observation interviews. PCK is both the knowledge of, reasoning behind, and planning for teaching a specific topic, and the actual act of teaching a specific topic (Carlson et al., 2015). Reflection is also a critical component of PCK development (Schneider & Plasman, 2011; Van Driel & Berry, 2012), with the summit definition identifying knowledge, reasoning, and planning as explicit reflection on action and the act of teaching as explicit or tactic reflection in action (Carlson et al., 2015). Therefore, planning, teaching, and reflection all provided different opportunities to capture agriculture teachers’ PCK. For example, addressing student misconceptions, a commonly agreed
on component of PCK (Depaepe, Verschafeel, & Kelchtermans, 2013), may surface during all three settings: planning, teaching, and reflection. During planning, a teacher may plan ahead of time to use a specific example because they know students typically struggle with a concept. During teaching, a teacher may react in-the-moment in response to a student misconception by explaining an example in a different way. Finally, during reflection, a teacher may reflect on the incident and contemplate a different teaching strategy or representation to use when teaching this concept again. All three of these examples are instances of a teacher demonstrating their PCK during different parts of the teaching process.

I collected data fall 2014 during a single plant science unit for each participant. To manage the data, the NVivo 10 qualitative software program was used. One-on-one semi-structured pre-observation interviews lasting between 45 minutes to an hour for each participant were first conducted to capture PCK emerging during the planning phase of teaching. Questions during the pre-observation interviews included having the participants describe the context of the unit, their teaching goals and objectives, teaching strategies for the content, assessments of student learning, curriculum resources for the unit, and knowledge of student preconceptions, misconceptions, or difficulties that affected their planning of the unit. All pre-observation interviews were conducted prior to the beginning of the plant science unit.

Classroom teaching observations were conducted to capture PCK emerging during the in-the-moment teaching phase. For example, if students surface preconceptions or misconceptions related to the content during the lesson, the teacher may or may not demonstrate PCK in response to addressing those preconceptions and misconceptions by altering their lesson in real time. Two observation blocks were conducted each lasting two days in length to maximize the potential for PCK to be captured. Observations were video recorded because I wanted the opportunity to replay the video to search for instances of PCK and clips from the videos were used for stimulated recall during the post-observation interview. Field notes were taken to record PCK emerging during the in-the-moment teaching phase of teaching not evident on the video recording. Additionally, field notes were used to capture any instances of PCK that could be used for the stimulated recall portion of the post-interview.

Two data sources were collected over the course of the entire unit: lesson artifacts and teacher journal reflections. Lesson artifacts were collected to capture PCK emerging during both the planning phases and in-the-moment teaching phases of teaching (see Hume & Berry, 2011). Artifacts from the participants related to the lesson including: handouts, PowerPoints, and worksheets, captured PCK from the planning phase as the teachers designed their lessons. Artifacts related to the students including: student completed work without identifiers, captured PCK from the in-the-moment teaching phase. Additionally, the type of assignments utilized, the content of the PowerPoints, and the exams all provided evidence to create a complete picture of the participants’ PCK. Teacher journal reflections were used to capture PCK emerging during the reflection phase of teaching. The limited time in the field and the complex nature of PCK led to a desire to capture the participants’ thoughts as the unit progressed. After each lesson was complete, the participants responded to five reflection questions corresponding to that particular lesson. An example of a reflection question was: what representations, illustrations, or analogies related to the content did you utilize during this lesson?

Post-observation interviews with stimulated recall were used to capture PCK emerging during the reflection phase of teaching. The use of interviews and video clips for reflection knowledge is an effective way to measure PCK (Nilsson, 2008). Interviews were conducted one-on-one in a semi-structured format lasting between 45 minutes to an hour and half in length. Participants were asked questions to reflect on the plant science unit they had just completed. An
example of a post-observation interview question was: what do you feel were the strengths and weaknesses of this unit? These questions evolved throughout the process to meet the needs of the participants and the concepts being investigated (Corbin & Strauss, 2008). In addition to general reflection questions based on the unit, a minimum of three video clips from the two teaching observation blocks were used to engage the participants in stimulated recall. Stimulated recall is an introspective technique designed to allow participants to explain their thought processes and decision making after hearing or viewing a stimulus to prompt recollections (Mackey & Gass, 2005). Stimulated recall techniques have been utilized in PCK specific studies to revisit a situation and explore the nature of PCK (Haston & Leon-Guerrero, 2008; Lannin et al., 2013; Loughran, Mulhall, & Berry, 2004). Video clips from the observations were played back for participants and they were asked to elaborate on the incident.

Data Analysis and Alterations to the Central Question

Collection and analysis were conducted simultaneously due to the nature of grounded theory methodology (Corbin & Strauss, 2008). All six data sources including pre-observation interviews, classroom teaching observations, field notes, lesson artifacts, teacher journal reflections, and post-observation interviews were used in data analysis. Data were analyzed using a constant comparative process where data is compared against data to search for similarities and differences (Corbin & Strauss, 2008). I followed the three step coding process of grounded theory: open, axial, and selective coding (Corbin & Strauss, 2008). The purpose of open coding is to develop categories, the purpose of axial coding is to connect categories, and the purpose of selective coding is to create a story ending in a developed theory (Corbin & Strauss, 2008). To begin the open coding process, I examined all data sources as they became available for initial codes and adapted my data collection and analysis based on information needed to saturate a particular idea (Creswell, 2013). Various analytical techniques as described by Corbin and Strauss (2008) were used throughout the data analysis process including: the use of questioning, making comparisons, drawing upon personal experiences, and examining language. Once an initial set of categories had been developed, I identified a pervasive phenomenon to focus on for this study that served as the central piece of my theory (Creswell, 2013).

After the first few pre-observation interviews, it became evident that plant sciences was not specific enough of a topic to be able to adequately describe the participants’ PCK in a way that allowed for comparisons between participants and ultimately the development of a theory. Simultaneously with my realization that conceptualizing PCK for plant sciences was not emerging from my data, a different phenomenon began to surface. Beginning with the first pre-observation interviews, the participants discussed their beliefs regarding agricultural education, plant science, and pedagogy. This was particularly interesting because my questions regarding orientations were purposefully left for the post-observation interviews. When I open coded the first teacher journal reflections, I also noticed an emergent theme of beliefs that seemed to shape teacher knowledge. Corbin and Strauss (2008) discuss how there are many different stories that can be told from a single set of data and how determining the central phenomenon in grounded theory methodology is partially a “gut feeling” on the part of the researcher. My “gut feeling” was that this phenomenon of beliefs was pervading the data in my study and could provide important knowledge to the field of agricultural education about how the PCK of agriculture teachers is shaped. At times the central phenomenon that emerges from the data demands that the original research question be altered to reflect the new direction of the study. My original research question was: “What is experienced agriculture teachers’ PCK related to the plant sciences?” Upon the emergence of the central phenomenon, the new guiding research question became: “What shapes experienced agricultural teachers PCK in the plant sciences?” Using this question as my guide, I re-coded existing data and applied the new research question to all subsequent data collected and analyzed.
The next step in the coding process was axial coding. The purpose of axial coding is to identify causal conditions influencing the central phenomenon (Creswell, 2013). Utilizing my central phenomenon as a guide, I continued to analyze the data using the strategies mentioned above. Corbin and Strauss (2008) describe open coding as breaking the data apart and axial coding as bringing the data back together in a new, more meaningful way. I analyzed the data for context, conditions, and consequences (Corbin & Strauss, 2008); to better understand the central phenomenon and how the categories interrelated. This process helped me to see how beliefs shaped the PCK of my participants. Memos were used in the research process not to simply record information but also to analyze information, making memos a crucial part of the data analysis process (Corbin & Strauss, 2008). Memos can assist the researcher in exploring the data, developing preliminary relationships, asking questions of the data, and creating meaning from the data. My memos in particular were helpful in establishing my central phenomenon. They were also crucial in the process of connecting the PCK of my participants to what was influencing that PCK both inside and outside of the classroom.

Trustworthiness

Throughout the study, I engaged in various validation strategies described by Tracy (2010) for qualitative research that met the following criteria: worthy topic, rich rigor, sincerity, credibility, resonance, significant contribution, ethics, and meaningful coherence. Exploration into agriculture teacher PCK is a research topic worthy of exploration because of its relevance to the field of agricultural education and the limited research to date specific to agriculture teachers’ beliefs and PCK. Rigor was achieved through an intense data collection and analysis process that included various forms of data and rich, thick descriptions of experiences to assist the reader in understanding the themes. Sincerity was evident in the study through disclosure of my potential biases and transparency of the challenges inherit to the study, including changes to the central questing during analysis. Credibility was first addressed by triangulation of six separate data sources to corroborate evidence. Second, I engaged in member checking of findings and interpretations. Resonance was achieved through vivid description, including first hand observations, and weaving the various data sources into a story. The research provides a significant contribution to the body of literature through development of themes and ultimately a substantive theory. Procedural ethics for protecting human subjects were followed and participants were protected with pseudonyms. Meaningful coherence was achieved by memoing throughout the entire research process to develop connections, document my thoughts, to ask questions of the data, and to interconnect literature and interpretations.

Findings

These findings are part of a larger study where a substantive theory emerged from the data to explain what was shaping experienced agriculture teachers’ PCK in the plant sciences (Rice & Kitchel, 2017). Experiences, context, and beliefs of the participants provided the framework for the substantive theory. Specifically, integrated belief systems was the most emergent of the three and had the greatest influence in shaping the PCK of experienced agriculture teachers in the plant sciences. The integrated beliefs systems theme was comprised of three main components that interacted with one another: beliefs about the purpose of agricultural education, beliefs about plant science education, and beliefs about teaching and learning in agricultural education. The findings below will focus on describing these individual components and unpacking the relationship between the participants’ integrated beliefs systems and their PCK.
Beliefs about the Purpose of Agricultural Education

The participants believed the four main purposes of agricultural education were: career preparation, college preparation, agricultural literacy, and practical life skills. A fifth view labeled individualization, based on individual student need, was surfaced by the participant Clint as he attempted to combine all of the purposes to meet the needs of his diverse student population. The majority of participants held multiple views about the purpose of agricultural education for their students, but some expressed more of an emphasis on specific views than others, leading to primary and secondary view categories (see Figure 1). Specifically, the word views was utilized to avoid any confusion between terms and improve readability of the findings, but is reflective of participants’ beliefs about the purpose of agricultural education.

<table>
<thead>
<tr>
<th>Pseudonyms</th>
<th>Primary Views</th>
<th>Secondary Views</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jane</td>
<td>Literacy</td>
<td>College</td>
</tr>
<tr>
<td>Dawn</td>
<td>Literacy</td>
<td>Life Skills, College and Career</td>
</tr>
<tr>
<td>James</td>
<td>Literacy</td>
<td>Life Skills, College and Career</td>
</tr>
<tr>
<td>Kelly</td>
<td>Life Skills and Literacy</td>
<td>Career</td>
</tr>
<tr>
<td>Allison</td>
<td>Career and College</td>
<td>Literacy and Life Skills</td>
</tr>
<tr>
<td>Cora</td>
<td>Career</td>
<td>Literacy and Life Skills</td>
</tr>
<tr>
<td>Clint</td>
<td>Individualization</td>
<td>N/A</td>
</tr>
<tr>
<td>Ashley</td>
<td>Literacy</td>
<td>Life Skills</td>
</tr>
</tbody>
</table>

*Figure 1. Participants’ beliefs about the purpose of agricultural education*

Participants who held a career preparation view about the purpose of agricultural education focused on the skills and knowledge their students needed to directly enter the agriculture industry or pursue training for a specific career. Participants with the college preparation view concentrated on the skills and knowledge their students needed to be successful in post-secondary education. Participants who held an agricultural literacy view were dedicated to developing general knowledge and awareness about agriculture in their students, often from a consumer and voter perspective. Participants with the practical life skills view focused on developing tangible life skills through an agricultural education context (e.g. create a budget) that went beyond agricultural literacy knowledge. Finally, student individualization encompassed all four of the previous views in an effort to meet the needs of each individual student.

The beliefs about the purpose of agricultural education directly influenced the other two components of the integrated belief systems (see Figure 2). For this reason, beliefs about the purpose of agricultural education and its impact on participants’ PCK will be reported intertwined with beliefs about plant science education and beliefs about teaching and learning throughout the remainder of the findings.
Beliefs about Plant Science Education

There were many emergent beliefs specifically for plant science education that influenced the participants’ PCK. Beliefs about plant science education included: the utilization of the greenhouse in plant science education, the level of science integration in plant science, and the influence of students’ prior knowledge on the teaching of plant science. It is important to surface the beliefs about plant science education as a whole mirrored the beliefs about the purpose of agricultural education for all of the participants (see Figure 2). For example, Cora held a primary career preparation view and consequently believed the greenhouse should be utilized to develop career and business skills and the level of science integration should focus on applied science.

The most prominent plant science education belief surfaced from the participants revolved around the purpose of the school greenhouse. All of the participants discussed the importance of hands-on learning in agricultural education, which was often enacted in the school greenhouse for plant science content. However, the primary difference between participants was some of them viewed the purpose of greenhouse as a laboratory, others saw it as business, and some had dual purposes for greenhouse. James, with a primary agricultural literacy view, approached the school greenhouse as a laboratory. He stated, “To me, a school greenhouse is primarily a lab where students can practice skills learned in the classroom and a place where they can conduct plant science related experiments.” Some of the participants viewed the school greenhouse primarily as a business because they had a career preparatory focus or because the school put additional pressure on the viability of the greenhouse. Cora, with a primary career view, described her school greenhouse as a “true production facility.” Dawn, with combined agricultural literacy and career preparation views, stated, “It is an extension of the classroom learning environment. The greenhouse will provide the student the opportunity to apply lessons learned in the classroom into a real life situation. The greenhouse also gives students the ability to gain skills which could lead to employment or future careers.” Her dual use of the school greenhouse as both a lab and a business combined characteristics of both greenhouse purposes and reflected her overarching views about the purpose of agricultural education.

The second plant science belief that emerged from the data was the belief that science integration was a component, at least to some degree, of teaching plant science. Many of the participants viewed agriculture in general as an applied science and this influenced their level of science integration. Allison elaborated on her belief that she is teaching an applied science course in the following journal reflection. “I think it’s important that they get the science content behind plant science (the processes, factors, etc.) but I also feel my job is the practical application of that
science.” Dawn also expressed a view of agriculture as an applied science, “The majority of the classes are applied science. We are not focusing on the memorization of the extreme technical aspects. We’re focusing more on the application aspects and the use for future applications.” Kelly, who had a primary agricultural literacy and life skills view, stated, “So I think a good mix of the sciences and the practice is a good combination.”

The belief that agriculture was an applied science influenced the depth of content the participants deemed important to address in their classrooms. Many of the participants discussed not duplicating but instead complimenting biology and other core science curriculum. However, a couple of the participants in the study actually felt they needed to cover more science, not less, because of what was being taught in current biology courses in their respective schools. Part of the participants’ reasoning for a strong belief in science integration related to context, specifically the desire of their students to acquire science knowledge. Cora said, “I try to get the plant science stuff. That’s why they’re here. They want to learn about the plant science.” Many participants organized their content to include science based curriculum in the fall and more manual skills content in the greenhouse in the spring.

The final belief related to plant science education was that plant science was different than other agriculture content areas regarding the amount of prior knowledge of students. In reference to his plant processes unit James said, “This first lesson is just a review of information that students have learned since 2nd grade.” Participants also believed students’ prior knowledge of plant science was developed in middle and high school years. I observed Ashley describe the unit to her students as a review from previous agriculture and science classes. James discussed the influence of student prior knowledge of plant science on his teaching throughout the interviews, reflections, and in dialogue with students during my classroom observations.

Sometimes this belief about prior knowledge in plant science influenced the pace at which the participants taught the content as evidenced from an interview with Jane, “My kids always get onto me about how fast sometimes I go through things. And I say, ‘I’m trying. We are using knowledge. We’re just recalling previously learned knowledge.” Experiences of the participants were also influenced by the belief that plant science education is primarily building on students’ prior knowledge. Some participants did not feel obligated to seek out additional information in plant science because they assumed students already had the knowledge. This was evident with Jane who commented she didn’t know how to elaborate more on photosynthesis after discussing the formula and the function of chloroplasts. On the other hand, if participants believed students didn’t have as much prior knowledge, they spent more time in the review stage like I observed in Ashley’s unit where she recapped crucial plant science concepts in more detail.

Beliefs about Plant Science Education and its Connection with Teachers’ PCK

Beliefs regarding the utilization of the school greenhouse influenced the PCK of the participants. When the participants wanted students to take away specific manual skills, then the participants themselves had to possess those skills. Cora said, “Especially the hands-on pieces, you have to be five steps ahead of every kid. You’ve got to know what you’re doing though. That’s not something that you can fake with them.” With plant science knowledge not directly tied to skill development, participants were more likely to feel confident having less knowledge than when it was tied to skill development. The specific plants the community wanted participants to grow in the greenhouse also influenced the participants’ PCK. Allison discussed how she had to learn how to grow poinsettias and learn how to teach students to grow poinsettias because it was something her school and community demanded from her agriculture program, not because she felt this was an important skill for her students to master for their future careers.
Believing the purpose of the school greenhouse was primarily business also influenced the structure and sequence of the content for some participants. Many participants at least partially based their lessons around preparing students for greenhouse work, which occurred primarily in the spring. Allison said, “We needed the sexual propagation lesson as well as the plant part lesson to really understand this lesson. It then helps us when we start growing plants in the greenhouse.” Cora also followed a similar structure, which was reflected in her journal entries. “This lesson connected to the plant parts and functions lesson as well as builds on tasks that will have to be accomplished next semester (planting from seeds, taking cuttings to establish hanging baskets).” While this sequence of fall content and spring application may be the best strategy for student knowledge development, it was the circumstances revolving around the use of the greenhouse, not how the students’ best processed the concepts, that drove the curriculum.

Another way participants’ beliefs about plant science education influenced their PCK is in the area of science integration, in particular the use of research in the classroom. Clint consistently utilized research articles from land grant university extension evidenced through observations, reflections, and lesson artifacts. For the forages unit I observed, Clint taught a lesson that discussed the nutrients different forages needed to grow and incorporated a university soil test into the discussion. Additionally, participants who had a practical life skills or career and college preparation as their primary view about the purpose of agricultural education gained more PCK in science related to applied science principles. This was in direct contrast with participants like Jane, with agricultural literacy as her primary view, who developed less PCK and even foundational content knowledge in complex science concepts. Instead she vocalized that knowing the “basics” was enough to achieve her goal of agricultural literacy.

Finally, participants’ beliefs about the quantity and quality of prior knowledge possessed by their students in plant science content directly impacted their PCK, specifically their knowledge of content and students. Dawn described that she didn’t teach students how to use dichotomous keys in her identification unit because they had experience in biology with the tool. James stated, “The biggest hurdle in this lesson is getting them to understand respiration. So far in their education, they have focused on how plants make food, not how they use it. That’s where we start with this lesson.” This quote demonstrated just how influential assumed student prior knowledge was on both the content James decided to teach and the level at which he decided to teach it. Prior knowledge of students, an important concept in PCK, was mentioned by all participants. Some participants seemed to have a more accurate grasp on students’ actual prior knowledge evidenced from students’ observed responses to content taught and ability to make connections with that content. Other participants’ possessed arguably inaccurate assumptions of student prior knowledge, which compromised many of their teaching decisions.

Beliefs about Teaching and Learning

The final component of the integrated belief systems was the participants’ beliefs about teaching and learning in agricultural education. These beliefs were distinctly separate from plant science specific education beliefs and delved into general pedagogical beliefs that could apply across content areas in agriculture. Specific beliefs related to teaching and learning that shaped participants’ PCK were: a teacher is a lifelong learner and reflector, students have a role in determining content taught, and students learn best through hands-on experience and application.

The most influential belief about teaching learning in agricultural education on the participants’ PCK was that it is the teachers’ responsibility to be a lifelong learner and reflector. This belief was held by all participants, but was especially evident in conversations with Clint, who also held a student individualization purpose of agricultural education. Clint expressed a need to
continually develop new knowledge to meet the needs of each of his individual students. Many participants communicated that they sought out additional professional development experiences because they believed it was their responsibility as teachers to seek out additional knowledge. Ashley described her beliefs, “Don’t ever quit learning. Keep your eyes open. Pay attention. Read the magazines…If they’re [students] learning, they’re making you learn.”

Participants believed agriculture teachers had an obligation to not only engage in lifelong learning but also to reflect on their knowledge and experiences in the classroom. Utilizing stimulated recall, the majority of participants described a variety of instructional strategies for the same piece of content and all the participants expressed that they would like to alter numerous aspects of their lessons for improvement. Clint voiced that he engaged in continuous reflection. “I reflect at every spare opportunity I get. Sometimes that’s driving home. Sometimes I reflect here when I eat lunch.” Cora and Clint agreed it was the responsibility of the agriculture teacher to find time for reflection. Clint claimed all teachers had time to reflect. “No time to reflect, I don’t buy that. That’s someone who is disconnected I believe.” However, both Kelly and Jane stated it was difficult to reflect on their experiences due to time constraints.

The second belief participants’ held about teaching and learning in agricultural education was the belief that students held a substantial role in determining the agriculture content they were taught in the classroom. Cora described how student interest directed her content choices. “If I have kids who are really interested in something we’ll go that direction. One year I had kids who were really interested in grafting.” A contextual component influencing the belief that student interest plays a role in the content taught in the classroom is the elective nature of agricultural education. Because agricultural education was not a mandatory course for students in the majority of these schools, enrollment was critical for teacher employment. In addition to student interest, many participants chose content based on student need and what they thought was important to teach. Allison stated, “I can pull in things that are necessary based on time of year, what interests the students, and what I think is important in the industry.” Much of this theme is related to the student first mentality that pervaded the entire study. When I asked Clint what type of knowledge guided his teaching he replied, “knowledge about my students.”

The final belief about teaching and learning in agricultural education was students learn best though hands-on experience and real life application. This belief was related to a common emphasis on student engagement from all of the participants. Cora described how she felt engaging in hands-on application was essential for student learning to occur. She said, “We in agricultural education want to be the ‘learning to do piece’. Without those activities, they’re not doing it, so, consequently, how much are they learning it?” I observed the participants use hands-on applications and activities in many classroom observations. The participants with a career preparatory view as their purpose of agricultural education completed a lot of hands-on application in the greenhouse setting. Participants with an agricultural literacy view created more hands-on applications for the classroom setting. For example, Jane had her students create models of perfect and imperfect flowers. Kelly also utilized hands-on and real life application by incorporating a wedding project in her floral industry unit.

Just because the participants valued student engagement and real life examples did not mean that they didn’t view lecture as a useful teaching method. In fact, many of the participants utilized lecture in their classrooms and claimed this was another way to foster student learning if used appropriately. Clint stated, “When we go to ag class, we discuss, we listen, we ask good questions, we write our notes, and that’s just my philosophy on how students learn.” However, in a later interview when I asked Clint if he had infinite resources and time would a hands-on approach always be best, after contemplation he responded with, “yes, nothing is better than the real thing.”
When I asked Kelly if she knew of any ineffective ways to teach plant science content she replied, “I think never doing hands-on would be a bad way to teach plant science and sad for those kids that take that class because I think they take it because it is a hands-on class.”

**Beliefs about Teaching and Learning and its Connection with Teachers’ PCK**

Many of the beliefs about teaching and learning described above are most likely common beliefs of teachers in a variety of disciplines. However, they are significant to this study because of their profound influence on the participants’ PCK. The belief that teachers should be lifelong learners and reflectors heavily influenced the type of professional development experiences (both formal and non-formal) participants sought out during inservice. All of the participants expressed it was the responsibility of the agriculture teacher to engage in reflection and learning, even if some of the participants did struggle with time to engage in this activity. The participants who expressed difficulty in finding time to reflect consequently struggled more than other participants come up with multiple ways to teach content when prompted during the stimulated recall.

The belief that students should play a role in determining the agriculture content taught, also influenced participants’ PCK. Participants presented many examples of researching information specific to a topic their students desired to learn more about. Ashley discussed how in her classroom, she would often elaborate on questions students asked or take a different turn in the lesson based solely on student inquiry. This often required her to seek out additional knowledge. The student first mentality drove many of the teachers’ beliefs and subsequent PCK development, and perhaps more importantly the amount of personal effort they put into their PCK development. Some of the participants based entire units around what their students were interested in, whether or not they deemed themselves proficient in content knowledge of that particular topic or experienced in how to teach that topic. Beliefs about the importance of student engagement on student learning also influenced participants’ PCK. Ashley commented, when I observed her students utilizing a computer-based testing program, one of her reasons for seeking out more information on technology use with content was because students were engaged, and learned more as a result.

The strong belief in hands-on learning led to many participants attending professional development initiatives to develop manual greenhouse skills such as thermostat control, pest management, and maintenance. Participants who utilized the greenhouse more frequently, and who held career preparatory views about the purpose of agricultural education, also attended more of these types of professional development opportunities. If these opportunities were limited due to context, many of the participants tried to increase the number of examples and visuals that they had for the content. Dawn discussed growing plants in her own yard to have as examples for her students and having to refresh herself on how to care for certain landscape plants. Participants who felt hands-on activities and real life examples were crucial for effective teaching had to seek out additional examples beyond the basic curriculum, which relied on a knowledge and comprehension level approach to agriculture content.

**Discussion, Implications, and Recommendations**

The utilization of grounded theory methodology for this study allowed what was shaping the participants’ PCK to surface from the data. The integrated belief systems theme was the most emergent component, and fits many of the characteristics of orientations described by Friedrichsen et al. (2010) including: beliefs about the purpose and goals of science teaching, nature of science, and science teaching and learning. Because of the controversy surrounding the nature of orientations, its specific use in science education, and the tendency for researchers go back to the
nine original orientation descriptions for science teachers (Magnusson et al., 1999) without exploring them further, I made the decision to refer to them simply as integrated belief systems and not regulate participants into pre-determined categories. Beyond identifying the beliefs of the participants, I also explored the influence of these beliefs on the participants’ PCK. Friedrichsen et al. (2010) discussed that there were often weak or nonexistent connections between orientations and PCK in the literature. By focusing on what shaped PCK, I was able to tease out specific beliefs and look at the impact of context and experiences on those beliefs. Often, the concept of beliefs or orientations is described in a vacuum without describing in what ways it influenced participants’ PCK. If PCK is truly person specific (Van Driel & Berry, 2012), then it makes sense that the individual belief systems of a teacher would have a key role in shaping their PCK. These various beliefs led to different PCK development in participants and approaches in the classroom.

Grossman’s (1990) description of orientations as purposes for teaching more closely fits the integrated belief systems theme that emerged from this study. One particular plant sciences belief that divided participants was the end use for the school greenhouse. For the majority of the participants, the greenhouse needed to be, at the very least, self-sustaining financially and for some it was an important fundraiser for their agriculture program. This additional pressure on the success of plant production in the greenhouse influenced the educational approach used by participants in their plant science units. If the participant’s school and community expected a successful plant sale than they were more likely to operate the greenhouse like a business instead of a laboratory environment. The overlap between fundraising and learning with the school greenhouse may be unique to agricultural education. Participants that needed to make a profit from their school greenhouse and thus had “higher stakes” on the vitality of the greenhouse often gave less responsibility to their students. This change in responsibility affected the type and depth of content students learned and the subsequent knowledge teachers’ sought.

To varying degrees, all of the participants believed a purpose of plant science was science integration. With the increased emphasis on science, technology, engineering, and math (STEM) education at the national level, agricultural education has been exploring their role in further integrating STEM in the secondary classroom (Stubbs & Myers, 2016). While teaching content based on community needs or student interest was described by various participants, there was also a need to address overarching science concepts that spanned agriculture and science disciplines. Curriculum for Agricultural Science Education (CASE) is one curriculum system that explores rigorous science concepts through student inquiry and experiential methods and provides teacher professional development on use of the curriculum (National Council for Agricultural Education, 2013). If agriculture teachers desire to prepare students for future careers, as evidenced by many of the participants’ views about the purpose of agricultural education, then perhaps the focus on science careers within the secondary classroom should increase. To facilitate this shift, agriculture teacher educators need to better prepare preservice teachers to seek out additional science knowledge and to collaborate with other science teachers both during and after student teaching. Tools such as the content representations (CoRe) rubric developed by Loughran, Berry, & Mulhall, (2012) could be utilized to assist agriculture teachers in breaking down science concepts they already address in their classrooms to facilitate their PCK development (Hume & Berry, 2011). It is recommended conversations continue among agricultural teachers and teacher educators about the role of agriculture in STEM education.

Another belief about plant science education that surfaced from the data was the assumption that students possessed more prior knowledge of plant science content than other agriculture content areas. Understanding student prior knowledge of content and utilizing this knowledge in teaching is reflected in various PCK models that address knowledge of content combined with knowledge of students (Gess-Newsome, 2015; Hill, Ball, & Shilling, 2008;
Magnusson et al., 1999; Park & Chen, 2012). However, some of the participants in the study, such as Jane, did not test their assumptions of student prior knowledge and instead just expected the knowledge was acquired in previous science courses. If students possess minimal or inaccurate content knowledge than the connections to new content may be weak or non-existent.

In order for student prior knowledge to facilitate absorption of new content it has to be activated, sufficient, appropriate, and accurate (Ambrose, Bridges, DiPietro, Lovett, & Norman, 2010). James, for example, was explicit in making connections between student prior knowledge and new content, evidenced from classroom observations and his dialogue with students. The extent to which students are able to connect the prior knowledge of a subject to new knowledge is dependent upon the nature of their prior knowledge, but also in the instructor’s ability to effectively harness that knowledge (Ambrose et al., 2010). Strategies recommended by Ambrose et al. (2010) for assessing student prior knowledge included talking to colleagues, administering assessments, having students assess their own knowledge, brainstorming to reveal knowledge, concept mapping, and examining student work for patterns of error. It is recommended agriculture teachers are both exposed to and encouraged to use these strategies in their own classrooms. Even if all of these strategies are employed and students possess accurate prior knowledge, it still does not guarantee they will be able to apply that knowledge to new material to sufficiently support further learning (Ambrose et al., 2010). Relying on student prior knowledge from elementary and middle school, as evidenced by many participants, may create gaps between what the students know and the new content being introduced.

Another strongly held belief by all the participants was it was the responsibility of the agriculture teacher to be a lifelong learner and reflector. This belief is particularly important because reflection is crucial for PCK development (Hashweh, 2005; Schneider & Plasman, 2011). The shared belief that learning and reflecting are critical to engage in throughout their teaching careers is most likely a factor in the development of these participants’ strong plant science PCK. The National Association of Agricultural Educators (2015) agriculture teachers’ creed, which hung in the classroom of multiple participants in the study, included a call for agriculture teachers to increase their knowledge of agriculture through studying, traveling, and exploration. The participants in this study strongly believed that accumulating new knowledge and reflecting on that knowledge was the responsibility of the individual agriculture teacher.

A couple participants surfaced that they thought current beginning agriculture teachers were not taking initiative to learn and reflect on content inservice. This lack of reflection could hinder their PCK development (Hashweh, 2005; Schneider & Plasman, 2011). Rice and Kitchel (2016) discovered beginning agriculture teachers often utilized coping strategies that involved ignoring content they were unfamiliar with or simply focusing on content in which they did have expertise. This study indicates a potential issue with the amount of learning that agriculture teachers are engaging in inservice. It is possible that beginning agriculture teachers do not truly understand what it means to be a lifelong learner and reflector. Or they may see the value in lifelong learning and reflection, but do not have the time and/or resources to commit to these tasks. It is recommended that teacher preparation programs encourage lifelong learning and reflection and provide preservice teachers with tools to engage in reflection. Traditionally during student teaching, reflection is limited to journal entries that often serve as a sounding board for the emotional challenges of student teaching. While this is a worthy area for support and growth, teacher educators must evaluate whether students are truly engaging in meaningful reflection about practice and approaching reflection as a vehicle for growing as a teaching professional.

PCK is one of the most effective knowledge bases for classroom teaching (Loughran et al., 2012); therefore, it is important to continue to unpack what is shaping teachers’ PCK development.
This data can be utilized in teacher preparation programs to surface or even positively alter teachers’ integrated belief systems and to connect the influence of experiences and context on those beliefs. Delving into the nuanced relationships between the three will be important as this area is understudied (Friedrichsen et al., 2010; Friedrichsen & Berry, 2015). Examination of what shapes PCK specifically in agriculture teachers can serve as a starting point for future PCK development studies specifically in agricultural education. Finally, this study focused just on plant science. Future studies should investigate other agricultural content areas such as animal sciences or agricultural mechanics to see what beliefs there are specific to those areas, how many beliefs (if any) overlap with plant science, and what is unique (if anything) to those content areas. The hands-on skill component of agricultural education that was regarded as a hallmark of the discipline by all of the participants could serve as an important vehicle to explore PCK further and could potentially contribute to the larger body of PCK research.

References


A National Analysis of School-Based Agricultural Education Involvement, Graduation, STEM Achievement, and Income

Aaron J. McKim¹, Jonathan J. Velez² & Tyson J. Sorensen³

Abstract

The progression of research on school-based agricultural education (SBAE) has been limited, in part, due to a lack of nationwide, student data detailing the effectiveness of SBAE. Using an ecological systems perspective, the relationships between SBAE enrollment; graduation rates; postsecondary science, technology, engineering, and mathematics (STEM) achievement; and income were explored using data from a nation-wide, longitudinal study conducted from 2002 to 2012. Results indicate SBAE students were more likely to be male, white, and have a lower socio-economic status than students not enrolled in SBAE. With regard to graduation rates, SBAE enrollment was a statistically significant, positive predictor of high school graduation. In fact, students enrolled in SBAE were 1.16 times more likely to graduate high school than students not enrolled in SBAE. In the analysis of STEM achievement, SBAE enrollment was a statistically significant, negative predictor of postsecondary science, math, and overall STEM GPA. With regard to income, each additional Carnegie unit of SBAE was related to $1,850.67 more annual income for high school graduates and $457.40 more annual income for postsecondary graduates. Findings are discussed in relation to the ecological systems theory, with an emphasis on recommendations for research and practice.

Keywords: school-based agricultural education; graduation; science achievement; math achievement; STEM achievement; income

Introduction and Theoretical Framework

As a smaller profession, with limited resources, researchers in school-based agricultural education (SBAE) have a difficult time developing nationwide, longitudinal studies which examine the effectiveness of SBAE. The lack of large-scale research leads to conversations about SBAE being riddled with questions such as “I wish we knew nationally if SBAE impacted STEM achievement” or “Is SBAE better preparing students for career success?” To continue forward, SBAE needs to answer the questions which directly impact the discipline. The goal of the current paper is to begin to answer a few of the critical, unanswered questions. In answering key questions, we welcome the potential cognitive disequilibrium created and embrace the opportunity to gain insight into opportunities to enhance and support SBAE.

¹ Aaron J. McKim is an Assistant Professor in the Department of Community Sustainability at Michigan State University, 480 Wilson Road Room 131, East Lansing, MI 48824, amckim@msu.edu.
² Jonathan J. Velez is an Associate Professor in the Department of Agricultural Education and Agricultural Sciences at Oregon State University, 108 Strand Agriculture Hall, Corvallis, OR 97331, jonathan.velez@oregonstate.edu.
³ Tyson J. Sorensen is an Assistant Professor of Agricultural Education in the School of Applied Sciences, Technology and Education at Utah State University, 2300 Old Main Hill, Logan, UT 84322, tyson.sorensen@usu.edu.
The current study seeks to break down prior limits of discourse regarding SBAE by identifying the relationship between SBAE enrollment, graduation rates, STEM achievement, and income using a national sample of secondary school students. Identifying the relationship between SBAE and critical outcomes will provide an opportunity for the discipline to reflect, plan, collaborate, and act in a more purposeful and informed manner. Additionally, the present study will account for three common limitations of current research which decrease our ability to holistically address the impacts of SBAE. Namely, limited generalizability due to non-longitudinal and state-wide studies, failure to account for mediating factors (e.g., sex, race, and socio-economic status), and failure to address STEM concepts other than science and math.

To provide a foundation on which to assess critical questions, we operationalized an ecological systems perspective (Bronfenbrenner, 1993; Lerner, 1995). The Ecological Systems theory posits human development and behavior are influenced by factors within different levels of environmental systems (i.e., individual, microsystem, mesosystem, exosystem, and macrosystem). Theorists with an ecological systems perspective contend a hierarchy of factors influence educational achievement (Bronfenbrenner, 1993). For example, because students (i.e., individual level) are rooted within a school system (i.e., microsystem and mesosystem), the teacher-student interaction, student-peer interaction, and student-academic program interaction can influence achievement. The emphasis of the current study is on the micro- and mesosystems; specifically, the influence of SBAE enrollment on graduation, STEM achievement, and income.

**Literature Review**

Three important outcomes related to secondary student enrollment in SBAE are considered in the current study: (a) graduation rates, (b) STEM achievement, and (c) income. Within the following review of literature, each of the identified outcomes are explicated by exploring literature throughout education.

**High School Graduation**

Dropping out of school has been a concern in American society for decades. In 2010, the Alliance for Excellence in Education (2010) reported approximately 1.3 million American children do not graduate each year, with about 7,000 students dropping out every day. Research indicates students most likely to drop out of school are of low academic ability, ethnic minority groups, or families in which parents did not graduate high school (Goldschmidt & Wang, 1999; Rumberger, 1995; Rumberger & Larson, 1998; Swanson & Schneider, 1999). Dropping out has negative effects on both the individual and society. Students who drop out are more likely to experience health problems, engage in criminal activity, earn less money, become dependent on government assistance programs, and not participate in the social or political process (Bridgeland, DiIulio, & Morison, 2006; Federal Student Aid Information Center, 2011; Hayes, Nelson, Tabin, Pearson, & Worthy, 2002; Martin, Tobin, & Sugai, 2003; Muennig, 2007).

The relationship between SBAE enrollment and graduation rates has received little attention in the literature. However, numerous studies have demonstrated a positive relationship between Career and Technical Education (CTE) and graduation (Plank, 2001; Plank, DeLuca, & Estacion, 2005). Additionally, evidence suggests CTE has a positive impact on the graduation rates of at-risk and special needs students, who enroll in CTE courses at a higher rate (Gray, 2004; Okou, 2004). In SBAE, FFA (i.e., a co-curricular student leadership organization) is an integral component of the curriculum (Croom, 2008). Research suggests additional experiences, similar to FFA, reduce drop out (Mahoney & Cairns, 1997); more specifically, extracurricular activities yield students 2.3 times more likely to remain in school (Davalos, Chavez, & Guardiola, 1999).
Furthermore, Bridgeland et al. (2006) suggest work-related experiences, which are foundations of SBAE, could have improved the graduation chances for 81% of dropouts. SBAE appears to offer graduation-enhancing experiences; unfortunately, no research has explored the relationship between graduation rates and SBAE enrollment on a national scale.

### STEM Achievement

A large body of research indicates CTE courses offer opportunities to learn core academic (e.g., science, math) content (Brigman & Campbell, 2003; Dahir & Stone, 2003; Gysbers & Lapan, 2001; Silverberg, Warner, Fong, & Goodwin, 2004). However, research on the efficacy of academic learning within CTE courses has produced mixed results. Some studies suggest CTE students lag behind in mathematics achievement compared to students in other academic tracks (Crain et al., 1999; Plank, 2001) while other studies suggest students perform better in mathematics when it is integrated into CTE coursework (Nolin & Parr, 2013; Stone, Alfred, Pearson, Lewis, & Jensen, 2006). Similar to math, results vary in terms of SBAE enrollment and science achievement (McKim, Velez, Lambert, & Balschweid, 2017). Some studies suggest enhanced science learning among SBAE students (Chiasson & Burnett, 2001; Ricketts, Duncan, & Peake, 2006; Ross, 2001; Theriot & Kotrlik, 2009) while others identify no statistical difference (Connors & Elliot, 1995; Nolin & Parr, 2013) or significantly lower science achievement (Despain, North, Warnick, & Baggaley, 2016; Israel, Myers, Lamm, & Galindo-Gonzalez, 2012). Mixed results intensify the need for national research on the STEM achievement of SBAE enrollees.

### Income

Income, the third outcome variable, has been sparsely explored in SBAE. However, in CTE, a 12-year longitudinal study indicated individuals who devoted about one-sixth of their high school enrollment to CTE earned at least 12% more one year after graduation and about 8% more seven years after graduation (Bishop & Mane, 2004). Another study compared CTE and non-CTE students who go directly into the workplace and found CTE students earned higher wages and were more likely to be employed in higher wage segments of the economy (Huang & Gray, 1992).

Existing research illuminates the potential for CTE, and in some cases SBAE, to positively influence graduation rates, STEM achievement, and income. However, for SBAE to advance, three important limitations must be addressed: (a) research specific to SBAE, (b) national research, and (c) attention to mediating factors such as sex, race, and socio-economic status (SES). In the current study, we sought to address the identified limitations by exploring the relationship between SBAE involvement, graduation rates, STEM achievement, and income among a national sample of secondary school students when accounting for sex, race, and SES.

### Purpose and Objectives

The purpose of the current study was to explore the relationship between SBAE enrollment, graduation rates, STEM achievement, and income among a nationally representative sample of secondary school students. The identified purpose was accomplished by addressing the following research objectives.

1. Describe the sex, race, and socio-economic status (SES) of public school students.

2. Determine the relationship between SBAE enrollment and high school graduation, accounting for sex, race, and SES.
3. Determine the relationship between SBAE enrollment and measurable achievement in STEM, accounting for sex, race, and SES.

4. Determine the relationship between SBAE enrollment and income, accounting for sex, race, and SES.

Methods

Research objectives were accomplished by analyzing data from the National Center for Educational Statistics (National Center for Educational Statistics, 2002), Educational Longitudinal Study (ELS:2002-2012), initially collected from 2002 to 2012. We retained a restricted use data file to allow for the tracking of students through 2012. The final data release, including postsecondary data, occurred in April 2015.

Population and Data Collection

The population for this study included all American high school sophomores in the spring of 2002. A stratified sample was utilized to reduce sampling error and to create subgroups of schools from which schools were independently selected. Initially, schools were stratified by superstrata (i.e., school type or sector and geographic region) and substrata (i.e., urban, suburban, rural) (U.S. Department of Education, 2004). A total of 800 high schools were selected, with 752 schools agreeing to participate (94% participation rate). Once schools agreed to participate, a rigorous recruitment process began with students, teachers, parents, librarians, and school administrators. In total, 15,362 high school sophomores from 50 states and the District of Columbia participated. Additional detailed methodological information can be found in the U.S. Department of Education, National Center for Educational Statistics, Education Longitudinal Study of 2002: Base Year Data File User’s Manual (2004). With the exception of the first research objective, analysis was limited to public schools where SBAE was offered. Private schools, charter schools, or religiously affiliated schools were not included in the research frame.

Statistical Analysis

For the first research objective, descriptive statistics were used to describe the population. Objectives two to four were accomplished via logistic and linear regressions, after accounting for the four primary assumptions of regression analyses (Hair, Anderson, Tatham, & Black, 2006). Research objective one, pertaining to the actual demographics of the sample, was analyzed using unweighted data while research objectives two to four were analyzed with weighted data. Weighting data is typical to compensate for unequal probabilities of sample selection and to adjust for actual participation in the survey (U.S. Department of Education, 2004). The use of weighted data afforded enhanced statistical clarity, enabling generalizations to all high school sophomores enrolled in the United States in 2002.

During statistical analysis, several variables were considered which, while commonly used, bear explanation. Carnegie units were used as a categorical descriptor of SBAE units. Carnegie units are defined as, “A standard of measurement used for secondary education that represents the completion of a course that meets one period per day for one year” (U.S. Department of Education, 2004, p. E-17). Socio-economic status (SES) was a composite variable which included five equally weighted standardized categories: (a) father’s/guardian’s education, (b) mother’s/guardian’s education, (c) family income, (d) father’s/guardian’s occupation and (e) mother’s/guardian’s occupation. Occupation was standardized using the 1961 Duncan index for determining occupational prestige (U.S. Department of Education, 2004). In research objective one, SES is
broken into four quartiles of lowest, mid to low, mid to high, and highest. In accordance with previous research (e.g., Plank et al., 2005) SES, sex, and race were included as control variables for research objectives two through four. Within the analyses, SES was a continuous variable, sex was dichotomous (i.e., 0 = male; 1 = female), and race was categorical.

Findings

In total, students in the sample enrolled in public schools included slightly more females ($f = 4,750; 50.13\%$) than males ($f = 4,730; 49.87\%$). A slight majority of females was also observed within public schools not offering SBAE and for students in public schools where SBAE was offered, but they did not enroll (see Table 1). For students enrolled in SBAE at a public school, the majority were male ($f = 550; 60.90\%$). Additionally, students in SBAE included a comparatively higher proportion of white ($f = 610; 70.83\%$), Hispanic ($f = 120; 13.89\%$), American Indian/Alaska Native ($f = 20; 2.33\%$), and Native Hawaiian/Pacific Islander ($f < 10; 0.35\%$) students. However, a smaller proportion of Black or African American ($f = 80; 8.98\%$) and Asian ($f = 30; 3.62\%$) students enrolled in SBAE coursework. For socio-economic status (SES), students enrolled in SBAE were from a lower SES when compared to their peers.

Research objective two sought to determine the relationship between SBAE enrollment and high school graduation after accounting for sex, race, and socio-economic status (see Table 2). The logistic regression produced a statistically significant model ($x^2 = 37,105.73; p$-value $< .001$) that explained 7% of the variance in high school graduation ($R^2 = .07$). After accounting for sex, race, and SES, enrollment in SBAE was a statistically significant, positive predictor ($B = .15; p$-value $< .001$) of high school graduation. Furthermore, students who enrolled in SBAE were 1.16 times more likely than students who did not enroll in SBAE to graduate from high school (Odds Ratio $= 1.16$).
Table 1

Sex, Socio-Economic Status, and Race of Respondents

<table>
<thead>
<tr>
<th></th>
<th>Public Schools, SBAE Offered</th>
<th>All Public Schools</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Students Enrolled in SBAE</td>
<td>Students Not Enrolled in SBAE</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>550 (60.90%)</td>
<td>1,480 (47.09%)</td>
</tr>
<tr>
<td>Female</td>
<td>360 (39.10%)</td>
<td>1,660 (52.91%)</td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
</tr>
<tr>
<td>American Indian/Alaska  Native</td>
<td>20 (2.33%)</td>
<td>40 (1.37%)</td>
</tr>
<tr>
<td>Asian</td>
<td>30 (3.62%)</td>
<td>280 (9.49%)</td>
</tr>
<tr>
<td>Black or African American</td>
<td>80 (8.98%)</td>
<td>350 (11.80%)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>120 (13.89%)</td>
<td>390 (13.07%)</td>
</tr>
<tr>
<td>Native Hawaiian/Pacific Islander</td>
<td>&lt;10 (0.35%)</td>
<td>10 (0.27%)</td>
</tr>
<tr>
<td>White</td>
<td>610 (70.83%)</td>
<td>1,920 (64.00%)</td>
</tr>
<tr>
<td>Socio-Economic Status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lowest</td>
<td>130 (14.41%)</td>
<td>360 (11.51%)</td>
</tr>
<tr>
<td>Mid to Low</td>
<td>490 (54.41%)</td>
<td>1,340 (43.20%)</td>
</tr>
<tr>
<td>Mid to High</td>
<td>260 (29.27%)</td>
<td>1,190 (38.15%)</td>
</tr>
<tr>
<td>Highest</td>
<td>20 (1.90%)</td>
<td>220 (7.14%)</td>
</tr>
</tbody>
</table>

Note. All frequencies rounded to the nearest 10, per IES restricted-use guidelines.
Research objective three, which sought to determine the relationship between SBAE enrollment and STEM achievement, was analyzed using three linear regressions. First, postsecondary GPA in mathematics courses was analyzed in relation to units of SBAE when controlling for sex, race, and SES (see Table 3). The regression analysis was statistically significant ($F = 5,990.81; p$-value < .001) and explained 6% of the variance in postsecondary mathematics GPA ($R^2 = .06$). After accounting for sex, race, and SES, units in SBAE was a statistically significant, negative predictor ($\beta = -.08; p$-value < .001) of postsecondary mathematics GPA.

In addition to using postsecondary GPA in mathematics, we analyzed the postsecondary GPA of students in science using multiple linear regression (see Table 4). The final model was statistically significant ($F = 5,933.00; p$-value < .001) and predicted 5% of the variance in postsecondary science GPA. Units in SBAE was a statistically significant, negative predictor ($\beta = -.02; p$-value < .001) of postsecondary science GPA.
Table 4

Relationship between SBAE Enrollment and GPA in Postsecondary Science Courses

<table>
<thead>
<tr>
<th>Dependent Variable: GPA in Postsecondary Science Courses</th>
<th>$B$</th>
<th>$SEB$</th>
<th>$\beta$</th>
<th>$p$-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>.13</td>
<td>.00</td>
<td>.06</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Race</td>
<td>.05</td>
<td>.01</td>
<td>.11</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Socio-Economic Status</td>
<td>.22</td>
<td>.00</td>
<td>.16</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Units in SBAE</td>
<td>-.03</td>
<td>.00</td>
<td>-.02</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

*Note. $R = .22$, $R^2 = .05$, $F = 5,933.00$, $p$-value < .001.*

The third analysis for research objective three included GPA in all postsecondary STEM courses (i.e., including technology and engineering) as the dependent variable (see Table 5). The final model was statistically significant ($F = 12,144.22; p$-value < .001) and predicted 8% of the variance in GPA in all postsecondary STEM courses ($R^2 = .08$). After accounting for sex, race, and SES, units in SBAE was a statistically significant, negative predictor ($\beta = -.03; p$-value < .001) of postsecondary STEM GPA.

Table 5

Relationship between SBAE Enrollment and GPA in Postsecondary STEM Courses

<table>
<thead>
<tr>
<th>Dependent Variable: GPA in Postsecondary STEM Courses</th>
<th>$B$</th>
<th>$SEB$</th>
<th>$\beta$</th>
<th>$p$-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>.25</td>
<td>.00</td>
<td>.12</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Race</td>
<td>.07</td>
<td>.00</td>
<td>.16</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Socio-Economic Status</td>
<td>.22</td>
<td>.00</td>
<td>.15</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Units in SBAE</td>
<td>-.03</td>
<td>.00</td>
<td>-.03</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

*Note. $R = .28$, $R^2 = .08$, $F = 12,144.22$, $p$-value < .001.*

After analyzing the relationships between units in SBAE and GPA in math, science, and STEM coursework using linear regressions, different levels of involvement in SBAE and mean, postsecondary GPA in math, science, and STEM courses were reviewed (see Table 6). Evaluating GPA by levels of SBAE involvement illuminated potential levels of involvement which may have yielded a higher GPA than no involvement in SBAE. Within math, mean GPA with no units of SBAE ($M = 2.64; SD = 1.08$) exceeded all levels of SBAE involvement (i.e., the highest GPA for SBAE involvement was for 4.00 to 4.99 Carnegie units; $M = 2.56; SD = 1.06$). The same pattern was observed within science, where the GPA of science with no units of SBAE ($M = 2.57; SD = 0.98$) exceeded all levels of SBAE involvement (i.e., highest GPA at 4.00 to 4.99 Carnegie units; $M = 2.54; SD = 0.87$). Within postsecondary GPA for all STEM courses, students having been enrolled in 4.00 to 4.99 Carnegie units of SBAE ($M = 2.54; SD = 0.98$) slightly exceeded the GPA of students not enrolled in SBAE ($M = 2.50; SD = 0.97$).
In the fourth research objective, focus transitioned from academics (i.e., graduation and postsecondary GPA) to labor market outcomes, specifically income. First, the relationship between units in SBAE and the 2011 income of high school graduates (see Table 7) and postsecondary graduates (see Table 8) were explored separately due to differences in earning potential among the two groups. For high school graduates who did not pursue postsecondary schooling, the model with sex, race, SES, and units in SBAE was statistically significant ($F = 5,767.09$; $p$-value < .001) and predicted 17% of the variance in income ($R^2 = .17$). When accounting for sex, race, and SES, units in SBAE was a statistically significant, positive predictor ($\beta = .10$; $p$-value < .001) of 2011 income. Using the unstandardized beta (i.e., $B$), a one Carnegie unit increase in SBAE enrollment was related to $1,850.67 more in 2011 income.

### Table 6

**Comparison of Units of SBAE and Math, Science, and STEM Post-Secondary GPA**

<table>
<thead>
<tr>
<th>Units of SBAE</th>
<th>Mathematics GPA</th>
<th>Science GPA</th>
<th>STEM GPA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$f$</td>
<td>$M$</td>
<td>$SD$</td>
</tr>
<tr>
<td>None</td>
<td>371,681</td>
<td>2.64</td>
<td>1.08</td>
</tr>
<tr>
<td>0.01 to 0.99</td>
<td>10,014</td>
<td>2.37</td>
<td>1.01</td>
</tr>
<tr>
<td>1.00 to 1.99</td>
<td>28,441</td>
<td>2.32</td>
<td>1.18</td>
</tr>
<tr>
<td>2.00 to 2.99</td>
<td>11,885</td>
<td>2.37</td>
<td>1.20</td>
</tr>
<tr>
<td>3.00 to 3.99</td>
<td>7,243</td>
<td>2.22</td>
<td>1.15</td>
</tr>
<tr>
<td>4.00 to 4.99</td>
<td>6,778</td>
<td>2.56</td>
<td>1.06</td>
</tr>
<tr>
<td>5.00 or more</td>
<td>1,906</td>
<td>1.75</td>
<td>1.32</td>
</tr>
</tbody>
</table>

*Note.* Frequencies provided reflect weighted data.
Table 7

Relationship between SBAE Enrollment and Income for High School Graduates

<table>
<thead>
<tr>
<th></th>
<th>Dependent Variable: Income in 2011</th>
<th>B</th>
<th>SEB</th>
<th>β</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>-14,908.10</td>
<td>11.57</td>
<td>-.38</td>
<td>&lt;.001</td>
<td></td>
</tr>
<tr>
<td>Race</td>
<td>935.24</td>
<td>24.80</td>
<td>.11</td>
<td>&lt;.001</td>
<td></td>
</tr>
<tr>
<td>Socio-Economic Status</td>
<td>-313.04</td>
<td>95.54</td>
<td>-.01</td>
<td>.001</td>
<td></td>
</tr>
<tr>
<td>Units in Agricultural Education</td>
<td>1,850.67</td>
<td>51.53</td>
<td>.10</td>
<td>&lt;.001</td>
<td></td>
</tr>
</tbody>
</table>

Note. $R = .41$, $R^2 = .17$, $F = 5,767.09$, $p$-value < .001.

Similar to the previous analysis, 2011 income for postsecondary graduates was analyzed in a regression with sex, race, SES, and units in SBAE (see Table 8). The model was statistically significant ($F = 11,118.79$; $p$-value < .001) and predicted 6% of the variance in 2011 income for postsecondary graduates ($R^2 = .06$). After accounting for sex, race, and SES, units in SBAE was a statistically significant, positive predictor ($\beta = .02$; $p$-value < .001) of income among postsecondary graduates. Furthermore, an additional Carnegie unit of SBAE was related to an additional $457.40 in 2011 income.

Table 8

Relationship between SBAE Enrollment and Income for Postsecondary Graduates

<table>
<thead>
<tr>
<th></th>
<th>Dependent Variable: Income in 2011</th>
<th>B</th>
<th>SEB</th>
<th>β</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>-8,944.55</td>
<td>54.06</td>
<td>-.19</td>
<td>&lt;.001</td>
<td></td>
</tr>
<tr>
<td>Race</td>
<td>570.01</td>
<td>13.11</td>
<td>.05</td>
<td>&lt;.001</td>
<td></td>
</tr>
<tr>
<td>Socio-Economic Status</td>
<td>3,740.27</td>
<td>39.75</td>
<td>.11</td>
<td>&lt;.001</td>
<td></td>
</tr>
<tr>
<td>Units in Agricultural Education</td>
<td>457.40</td>
<td>30.82</td>
<td>.02</td>
<td>&lt;.001</td>
<td></td>
</tr>
</tbody>
</table>

Note. $R = .24$, $R^2 = .06$, $F = 11,118.79$, $p$-value < .001.

In addition to exploring the relationship between involvement in SBAE and income using linear regressions, the mean 2011 income for varying levels of enrollment was analyzed (see Table 9). For high school graduates, five of the six levels of SBAE enrollment (i.e., 1.00 to 1.99, 2.00 to 2.99, 3.00 to 3.99, 4.00 to 4.99, and more than 5.00 units of SBAE) exceeded the income of individuals who did not enroll in SBAE ($M = 19,307.43$; $SD = 18,097.71$) with the starkest difference illustrating students who enrolled in 4.00 to 4.99 Carnegie units of SBAE ($M = 31,248.58$; $SD = 20,317.49$) made $11,951.15 more in 2011 than students who did not enroll in SBAE. For post-secondary graduates, three of the six levels of SBAE enrollment (i.e., 3.00 to 3.99, 4.00 to 4.99, and more than 5.00 units of SBAE) yielded a higher 2011 income than students who did not enroll in SBAE ($M = 26,384.15$; $SD = 23,854.15$) with the starkest difference showcasing students who enrolled in more than 5.00 Carnegie units of SBAE ($M = 35,031.05$; $SD = 18,408.24$) earned $8,646.06 more than students who did not enroll in SBAE.
Table 9

Comparison of Units of SBAE and Income

<table>
<thead>
<tr>
<th>Units of SBAE</th>
<th>High School Graduate, No Post-Secondary</th>
<th></th>
<th>Post-Secondary Diploma</th>
</tr>
</thead>
<tbody>
<tr>
<td>f</td>
<td>M</td>
<td>SD</td>
<td>f</td>
</tr>
<tr>
<td>None</td>
<td>87,112</td>
<td>19,307.43</td>
<td>18,097.71</td>
</tr>
<tr>
<td>0.01 to 0.99</td>
<td>6,763</td>
<td>16,875.94</td>
<td>17,472.04</td>
</tr>
<tr>
<td>1.00 to 1.99</td>
<td>15,422</td>
<td>26,434.82</td>
<td>26,101.01</td>
</tr>
<tr>
<td>2.00 to 2.99</td>
<td>9,071</td>
<td>29,066.12</td>
<td>21,093.75</td>
</tr>
<tr>
<td>3.00 to 3.99</td>
<td>2,128</td>
<td>27,206.06</td>
<td>11,557.69</td>
</tr>
<tr>
<td>4.00 to 4.99</td>
<td>1,707</td>
<td>31,248.58</td>
<td>20,317.49</td>
</tr>
<tr>
<td>5.00 or more</td>
<td>1,130</td>
<td>25,750.47</td>
<td>10,504.23</td>
</tr>
</tbody>
</table>

Note. Frequencies provided reflect weighted data.

Conclusions and Discussion

A goal of the current study was to spark informed conversations about the status and future directions of SBAE. Therefore, the conclusions and discussions are purposefully designed to initiate conversations by introducing readers to pivotal questions emerging from the results of the current study. Before moving forward, however, we must address two limitations. First, data collection began in 2002 and concluded in 2012, with final results available in 2015. Given the timeframe and the continual evolution of education, society, and SBAE, the current picture may vary from the findings. Unfortunately, longitudinal research takes time, and given the many years needed to collect data, we will not realize any more nationally representative data of this scale for some time. Second, analyses of the research objectives yielded limited explanatory power (i.e., $r^2$ values ranged from .05 to .17). Human achievement is the product of complex networks of variables (e.g., location, personality, professional networks) not considered in the current study, which explain the unaccounted variances. When formulating the discussion, identified limitations were taken into consideration with purposeful focus on practically significant results and discussions to illuminate how data collected from 2002 to 2012 inform current and future practices in SBAE.

Question 1: Recruiting Black and Asian Students

Comparing the demographics of respondents enrolled in public high schools illuminates a lower proportion of Black and Asian students in SBAE courses. Previously, limited minority enrollment in SBAE may have been rationalized by pointing to the higher proportion of SBAE programs in rural, largely white communities. However, these data illustrate when Black and Asian students have the option to enroll in SBAE, they do so at a lower rate than their peers. The missing perspectives of Black and Asian students has the potential to weaken SBAE and could be a contributing factor to less diversity within professional agriculture, food, and natural resource (AFNR) sectors. Within SBAE, conversations must begin to answer - what should we be doing to engage more Black and Asian students?

As a profession, SBAE must act with purpose and intention to understand the reduced enrollment of Black and Asian students. To provide direction, the decisions of Black and Asian
students to enroll, or not enroll in SBAE should be considered from an ecological systems perspective. Specifically, analysis should be done at the microsystem and macrosystem levels. At the microsystem level, efforts should explore the influence of teacher to student, student to peer, and student to SBAE program interactions to identify potential roadblocks to Black and Asian student enrollment. Additionally, efforts should explore the macrosystem level; specifically, research into the intersections of Black and Asian culture, agriculture, and SBAE. Research will be necessary to address these potential influencers on a broader scale. However, we recommend SBAE programs and teacher education programs evaluate the content, culture, and norms of focus and how current programmatic foci influence recruitment of Black and Asian students. As a product of research and programmatic evaluations, we look forward to a collective conversation in SBAE regarding areas for improvement as well as current areas of strength with regard to recruiting Black and Asian students.

Question 2: Evaluating STEM Learning in SBAE

In an effort to understand the relationship between SBAE enrollment and STEM learning, the relationship between units of SBAE and postsecondary math, science, and STEM GPA were analyzed. First, we recognize the limitations of this analysis; specifically, the potential evolution of SBAE since 2002 with regard to STEM education; the potential variations in postsecondary institutions, courses, instructors, and grading processes; and individual student factors which may have influenced our analyses. Acknowledging those limitations, findings from this research provided no evidence SBAE enrollment was related to increased math, science, or STEM GPA at the postsecondary level. In fact, evidence emerged linking increased SBAE coursework to reduced math, science, and postsecondary STEM GPA. Importantly, these findings are not the first to suggest SBAE does not improve measurable STEM achievement (Connors & Elliot, 1995; Despain et al., 2016; Israel et al., 2012; Nolin & Parr, 2013).

Initially, findings may cause concern regarding the impact of SBAE enrollment on STEM learning; however, we believe findings illuminate a chasm between the envisioned role of SBAE in STEM and the way STEM learning is evaluated. Throughout the history of the discipline, SBAE has claimed teaching agriculture, food, and natural resources (AFNR) contextualized STEM concepts. However, research into the STEM learning of students in SBAE consistently uses decontextualized STEM achievement as the outcome of interest. Within the current study, postsecondary STEM GPA was considered as an indicator of STEM achievement. While dependent on institution, course, and instructor, postsecondary STEM courses rarely contextualize concepts within AFNR; therefore, as others before us, we used a decontextualized outcome to measure a contextualized approach to STEM learning. Within SBAE, conversations must begin to answer — what must change to better connect the STEM learning approach of SBAE to the way we evaluate STEM knowledge?

Connecting practice and evaluation is critical for the continued evolution of STEM and AFNR learning. To link practice and evaluation, two approaches should be considered: (a) re-conceptualize the role of SBAE as a method through which students learn decontextualized STEM concepts or (b) develop new methods to evaluate contextualized STEM knowledge and skills. Recognizing the critical importance of AFNR knowledge and skills as well as the ethos of SBAE (i.e., to build AFNR knowledge) we encourage maintaining the contextualized STEM education approach in combination with the development, and use, of new evaluation methods focused on contextualized STEM knowledge and skills.
Question 3: Positioning AFNR for Future Success

In the current study, three potential outcomes of student enrollment in SBAE (i.e., graduation, STEM achievement, and income) were considered. As discussed, no evidence emerged linking SBAE enrollment and STEM achievement. However, evidence suggested SBAE enrollment was related to increased graduation rates and higher incomes. The positive relationship between SBAE and graduation rates supports existing literature identifying a positive relationship between CTE and graduation (Plank, 2001; Plank et al., 2005). Likewise, the positive relationship between SBAE enrollment and income supports existing research evaluating CTE enrollment and income (Bishop & Mane, 2004; Haung & Gray, 1992).

First, and foremost, findings provide an exciting foundation for marketing current and future SBAE programs. Specifically, marketing information should highlight three findings, (a) students who enrolled in SBAE were 1.16 times more likely to graduate high school than students who did not enroll in SBAE, (b) each additional Carnegie unit (i.e., one course, one period a day, for one year) of SBAE enrollment was related to $1,850.67 more in annual income among high school graduates, and (c) each additional Carnegie unit of SBAE enrollment was related to $457.40 more in annual income among postsecondary graduates. Second, findings, especially when juxtaposed with those of STEM achievement, provide an opportunity to reflect on, and discuss, – what disciplinary foci best positions SBAE for future relevance and an enhanced impact on students?

In 1988, the focus of SBAE transitioned from vocational preparation to STEM (i.e., emphasizing science) knowledge building (McKim et al., 2017). This transition was a critical maneuver to ensure the continued relevance of the discipline in light of social pressure on education to focus on core academic subjects. However, the findings from the current study do not appear to support this transition. In fact, graduation rates and income (i.e., two areas positively associated with SBAE enrollment) are more closely aligned outcomes of vocational preparation than STEM achievement (i.e., the one area negatively associated with SBAE enrollment). For the SBAE discipline to increase in relevance and positive student impact, which outcome(s) should the discipline strive for? Should SBAE continue to push STEM learning with the hope of measurable student success? Should SBAE return to its vocational roots, marketing the discipline as a way to enhance graduation rates and the professional earning potential of students? Should SBAE attempt to combine goals, seeking to enhance STEM learning and vocational development? Is there a new outcome (e.g., ecological problem solving, leadership, social equity) which would better propel SBAE in an enhanced direction? Engaging in conversations around potential future directions is a challenging, yet valuable, endeavor.

Answering unanswered questions often provides a foundation to ask more questions. In this study, we sought to pose challenging questions. Engaging in the self-reflection and critical conversations required to answer the questions may at times prove difficult. However, progression as a discipline depends on the collective willingness of SBAE professionals, at all levels, to address these challenging questions with a commitment to better the experience of SBAE students, today and tomorrow.

References


Lessons Learned: Describing the Preservice Preparation Experiences of Early-Career Award-Winning Agricultural Educators

Lockie Breeding¹, John Rayfield² & Kasee L. Smith³

Abstract

This study was designed to describe the experiences of National Association of Agricultural Educators (NAAE) Outstanding Young Member award winners. These teachers were asked about the concepts that they were most and least prepared for upon entering the teaching field. A modified Delphi method was used to collect data utilizing three rounds of researcher-developed questionnaires. Round one included open-ended and demographic-type questions. Rounds two and three were constructed using panelists’ answers from previous rounds and included Likert-type, five-point rating scales. These award winning teachers felt most prepared to: 1) teach animal science, 2) provide classroom instruction, and 3) teach introductory lessons or units. They felt least prepared to: 1) plan for retirement and 2) manage work-life balance. The findings of this study may provide a framework for teacher education programs and teacher in-service workshops that will aid in more comprehensive training and development of future agricultural education teachers.

Introduction

New agriculture teachers are facing a well-documented battle upon entering the profession (Camp, Broyles, & Skelton, 2002; Duncan, Ricketts, Peake, & Uesseler, 2006; Joerger, 2002; Layfield & Dobbins, 2002; Myers, Dyer, & Washburn, 2005; Roberts & Dyer, 2004; Stair, Warner, & Moore, 2012; Washburn & Dyer, 2006). As novice educators navigate through the first few years in the classroom, they encounter troublesome issues including managing time, organizing and planning FFA chapter events and activities, and dealing with student discipline (Myers, Dyer, & Washburn, 2005). If not addressed, these problems may have the potential to make new teachers feel overwhelmed, ineffective, and eventually seek employment opportunities elsewhere (Bennett, Iverson, Rohs, Langone, & Edwards, 2002). The field of agricultural education is facing shortages (Foster, Lawver, & Smith, 2014), and cannot afford for those who have started in the profession to change their minds and leave, which increases the urgency in addressing the concerns of early-career agricultural educators.

The in-service needs of new agricultural educators have been previously examined in an effort to inform teacher preparation programs of potential topics to add or strengthen in preservice instruction (Birkenholz & Harbstreit, 1987; Duncan, Ricketts, Peake, & Uesseler, 2006; Edwards & Briers, 1999; Garton & Chung, 1996; Joerger, 2002; Layfield & Dobbins, 2002; Mundt & Connors, 1999; Roberts & Dyer, 2004; Washburn & Dyer, 2006). The need for this study stems from the desire to collect current data related to the specific preparation needs of early-career agricultural educators in the United States.

¹ Lockie Breeding, Forney Independent School District
² John Rayfield is an Associate Professor in the Department of Agricultural Education, and Communications at Texas Tech University, Box 42131, Lubbock, TX 79404-213, john.rayfield@ttu.edu
³ Kasee L. Smith is an Assistant Professor in the Department of Agricultural and Extension Education at the University of Idaho, 875 Perimeter Drive, MS 2040, Moscow, ID, 83844-2040, klsmith@uidaho.edu
In order to describe new agricultural educators’ perceived strengths and weaknesses in their preservice preparation programs, we solicited the knowledge and opinions of the 2010-2014 National Association of Agricultural Educators (NAAE) Outstanding Young Member regional award winners. These teachers were peer-rated as exceptional early-career agriculture teachers from each of the NAAE regions. We sought input from these individuals regarding their preparation and transition to the classroom. By examining the thoughts regarding preparation of new teachers who had persevered through the difficult transition from teacher candidate to teacher successfully, we sought to find information related to how teacher preparation programs had played a role in these individuals’ success, and determine future directions for agricultural education preservice training.

**Challenges of New Agricultural Educators**

Because of the extensive amount of work with which an agriculture teacher is tasked (Torres, Ulmer, & Ashenbrener, 2008), early-career teachers risk becoming overwhelmed and may experience a type of reality-shock in the transition from student teacher to full-time teacher (Veenman, 1984). An examination of this topic requires a review of literature related to challenges of early-career agricultural educators, along with an examination of in-service needs of novice agricultural educators.

The body of literature lends evidence for a strong case related to the time management challenges faced by early-career agriculture teachers. Time management has been noted as a common problem reported by early-career teachers (Boone & Boone, 2009; Lambert, Henry, & Tummons, 2011; Murray, Flowers, Croom, & Wilson, 2011; Torres, Ulmer, & Aschenbrener, 2008; Touchstone, 2015). In a study of award winning agriculture teachers by Mundt and Connors (1999), three out of eight early agricultural educator problems identified were associated with time management. Understanding more about how prepared early-career agricultural education teachers feel in regard to time management may shed light on this noted concern, and allow teacher educators to determine if additional preparation in this area is warranted.

Although time management is prevalent in the literature, other challenges have been highlighted for beginning agricultural educators. A study of novice agricultural educators by Talbert, Camp, and Heath-Camp (1994) revealed that respondents, who differed in both gender and type of preparation, reported issues with student discipline and isolation from co-workers. They also faced problems including lesson planning and classroom/laboratory management (Talbert, et al., 1994). Myers, Dyer, and Washburn (2005) conducted a Delphi study which yielded 11 major issues facing these early-career agriculture teachers. The top five problems included organizing FFA chapter events and activities, managing student discipline in the classroom, organizing effective alumni chapters, organizing effective advisory committees, and recruiting and retaining alumni members (Myers et. al, 2005).

**Determining Needs of Early-Career Agricultural Educators**

Determining the in-service needs of preservice teachers through descriptive measures has also revealed areas for growth in teacher preparation programs. Layfield and Dobbins (2002) compared in-service needs of both early and established agricultural educators and concluded that needs differ based on experience level. Among the topics suggested for early-career educators were preparing for Career Development Events (CDEs), developing student supervised agricultural experiences (SAEs), and developing adult education programs and advisory committees (Layfield & Dobbins, 2002). Touchstone (2015) outlined the in-service needs for beginning agricultural educators in Idaho to include training in time management, classroom management, and program
funding. Researchers have also recommended a higher need for in-service education in the fields of instruction, program planning, development and evaluation, and program administration (Garton & Chung, 1996; Joerger & Boettcher, 2000; Stair, Warner, & Moore, 2012). Although many needs assessments of early-career agricultural educators have been conducted, many of them are limited in scope and examine only a single state or region, rather than providing a national-level view. This study was developed in an effort to provide a national view of the preparation for new agricultural educators who had successfully navigated their first few years in the classroom.

There may be challenges and in-service needs of novice teachers which are unrealistic for teacher preparation program to address, and there is an expectation that a portion of learning how to be an effective teacher comes from in-service experience (Lytle, 2000). Describing the perceived preparation levels of early-career agricultural educators may provide insight into challenges and areas which new teachers feel additional training during teacher preparation would have been helpful to their in-service experience. By conducting current research into the perceived preparation levels of early-career agricultural educators on a national level, teacher educators can begin to evaluate teacher education programs and implement positive changes to give in-service support in areas where teachers feel less prepared.

Theoretical Foundation and Conceptual Framework

The framework for this study was based on Chapman’s (1984) model of teacher retention. We conceptually adapted and simplified Chapman’s (1984) model to conform more closely with the subjects and parameters of this study. This portion of a larger study was designed to examine only the adequacy of teacher preparation program influence mentioned in Chapman’s (1984) complete framework. Our revised conceptual model for teacher retention is shown in Figure 1.

Figure 1. A conceptual model of the influences associated with teacher retention and attrition, adapted from Chapman (1984).

The model depicts the perceived adequacy of preparation as a potential contributing factor in the decision to remain in or leave the teaching profession. According to Chapman (1984), if a teacher feels adequately prepared in a subject, he or she may have a better chance of remaining in the teaching profession; if he or she feels inadequately prepared, he or she is faced with the choice to seek additional in-service preparation and, if corrective in-service training is not available, he or
she may choose to leave the profession. Looking at preparation experiences for teachers who chose to stay in the profession, and comparing the preservice experience of successful teachers to those who chose to leave teaching may provide valuable insight into practices which impact early-career retention and job satisfaction.

**Purpose and Objectives**

The purpose of this study was to describe the specific teaching activities early-career agriculture teacher award winners felt prepared and unprepared for through their teacher preparation program. To accomplish this purpose, the following research objectives were employed:

1. Identify demographic characteristics of NAAE Outstanding Young Member award winners from 2010-2014.
2. Describe the aspects of teaching agriculture early-career teacher award winners reported being most prepared for by their teacher preparation program.
3. Describe the aspects of teaching agriculture early-career teacher award winners reported being least prepared for by their teacher preparation program.

**Methods**

This descriptive study employed the use of Delphi survey techniques using three rounds of researcher-developed questionnaires. The basic Delphi procedures as outlined by Hsu and Sandford (2007) were adapted to meet the needs of this study and allowed for online data collection. Delphi is noted to be highly effective at obtaining a consensus among a sample group of purposively selected individuals (Stufflebeam, McCormick, Binkerhoff, & Nelson, 1985).

Round one of the series of questionnaires included open-ended and demographic questions. The questionnaires from rounds two and three were constructed using panelists’ answers from previous rounds using Likert-type five-point rating scales designed to determine a level of agreement determined *a priori*.

Purposeful sampling was used to identify a group of experts who served as the Delphi panel, in line with the recommendation to select a panel which meets the needs of the study (Delbecq, Van de Ven, & Gustafson, 1975; Duffield, 1993; Fink, Kosecoff, Chassin, & Brook, 1991). The Delphi panel in this study included agriculture teachers who received the National Association of Agricultural Educators Outstanding Young Member award as a regional winner from 2010-2014. The Outstanding Young Member (OYM) award is given annually to one NAAE member who has completed less than five years of teaching from each of the six NAAE regions. Winners are determined through peer evaluation of a dossier related to a candidate’s effectiveness in instruction, teaching philosophy, experiential learning, student organizations, partnerships, marketing, and professional growth.

We determined that the OYM winners would have the expertise necessary to understand topics that new agricultural education teachers felt prepared and unprepared for upon entering the profession. Award recipients have demonstrated positive actions in many of the activities deemed necessary to becoming an effective agricultural educator, and have been recognized by their peers as experts in the field of early-career agricultural education. We understand that these experts are not representative of the total population of early-career agricultural educators, and caution must be taken in generalizing the results of this study to a broader scope of individuals.
Potential subjects were identified using the publicly available list of 2010-2014 OYM award winners listed on the NAAE website. An initial email requesting participation was sent to all teachers on the list. A total of \( N = 29 \) OYM award winners were identified for this study, as one region did not award a winner in 2012. Round one achieved a response rate of 79.3\% (\( n = 23 \)). Of the 23 respondents in round one, 100\% completed the questionnaire in round two (\( n = 23 \)) and 95.6\% responded in round three (\( n = 22 \)). The tailored design method (Dillman, Smyth, & Christian, 2009) was used in distributing and collecting survey data. Questionnaires for each round were distributed with Qualtrics and data were analyzed following the methods described by Hsu and Stanford (2007).

**Round One**

Round one included demographic questions asking respondents to report age, sex, number of teachers in the agricultural education program, size of the school, number of years teaching, number of different programs taught at, highest degree obtained, and type of certification received. The questionnaire also included five open-ended questions, two of which are addressed and were directly related to the topic of determining teacher preparation adequacy. The foundation teacher preparation questions included: “In terms of your teacher preparation program, what aspects of teaching agriculture did you feel most prepared for?” and “In terms of your teacher preparation program, what aspects of teaching agriculture did you feel least prepared for?”

**Round Two**

The round two questionnaire was developed based on responses from round one. Responses from round one were condensed to remove duplicate and redundant responses prior to distribution of the round two questionnaires, per the suggestion of Hsu and Stanford (2007). Participants in this round were asked to rank their level of agreement for each statement on a five-point summated scale (1 = Strongly Disagree; 2 = Disagree; 3 = Uncertain; 4 = Agree; 5 = Strongly Agree). Panelists were given the opportunity to expand their answers, provide clarity, or suggest revisions at the end of each question. We established a priori that any item receiving a mean score of 3.75 or greater (more than 75\% of panelists ranking “agree” or “strongly agree”) would be considered to have reached a level of consensus and therefore would not need to be included in the third and final questionnaire. This level of consensus has been previously established by Delphi studies in agricultural education to be an acceptable mean score to classify a statement as meeting consensus (Buriak & Shinn, 1989; Ramsey & Edwards, 2011).

**Round Three**

Following the guidelines of Hsu and Stanford (2007), the round three questionnaire included only items which failed to reach consensus during round two. Participants in this round were asked to rate their level of agreement for statements using the same five-point scale utilized in round two (Hsu & Stanford, 2007). It was determined that items which failed to reach a mean score of \( M = 3.75 \) had not reached consensus.

**Results**

Demographic information was collected from the respondents during round one. Almost all of the respondents in this study were between 26-30 years of age (\( n = 11 \)) or 31-35 years of age (\( n = 10 \)). A majority of the participants were female (\( n = 19 \)) and had received a Master’s degree (\( n = 14 \)). Respondents ranged from having no teaching partners to working in a program with five or more agriculture teachers. Many of the respondents reported being either the sole agriculture teacher in
their program \((n = 7)\) or working in a two-teacher department \((n = 9)\). Of the 23 total participants in this study, 91.3\% \((n = 21)\) received their teaching certification through a traditional teacher preparation program. Complete demographic information is shown in Table 1.

Table 1

*Demographic Variables. Selected Teacher Characteristics \((n = 23)\)*

<table>
<thead>
<tr>
<th>Demographic Variables</th>
<th>(f)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26-30</td>
<td>11</td>
<td>47.80</td>
</tr>
<tr>
<td>31-35</td>
<td>10</td>
<td>43.50</td>
</tr>
<tr>
<td>36-40</td>
<td>2</td>
<td>8.70</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>4</td>
<td>17.40</td>
</tr>
<tr>
<td>Female</td>
<td>19</td>
<td>82.60</td>
</tr>
<tr>
<td><strong>Highest Degree Obtained</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bachelor’s</td>
<td>7</td>
<td>30.40</td>
</tr>
<tr>
<td>Master’s</td>
<td>14</td>
<td>61.00</td>
</tr>
<tr>
<td>Educational Specialist</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>Doctoral</td>
<td>1</td>
<td>4.30</td>
</tr>
<tr>
<td>Other</td>
<td>1</td>
<td>4.30</td>
</tr>
<tr>
<td><strong>Number of Agriculture Teachers in Current Program</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>7</td>
<td>30.40</td>
</tr>
<tr>
<td>2</td>
<td>9</td>
<td>39.10</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>17.40</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>4.30</td>
</tr>
<tr>
<td>5 or more</td>
<td>2</td>
<td>8.70</td>
</tr>
<tr>
<td><strong>Number of Students in School</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;500</td>
<td>8</td>
<td>34.90</td>
</tr>
<tr>
<td>500-999</td>
<td>7</td>
<td>30.40</td>
</tr>
<tr>
<td>1,000-1,499</td>
<td>3</td>
<td>13.00</td>
</tr>
<tr>
<td>1,500-2,000</td>
<td>3</td>
<td>13.00</td>
</tr>
<tr>
<td>&gt;2,000</td>
<td>2</td>
<td>8.70</td>
</tr>
<tr>
<td><strong>Type of Teacher Certification</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Traditionally Certified</td>
<td>21</td>
<td>91.30</td>
</tr>
<tr>
<td>Alternatively Certified</td>
<td>2</td>
<td>8.70</td>
</tr>
</tbody>
</table>
Table 1 (continued)

Demographic Variables. Selected Teacher Characteristics (n = 23)

<table>
<thead>
<tr>
<th>Demographic Variables</th>
<th>f</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Years of Teaching Agriculture Completed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-2</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>3-4</td>
<td>2</td>
<td>8.70</td>
</tr>
<tr>
<td>5-6</td>
<td>9</td>
<td>39.10</td>
</tr>
<tr>
<td>7-8</td>
<td>6</td>
<td>26.10</td>
</tr>
<tr>
<td>9-10</td>
<td>6</td>
<td>26.10</td>
</tr>
<tr>
<td>Racial/Ethnic Heritage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Hispanic White</td>
<td>22</td>
<td>95.70</td>
</tr>
<tr>
<td>Black, Afro-Caribbean, or African America</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>Latino or Hispanic American</td>
<td>1</td>
<td>4.30</td>
</tr>
<tr>
<td>East Asian or Asian American</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>Number of Schools Taught at as an Agriculture Teacher</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>10</td>
<td>43.50</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
<td>43.50</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>8.70</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>4.30</td>
</tr>
</tbody>
</table>

Data collection resulted in round one yielded 47 statements for the question “In terms of your teacher preparation program, what aspects of teaching agriculture did you feel most prepared for?” These 47 statements were individually analyzed. Duplicate and like statements were combined, and compound statements were separated, resulting in 18 statements retained for round two. Round two survey analysis revealed four items which reached the established mean score for consensus. The remaining 14 statements were redistributed to panel experts in round three, none of which reached a level of consensus for round three. The 18 statements for rounds two and three are shown in Table 2.
Table 2

Aspects of Teaching Agriculture OYM Award Winners Reported As Most Prepared for (n = 23)

<table>
<thead>
<tr>
<th>Factors Most Prepared For</th>
<th>M</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teaching Animal Sciencea</td>
<td>4.17</td>
</tr>
<tr>
<td>Classroom instructiona</td>
<td>3.96</td>
</tr>
<tr>
<td>Introductory lessons/units a</td>
<td>3.87</td>
</tr>
<tr>
<td>Developing curriculum (Writing lesson plans)a</td>
<td>3.78</td>
</tr>
<tr>
<td>Teaching FFAb</td>
<td>3.61</td>
</tr>
<tr>
<td>Differentiated instruction</td>
<td>3.43</td>
</tr>
<tr>
<td>Networking</td>
<td>3.43</td>
</tr>
<tr>
<td>Classroom management</td>
<td>3.22</td>
</tr>
<tr>
<td>Basic agricultural mechanics</td>
<td>3.09</td>
</tr>
<tr>
<td>Teaching multicultural students</td>
<td>2.87</td>
</tr>
<tr>
<td>Teaching high-level concepts</td>
<td>2.83</td>
</tr>
<tr>
<td>Understanding complexities of being an agriculture teacher</td>
<td>2.83</td>
</tr>
<tr>
<td>Inquiry-based learning</td>
<td>2.78</td>
</tr>
<tr>
<td>Teaching Horticulture</td>
<td>2.78</td>
</tr>
<tr>
<td>Time management in and out of classroom</td>
<td>2.65</td>
</tr>
<tr>
<td>Completing duties that take place outside of class time</td>
<td>2.52</td>
</tr>
<tr>
<td>Teaching Forestry</td>
<td>2.30</td>
</tr>
<tr>
<td>Teaching Wildlife</td>
<td>2.30</td>
</tr>
</tbody>
</table>


a Statements which reached consensus after round two
b Statement reached consensus after round three

With regard to the question “In terms of your teacher preparation program, what aspects of teaching agriculture did you feel least prepared for?” round one resulted in the identification of 56 statements which were analyzed and condensed to 35 statements for round two. Of the 35 statements examined during round two, only two reached consensus. The remaining 33 statements were distributed for round three, none reached a consensus. The statements related to this topic are shown in Table 3.
Table 3

*Aspects of Teaching Agriculture OYM Award Winners Reported As Least Prepared for (n = 23)*

<table>
<thead>
<tr>
<th>Factors Least Prepared For</th>
<th>M</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning for retirement&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4.13</td>
</tr>
<tr>
<td>Work-life balance&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4.13</td>
</tr>
<tr>
<td>Filling out applications (Ex: proficiencies and state degrees)</td>
<td>3.74</td>
</tr>
<tr>
<td>Management of equipment</td>
<td>3.74</td>
</tr>
<tr>
<td>Workload</td>
<td>3.74</td>
</tr>
<tr>
<td>Dealing with finances</td>
<td>3.70</td>
</tr>
<tr>
<td>Paperwork</td>
<td>3.70</td>
</tr>
<tr>
<td>Renewal process</td>
<td>3.70</td>
</tr>
<tr>
<td>How reimbursement funding works</td>
<td>3.65</td>
</tr>
<tr>
<td>Managing a greenhouse</td>
<td>3.61</td>
</tr>
<tr>
<td>Teaching SAEs</td>
<td>3.61</td>
</tr>
<tr>
<td>Agricultural mechanics</td>
<td>3.26</td>
</tr>
<tr>
<td>Recruitment of diverse students</td>
<td>3.26</td>
</tr>
<tr>
<td>Teacher evaluations (by principal/administrator)</td>
<td>3.22</td>
</tr>
<tr>
<td>Time management</td>
<td>3.22</td>
</tr>
<tr>
<td>Communicating with parents</td>
<td>3.13</td>
</tr>
<tr>
<td>Following school approved course outlines</td>
<td>3.09</td>
</tr>
<tr>
<td>Managing a chapter</td>
<td>3.09</td>
</tr>
<tr>
<td>Communicating with administration</td>
<td>3.04</td>
</tr>
<tr>
<td>Following a textbook/approved outline</td>
<td>3.00</td>
</tr>
<tr>
<td>Management of a laboratory area</td>
<td>3.00</td>
</tr>
<tr>
<td>Career preparations</td>
<td>2.96</td>
</tr>
<tr>
<td>Communicating with teaching partner(s)</td>
<td>2.96</td>
</tr>
<tr>
<td>Record-keeping</td>
<td>2.96</td>
</tr>
<tr>
<td>Scheduling lessons</td>
<td>2.96</td>
</tr>
<tr>
<td>Classroom management</td>
<td>2.91</td>
</tr>
<tr>
<td>Laboratory courses</td>
<td>2.91</td>
</tr>
<tr>
<td>Differentiated instruction</td>
<td>2.83</td>
</tr>
<tr>
<td>Working with special needs students</td>
<td>2.83</td>
</tr>
<tr>
<td>Importance of marketing the agriculture program</td>
<td>2.70</td>
</tr>
</tbody>
</table>
Aspects of Teaching Agriculture OYM Award Winners Reported As Least Prepared for (n = 23)

<table>
<thead>
<tr>
<th>Factors Least Prepared For</th>
<th>M</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning activities for topics taught</td>
<td>2.65</td>
</tr>
<tr>
<td>Making lessons hands-on</td>
<td>2.43</td>
</tr>
<tr>
<td>Certification requirements</td>
<td>2.39</td>
</tr>
<tr>
<td>Teaching methodology</td>
<td>2.35</td>
</tr>
<tr>
<td>Teaching FFA</td>
<td>2.35</td>
</tr>
</tbody>
</table>

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

* Statements which reached consensus after round two.

Conclusions and Recommendations

Several conclusions can be drawn from this study which warrant further discussion. The demographic information from this study includes several interesting findings. Perhaps the most encouraging finding is that all of the OYM winners from 2010-2014 were still teaching agricultural education. This conclusion brings several questions for consideration: Is there something about their success which has led to their persistence in the classroom? Did the recognition they received as a successful young teacher help motivate them to remain in the profession? Although determining the influence of awards on new teachers was not directly tied to the purpose of this study, it is interesting to note the resilience of this group of experts. Future research on the role of awards and recognition on new teacher attrition may help shed light on this interesting finding.

Nearly 75% of the OYM member respondents were female. With the growing number of females in the profession, it would be expected that the percentage of female award recipients would increase, however, the portion of new agricultural educators who are female is not likely to be at three-quarters of the total population. Is there a reason that females are more awarded than their early-career male counterparts? Are equal numbers of males and females seeking the NAAE Outstanding Young Member Award? The large discrepancy in gender of winners certainly warrants further investigation.

Another interesting finding from the demographic information is the high percentage of OYM recipients who had attained advanced degrees. More than 60% of the panel of experts had earned a master’s degree. It is promising that excellent novice agriculture teachers are pursuing additional opportunities for learning. There may be something about this finding which relates to their earning a OYM award. Novice teachers who are willing to pursue advanced degrees are often more likely to feel confident in their teaching abilities (Darling-Hammond & Bransford, 2007). This increased confidence may have helped them feel more comfortable in applying for a teaching award, or may have influenced their teaching abilities in the areas related to the OYM award metrics. Future research related to the differences in novice teachers based on the pursuit of advanced degrees may help researchers understand the role of continuing education on novice agricultural educator performance.

Based on the findings of this study, teacher preparation programs are providing adequate information on the subjects of teaching animal science, teaching FFA, classroom instruction,
introductory lessons and units, and developing curriculum. Dobbins and Camp (2003) reported the need for more instruction in curriculum development, teaching methods, and teaching techniques. The findings of this study, indicate a potential shift in the in-service needs of early-career teachers since that time, as the panel experts reported being adequately prepared by their teacher training programs in teaching related tasks. It is an encouraging that, at least for some of the most successful young agriculture teachers, their preparation allowed them to feel as though they could develop and present lessons to their students.

This study examined only the preparation views of teachers who have been shown to be successful novice agricultural educators. It is possible that their overall success in the field is related to their belief that they were well prepared as classroom instructors. Myers et. al, (2005) identified major issues facing early-career teachers. Two of their top issues faced by novice teachers were organizing FFA chapter events and activities and classroom management. According to our panel, teaching FFA and classroom management were concepts they felt prepared for entering the classroom. The role of self-efficacy in effective teaching should continue to be examined, including the relationship between self-efficacy and novice teaching awards. It is highly unlikely that those who feel less efficacious about their teaching would apply for the OYM award, regardless of their actual abilities.

A comparison of the reported classroom teaching preparation of novice agricultural educators who have excelled in the profession in their early years and those who have struggled or left the profession may provide some insight into the role classroom teaching preparation plays in overall agricultural educator performance. The OYM winners are those who have been able to navigate the difficulties of the new agriculture teacher experience and persist through the first few years. It may be more telling to examine the pitfalls experienced by those who have left, especially the pitfalls which may have contributed to decisions to leave the profession.

As the OYM winners come from different regions and multiple preparation institutions, their preparation experiences likely varied. This could be the reason that reaching a consensus on topics related to preparation was difficult. It also lends some legitimacy to those items on which this nationally representative panel experts were able to reach consensus. According to this panel of experts, agricultural education teacher preparation programs as a whole are providing adequate levels of preparation to early-career educators in instructing animal science courses and performing the basic tasks associated with teaching. This contradicts Talbert et. al, (1994) that reported beginning agriculture teachers faced problems with lesson planning and classroom/lab management. It also lends some legitimacy to those items which this nationally representative panel experts were able to reach consensus on.

With regard to the universally agreed upon items, OYM winners felt least prepared in managing work life balance, which is a reflection of the well-documented struggle early-career agricultural educators face with time management (Boone & Boone, 2009; Lambert, Henry, & Tummons, 2011; Murray, Flowers, Croom, & Wilson, 2011; Mundt & Connors, 1999; Torres, Ulmer, & Aschenbrener, 2008; Touchstone, 2015). It appears that even those novice agriculture teachers who are recognized as effective still struggle with managing the requirements on their time. This group echoes the sentiment that new teachers desire assistance in understanding how to effectively balance job responsibilities from a time management standpoint. Myers et. al, (2005) and Murray et. al, (2011) found that a majority of agriculture teachers reported struggling to balance their personal and professional lives. Teacher education programs as well as state agricultural education staff should continue preservice and in-service opportunities to provide agricultural education teachers with the skills to achieve balance in their personal and professional lives.
This study reveals several areas for future research. First, it would be interesting to examine the teacher preparation adequacy through a panel of early-career agricultural educators who have decided to leave the profession. This may yield different topics than those who have had successful interactions as a new teacher, and may give even more information to teacher preparation programs who are looking to increase retention among new teachers.

Second, it is recommended that each teacher preparation program replicate this study using cohorts of students from their own institution. This targeted examination would serve as a more focused assessment of teacher preparation adequacy for specific teacher preparation programs. Institutional needs assessments could be compiled to compare areas where each institution excels. Knowing what each institution does well could allow sharing of best practices between institutions, as we work together to provide the best possible pre-service education for agricultural educators.

Teacher preparation programs are tasked with the challenge of adequately preparing the students to enter a remarkably challenging profession. Understanding how prepared early-career agricultural educators were in certain areas could help teacher preparation programs as they prepare the next generation of agricultural educators. Conversely, understanding the perceptions of early career teachers who left the profession or who struggled to be successful might shed light on many teaching efficacy and teacher attrition issues in agricultural education. Further investigation is required to answer these questions.

Another venue for future research is to go beyond the descriptive investigation of demographic variables and identify relationships between prior experiences and the role they play in teacher self-efficacy and success which may lead to early career awards. Were these award winning teachers also former state FFA officers? Where they a member of a state winning career development event team? Was their agriculture teacher an award winning/recognized teacher in the agricultural education profession? This line of inquiry, whether it be quantitative or qualitative, may aid in developing a profile for future successful agricultural education teachers.

References


The Effect of Two Different Pedagogical Delivery Methods on Students’ Retention of Knowledge Over Time

Marshall A. Baker & J. Shane Robinson

Abstract

The purpose of the study was to determine the effect of two contrasting pedagogies (i.e., experiential learning and direct instruction) on students’ retention of agricultural knowledge over time. A six-week deferred post-test was employed to assess long-term retention of the subject matter. The results indicated that initially, students who were taught both experientially and through direct instruction experienced a statistically significant increase in analytical scores, with the direct instruction treatment group outperforming the experiential learning treatment group. However, that increase was not statistically significant but was followed by a statistically significant decrease in analytical scores six weeks following instruction. Implications exist for preparing instructors to pace their lessons in a slower fashion to increase understanding and mastery of the content learned.

Keywords: Pedagogy; knowledge retention; experiential learning; direct instruction

Introduction

Students are being left behind due to an educational system that is broken and in need of overhaul (Dunlosky, Rawson, Marsh, Nathan, & Willingham, 2013). Although some students learn great details in their public school years, many forget much of what is taught to them over the course of their 13 years in public school systems (Conway, Cohen, & Stanhope, 1991). Therefore, a common goal of all educators is to increase the long-term knowledge retention of learners (Halpern & Hakel, 2002). However, the fact remains, “students ordinarily and regularly forget what they have learned in their classes” (Shulman, 1999, p. 13). In fact, the majority of the knowledge students seemingly have mastered, as evidenced by their performance on a final examination, is not retained or sustained over time (Bacon & Stewart, 2006). Numerous reasons exist for the vast amount of learning loss from students. Chief among them is students’ use of cramming, which has shown “significant negative impact[s]” of retention over delayed periods of time involving long-term memory (McIntyre & Munson, 2008, p. 11). Although students admit that cramming does not lead to long-term retention, they continue the practice because the system has rewarded them for remembering and recalling information on demand (McIntyre & Munson, 2008).

It has been recommended that teachers discourage students from cramming by employing pedagogies that require a “deeper level of learning” (McIntyre & Munson, 2008, p. 11). The pedagogical approach that instructors choose to employ in the classroom has implications for...
increasing students’ deep learning over time (Bacon & Stewart, 2006). Teachers need strategies and methods that will help students learn content long term (Dunlosky et al., 2013). Miller, McNear, and Metz (2013) suggested that one way to increase students’ long-term retention of the subject matter is through the use of active and engaging pedagogies. Semb and Ellis (1994) echoed this claim by stating that instructors can impact the long-term retention of learning in their students positively if they will allow them numerous opportunities to apply their learning through higher order cognitive activities.

To accommodate deeper learning of students, McIntyre and Munson (2008) recommended that teachers slow down their pace of teaching and delivery of content so that students have adequate time to process new information. In addition, Weinstein and Mayer (1983) advocated for teachers to utilize elaboration, rehearsal, and organizational strategies for students, such as highlighting and underlining text, paraphrasing content, summarizing key points, and checking for understanding. McIntyre and Munson (2008) stated,

> For long-term retention, students need to engage with the study material and apply it to situations of relevance to them. The all-too-common use of PowerPoint slide lectures, even with in-class handouts of the slides, does not engage students to take notes in their own language and handwriting, which shunts their processing of the material, leaving all effective learning to the cramming period at the end of the term. (p. 12)

When teaching science concepts, teachers should consider active learning when constructing their units of instruction (Taraban, Box, Myers, Pollard, & Bowen, 2007). Because agriculture is considered a science (Ricketts, Duncan, & Peake, 2006), implications exist for the use of active learning pedagogies for increasing students’ content understanding (Haynes, Robinson, Edwards, & Key, 2012).

Understanding more about how various pedagogies affect students’ ability to learn and remember agricultural content is imperative for sustaining the world’s growing population. Mercier (2015) identified two imperative challenges facing agricultural education today: 1) a deficiency of people prepared to enter the food and agricultural industry; and 2) a majority of people who do not understand agriculture. Addressing these challenges could be met with better engagement strategies and methods of delivery of instructors who teach agricultural classes (Arum & Roska, 2011; Smith, Sheppard, Johnson, & Johnson, 2005). Therefore, it is vital that educators determine the best way to teach and distribute agricultural information to students for optimal long-term retention (Frick, Birkenholz, & Machtmes, 1995; Pense & Leising, 2004).

The use of various pedagogies can affect the amount of knowledge students retain or forget (Sallee, Edgar, & Johnson, 2013; Thalheimer, 2010) as well as their positive perceptions for learning the content (Mueller, Knobloch, & Orvis, 2015). They also have been identified as having the greatest impact on students’ attention, learning, and retention of knowledge over time (Marzano, Pickering, & Pollock, 2001; Sallee et al., 2013). Unfortunately, “effective teaching has continually been hampered by pedagogical constraints, such as time, materials, and ever changing
technological advances” (Edgar, Retallick, & Jones, 2016, p. 38). Therefore, the need exists to determine which form of pedagogy could have the greatest effect on student learning in a short time frame.

Long-term retention of instruction is not a new topic for researchers of experiential learning. Recently, Kolb and Kolb (2017) discussed the idea of retention at length which is grounded in the work by Zull (2002) that connected the experiential learning cycle to specific areas of the brain and made a distinction between non-integrated instruction/recall learning and fully integrated learning. Procedural memory is the result of learned connections resulting from stimulus and response, semantic memory is most often associated with instruction and focuses on learning and abstraction, and episodic memory describes full cycle learning where one is sensing, reflecting, formulating abstraction, and taking action (Kolb & Kolb, 2017). Semb and Ellis (1994) looked at a number of recall studies exploring various instructional methods and concluded there was little difference and similar forgetting curves for all, but claimed a “qualitative difference” (p. 275) in the quality of learning resulting from active involvement of the student. Specht and Sandlin (1991) found that this fully integrated, experiential, learning process does not lead to immediate gains in retention, but led to significant gains of recall after six weeks. Experiential learning literature focuses on the shift from remembering to learning that occurs through actively involved, integrated, full-cycle learning (Herbert & Burt, 2004).

This study was underpinned using the experiential learning theory. Inherent to the theory is the notion that all learning is experiential (Joplin, 1981). Theoretically, experiential learning is a holistic approach to learning “that combines experience, perception, cognition, and behavior” (Kolb, 1984, p. 21) and is recognized as one of the most essential and natural forms of educational theory (Beard & Wilson, 2006). Regarding secondary agricultural education, the entire model of the program (i.e., classroom, SAE, and FFA) is a natural experiential playground (Baker, Robinson, & Kolb, 2012).

Kolb (1984) stated that experiential learning is that which is grasped and transformed by the learner (see Figure 1). Learners grasp and transform content, which results in either divergent, assimilative, convergent, or accommodative knowledge (Kolb, 1984).
As people become more affluent and specialized in their knowledge, they are able to retrieve important concepts from their memory with little effort and integrate, or conditionalize, them to other settings (Bransford, Brown, & Cocking, 2000). Teachers can help students develop
their expertise in the subject by using retrieval cues (Santrock, 2004) and testing them frequently on what they have learned (Carrier & Pashler, 1992; Roediger III & Karpicke, 2006).

Because all learning is experiential (Joplin, 1981), implications exist for how teachers choose to teach their content. Traditional methods of instruction (i.e., lecture and direct instruction) are used most frequently in education systems (Khalid & Azeem, 2012). They also tend to be the most common methods of choice for agricultural education teachers when integrating science, technology, engineering, and mathematics (STEM) principles into their lessons (Smith, Rayfield, &McKim, 2015). However, research has shown that active learning methods (i.e., experiential learning) are more likely to improve students’ understanding of science (Mabie & Baker, 1996; Taraban et al., 2007). What is more, although traditional methods of instruction are effective with recognition tests, they tend to work poorly for long-term understanding (Halpern & Hakel, 2010). One pedagogy that provides authentic learning situations for students in classrooms and holds promise for long-term retention is experiential learning (Clark, Threeton, & Ewing, 2010). Historically, agricultural education has prided itself as a symbol of experiential learning (Baker, Robinson, & Kolb, 2012; Knobloch, 2003; Phipps, Osborne, Dyer, & Ball, 2008; Roberts, 2006). However, a dearth of information in the literature exists regarding the effects of experiential learning on students’ long-term retention of the material in agricultural education.

Because teaching affects learning, instructors need to know which pedagogies yield the best results for long-term learning (Kiewra, 2002). Specifically, Clark et al. (2010) called for the evaluation of how experiential learning impacts students’ knowledge of retention by stating, “further research into how experiential learning is aligned with other learning research will provide the profession a better understanding of why experiential learning offers a sound opportunity to improve student retention and provide students with richer experiences” (p. 58).

In comparison to experiential learning, direct instruction could be considered its polar opposite. Direct instruction has been the pedagogy used most widely in schools (Begeny & Martens, 2006). It allows for the quick and efficient transfer of information from the teacher to the student in a straightforward manner (Watkins & Slocum, 2003).

“Enhancing memory for what is taught in school should be a primary goal for any educator” (Semb & Ellis, 1994, p. 279). Since its inception, agricultural education has focused on providing students with deep, rich experiences to adjust to a constantly changing world (Fitzgerald, 1936). Because the retention of agricultural knowledge is crucial to the worlds’ success, it is important to know which pedagogy impacts students’ long-term retention most.

Purpose of the Study

The purpose of the study was to determine the effect of two contrasting pedagogies (i.e., experiential learning and direct instruction) on students’ retention of agricultural knowledge over time. This goal is aligned with Research Priority 4: Meaningful, Engaged Learning in All Environments of the National Research Agenda of the American Association of Agricultural Education (Roberts, Harder, & Brashears, 2016). The research question that guided the study was, do the analytical effects achieved by experiential and direct instructional approaches persist over time? The two null hypotheses created for this research question were as follows:

$H_0$ 1: There is no statistically significant difference in the pre-test, post-test, and deferred post-test scores for students taught with the experiential approach.
H₀₂: There is no statistically significant difference in the pre-test, post-test, and deferred post-test scores for students taught with the direct instruction approach.

**Methods**

The population for this experimental design study included all students (N = 120) who were enrolled in a local, rural secondary agricultural education program in Oklahoma. This two-teacher program was chosen for the study because it is perceived as a typical and holistic program in Oklahoma. Further, its geographic proximity to Oklahoma University made it accessible to the teachers, students, and researchers. In all, 80 students agreed to participate in the study by completing the necessary IRB documents for consent and assent. To initiate the study, the two teachers bussed students to an off-site location in [City] where they were welcomed, checked in, and assigned to a treatment room (i.e., experiential learning or direct instruction). Thirty-eight students were assigned to the experiential learning treatment and 42 were assigned to the direct instruction treatment. The experiential learning treatment group consisted of 15 males (39%) and 23 females (61%). The direct instruction treatment group consisted of 23 males (55%) and 19 females (45%). Equal representation existed in both treatment groups regarding school grade, with the highest frequencies being freshmen (n = 35; 44%) and juniors (n = 20; 25%).

Because “no analysis, no matter how sophisticated, can compensate for poor data collection and measurement” (Stevens, 2009, p. 38), the researchers gave careful attention to the polarization of the treatments (Kirk, 1995). Specifically, two Oklahoma State University faculty members were assigned to deliver the curriculum to each respective treatment group. Although both had degrees in teacher education and worked at the university to prepare secondary teachers, they each received additional, explicit training regarding the study’s content and pedagogy necessary to teach it effectively while staying true to the method being featured. Also, because both the direct instruction and experiential learning pedagogies require instructors to provide instant feedback, guidance, and support to students, four additional instructors were used per room to ensure fidelity and potency of the treatment. These instructors were pre-service agricultural education students at Oklahoma State University who were engaged in learning about specific pedagogies in their college curriculum. Each instructor received four hours of training in the treatment area he or she was assigned regarding the pedagogical delivery of the content taught.

Specifically, the content taught was a unit on wind turbines. The content was chosen because it fit into an existing career pathway in agricultural education, has implications for potential careers for secondary students, and is becoming a popular energy source in Oklahoma. Further, the content had not been taught previously by the two teachers, thus, making it novel and fresh for the students and assuring that the findings would be authentic and not contaminated by previous learning or exposure.

On arrival to the site, students were escorted to their assigned treatment room. There, they completed an analytical pre-test regarding their knowledge of the curriculum. Once every student had completed the pre-test, the daylong workshop began. The major goal of the study was for students to construct a wind turbine, complete with blade design, which would produce the most amount of energy output possible. Throughout the day, each treatment group participated in various activities relevant to their assigned pedagogy. For instance, the experiential learning instructional room was set up with six different stations that allowed students to interact regarding key concepts of blade design. Students were allowed to experiment with building different blade designs and then reflect on various aspects of the process by completing abstract facilitation sheets while using products such as cups, plates, and paper. Throughout the day, students in the experiential learning
treatment room walked freely around the learning environment, interacted with the various stations, and designed and tested a number of different blade designs.

In contrast, the direct instruction treatment group received three distinct lessons targeting specific learning objectives related to wind energy. The instruction was scripted using a lesson plan template where the instructor shared a PowerPoint® presentation and specific information related to building wind turbines. True to the method, the instructor offered praise and rewards where appropriate. Specific KidWind® materials were used to demonstrate key principles. Students remained seated at their tables throughout the day and worked to master the objectives of the lesson.

Once students created their blade, they brought them to a measurement station to be assessed. These stations were standardized to ensure that each turbine in both conditions was measured consistently. This included the distance at which the turbines were placed from the fan, the speed of the fan, and the height of the wind turbine. Each blade design was connected to a Basic Wind Turbine KidWind® base that included a small generator connected to the hub. Using a voltage meter, the voltage reading of each blade design was recorded as a practical measurement.

The specificity of detail regarding the designing of blades was important because it offered experiences necessary for the instructional unit. In addition, it created episodic and procedural memories consistent with the information processing theory (Schunk, 2012). This attention to detail was necessary to determine the amount of learning sustained over time, in this case a six-week deferred post-test.

In the often cited Specht and Sandlin (1991) study, retention of knowledge was defined as six weeks following instruction. Therefore, this study employed a deferred analytical post-test to participants six weeks after the treatment ended. This assessment was administered in the secondary school setting by the agricultural education instructors.

A criterion-referenced test (CRT) based on the selected educational objectives of the wind turbine blade design instructional unit served as the main analytical assessment for the study. The CRT was created as a collaborative effort by the researcher, KidWind® staff and consultants, experts in the field of wind energy engineering, and pedagogical experts in agricultural education. The purpose of the CRT was to capture students’ ability to analyze, critique, judge, compare and contrast, evaluate, and assess concepts related to the objectives of the lesson. The CRT included 40 total questions, of which 30 were multiple-choice and ten were matching. The CRT was utilized for two purposes: (1) to determine that no statistically significant differences in analytical knowledge of blade design content existed prior to the experiment, and (2) as the first of three repeated measures in the SPF-2x3 ANOVA.

Creswell (2008) explained that, “content validity is the extent to which the questions on the instrument and the scores from these questions are representative of all the possible questions that a researcher could ask about the content or skills” (p. 172). Further, Creswell (2008) suggested that researchers should establish both face and content validity on instruments through the review of the assessment by a panel of experts. Therefore, experts from KidWind® assessed the CRT for content validity, suggested changes, and approved the final set of 40 questions. Suggestions included the deletion of two ambiguous questions, insertion of four discriminating items, three content-related mistakes, and a few typographical errors. Pedagogical experts assessed the CRT for face validity and found it appropriate for secondary agricultural education students.

In addition to issues of validity, reliability refers to the extent that the scores made by an individual remain nearly the same in repeated measurements (Ary, Jacobs, & Razavieh, 2002).
Wiersma and Jurs (1990) suggested eight specific methods to increase the reliability of criterion-referenced examinations, including homogenous items, discriminating items, enough items, high quality copying and format, clear directions for the students, a controlled setting, motivating introduction, and clear directions for the scorer. Each of these suggestions were considered carefully and addressed fully in the development of the CRT used for this study.

The role of reliability indices in criterion-reference examinations has been described adequately in the literature (Kane, 1986; Lang, 1982; Popham & Husek, 1969; Wiersma & Jurs, 1990). Although traditional reliability indices based on internal consistency are not relevant, it is an important indication of reliability in criterion-referenced examinations (Kane, 1986). Kane (1986) purported that a reliability coefficient less than .50 would not provide reliable results. The Kuder-Richardson 20 (KR20) formula (Cronbach, 1970), a test for internal consistency used commonly with criterion-referenced examinations, was used to determine the test’s reliability.

The CRT included the same questions and answers over the three periods of time (pre-test, post-test, deferred post-test). However, the order of questions and answers were altered to prevent students from memorizing the answers or becoming conditioned to the questions and responses. Reliability coefficients (KR20) for each of the three tests were as follows: (a) .82 for the pre-test, (b) .90 for the post-test, and (c) .88 for the deferred post-test. Therefore, it was determined that the CRT used in this study was a reliable measure of students’ analytical knowledge.

A SPF-2•3 repeated measure MANOVA design was employed to analyze the data. Stevens (2009) shared that repeated measures “are the natural design to use when the concern is with performance trends over time” (p. 413). Assumptions of normality and independence of observations were met. Mauchly’s test of sphericity produced a p value of .30, making the assumption tenable. Since no simple main effects were found, the main effects using univariate analysis of variance was assessed. Levene’s test produced p values of .13, .07, and .96 for the pre-, post-, and deferred post-tests, respectively.

**Findings**

The study’s research question sought to examine if analytical effects achieved by experiential and direct instructional approaches persisted over time. Prior to the conduction of the study, the pre-test was administered as both one of three repeated measures and a pre-test assessment of pre-existing differences in analytical content knowledge related to blade design. Table 1 presents the findings of a one-way ANOVA that found no statistically significant differences in the analytical knowledge of blade design prior to the treatment, $F(1, 78) = 1.28$, $p = .26$. Thus, it was assumed that the groups were similar in their analytical knowledge entering the experiment (see Table 1).

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td>62.11</td>
<td>1</td>
<td>62.11</td>
<td>1.28</td>
<td>.26</td>
</tr>
<tr>
<td>Error</td>
<td>3795.10</td>
<td>78</td>
<td>48.66</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>3857.2</td>
<td>79</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
All analytical scores, including each of the repeated measures, utilized the criterion-referenced examination built around the blade design learning objectives. The test included forty multiple choice and matching questions that added to a total possible score of 40. The scores ranged from 4 to 32 points coordinating with a typical school grade of 10% and 80%, respectively. The experiential learning treatment group means were 15.35 \((SD = 5.59)\) for a learning preference of grasping via apprehension, 15.75 \((SD = 6.94)\) for a learning preference of grasping via comprehension, 15.67 \((SD = 5.15)\) for a learning preference of transforming via extension, and 15.14 \((SD = 7.35)\) for a learning preference of transforming via intention (see Table 2). The direct instruction group means were 16.55 \((SD = 7.32)\) for a learning preference of grasping via apprehension, 19.18 \((SD = 9.04)\) for a learning preference of grasping via comprehension, 17.45 \((SD = 7.94)\) for a learning preference of transforming via extension, and 16.77 \((SD = 7.72)\) for a learning preference of transforming via intention (see Table 2).

Table 2

Analytical Pre-Test Means and Standard Deviation

<table>
<thead>
<tr>
<th></th>
<th>Experiential Learning</th>
<th>Direct Instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(n)</td>
<td>(M (SD))</td>
</tr>
<tr>
<td>Grasping via</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apprehension</td>
<td>26</td>
<td>15.35 (5.59)</td>
</tr>
<tr>
<td>Comprehension</td>
<td>12</td>
<td>15.75 (6.94)</td>
</tr>
<tr>
<td>Transforming via</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extension</td>
<td>24</td>
<td>15.67 (5.15)</td>
</tr>
<tr>
<td>Intention</td>
<td>14</td>
<td>15.14 (7.35)</td>
</tr>
<tr>
<td>Treatment Total</td>
<td>38</td>
<td>15.47 (5.96)</td>
</tr>
</tbody>
</table>

Analytical post-test scores were assessed using the same criterion-referenced examination as the pre-test with slight question and response order changes. The test included forty multiple choice and matching questions that added to a total possible score of 40. The scores ranged from 7 to 37 points, coordinating with a typical school grade of 18% and 93%, respectively. The experiential learning treatment group means were 24.15 \((SD = 7.80)\) for a learning preference of grasping via apprehension, 25.42 \((SD = 9.89)\) for a learning preference of grasping via comprehension, 26.75 \((SD = 8.35)\) for a learning preference of transforming via extension, and 20.79 \((SD = 7.29)\) for a learning preference of transforming via intention (see Table 3). The direct instruction comparison group means were 29.07 \((SD = 6.30)\) for a learning preference of grasping via apprehension, 29.18 \((SD = 8.32)\) for a learning preference of grasping via comprehension, 28.69 \((SD = 7.47)\) for a learning preference of transforming via extension, and 30.00 \((SD = 7.87)\) for a learning preference of transforming via intention (see Table 3).
Table 3

Analytical Post-Test Score Means and Standard Deviations

<table>
<thead>
<tr>
<th></th>
<th>Experiential Learning</th>
<th>Direct Instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>M (SD)</td>
</tr>
<tr>
<td><strong>Grasping via</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apprehension</td>
<td>26</td>
<td>24.15 (7.80)</td>
</tr>
<tr>
<td>Comprehension</td>
<td>12</td>
<td>25.42 (9.89)</td>
</tr>
<tr>
<td><strong>Transforming via</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extension</td>
<td>24</td>
<td>26.75 (8.35)</td>
</tr>
<tr>
<td>Intention</td>
<td>14</td>
<td>20.79 (7.29)</td>
</tr>
<tr>
<td><strong>Treatment Total</strong></td>
<td>38</td>
<td>24.55 (8.40)</td>
</tr>
</tbody>
</table>

Analytical deferred post-test scores ranged from 6 to 34 points, coordinating with a typical school grade of 15% and 85%, respectively. The experiential learning treatment group means were 17.12 (SD = 8.82) for a learning preference of grasping via apprehension, 20.00 (SD = 7.07) for a learning preference of grasping via comprehension, 18.00 (SD = 8.19) for a learning preference of transforming via extension, and 18.11 (SD = 8.89) for a learning preference of transforming via intention (see Table 4). The direct instruction comparison group means were 17.57 (SD = 8.53) for a learning preference of grasping via apprehension, 22.20 (SD = 7.66) for a learning preference of grasping via comprehension, 18.85 (SD = 10.58) for a learning preference of transforming via extension, and 18.64 (SD = 7.15) for a learning preference of transforming via intention (see Table 4).

Table 4

Analytical Deferred Post-Test Score Means and Standard Deviations

<table>
<thead>
<tr>
<th></th>
<th>Experiential Learning</th>
<th>Direct Instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>M (SD)</td>
</tr>
<tr>
<td><strong>Grasping via</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apprehension</td>
<td>17</td>
<td>17.12 (8.82)</td>
</tr>
<tr>
<td>Comprehension</td>
<td>8</td>
<td>20.00 (7.07)</td>
</tr>
<tr>
<td><strong>Transforming via</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extension</td>
<td>16</td>
<td>18.00 (8.19)</td>
</tr>
<tr>
<td>Intention</td>
<td>9</td>
<td>18.11 (8.89)</td>
</tr>
<tr>
<td><strong>Treatment Total</strong></td>
<td>25</td>
<td>18.04 (8.26)</td>
</tr>
</tbody>
</table>
The MANOVA (see Table 5) for the repeated measure design indicated that there were no statistically significant simple main effects, $\Lambda = .98, F(2,60) = .56, p = .58$. Attention then turned to main effects of which statistically significant differences were found, $\Lambda = .25, F(3,76) = 88.13, p = .00$ (see Table 5).

Table 5

Summary of MANOVA Analyses Testing for Both Simple Main and Main Effects of the Deferred Analytical Repeated Measures ($df = 60$)

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>$\Lambda$</th>
<th>$F$</th>
<th>$p$</th>
<th>Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time x Group</td>
<td>.98</td>
<td>.56</td>
<td>.58</td>
<td>.02</td>
</tr>
<tr>
<td>Time</td>
<td>.25</td>
<td>88.13</td>
<td>.00</td>
<td>.75</td>
</tr>
</tbody>
</table>

Contrasts revealed that there were statistically significant differences between the three repeated analytical measures, $F(2,122) = 86.01, p = .00, \eta^2_p = .59$, with a large practical effect (see Table 6). Table 7 clarified further those disparities in identifying statistically significant differences between the pre- and post-test, $F(1,61) = 172.84, p = .00, \eta^2_p = .74$, as well as a statistically significant difference between the post- and deferred post-tests, $F(1,61) = 87.36, p = .00, \eta^2_p = .59$ (see Table 7).

Table 6

Comparative Analysis of Student Analytical Knowledge by Treatment Group: A Split-Plot Factorial 2.3 Repeated Measures ANOVA Summary Table ($n = 63$)

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>SS</th>
<th>MS</th>
<th>$F$</th>
<th>$p$</th>
<th>$\eta^2_p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repeated Measure Effects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>4086.63</td>
<td>2</td>
<td>2043.32</td>
<td>.00</td>
<td>.59</td>
</tr>
<tr>
<td>Error</td>
<td>2898.47</td>
<td>122</td>
<td>23.76</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Subjects Effects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group</td>
<td>31.33</td>
<td>1</td>
<td>31.33</td>
<td>.68</td>
<td>.01</td>
</tr>
<tr>
<td>Error</td>
<td>2826.22</td>
<td>61</td>
<td>46.33</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 7
Repeated Measure Analytical Repeated Design Within-Subjects Contrasts

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
<th>η²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level 1 vs. Level 2</td>
<td>7108.30</td>
<td>1</td>
<td>7108.30</td>
<td>172.84</td>
<td>.00</td>
<td>.74</td>
</tr>
<tr>
<td>Level 2 vs. Level 3</td>
<td>4958.56</td>
<td>1</td>
<td>4958.56</td>
<td>87.36</td>
<td>.00</td>
<td>.59</td>
</tr>
<tr>
<td>Error</td>
<td></td>
<td>61</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level 1 vs. Level 2</td>
<td>2508.68</td>
<td>61</td>
<td>41.13</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level 2 vs. Level 3</td>
<td>3462.33</td>
<td>61</td>
<td>56.76</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Both of these contrasts also produced strong practical effects, as indicated by measure of effect. The graph (see Figure 3) of repeated measures also depicts that no statistically significant differences existed between analytical scores for the two treatments over time, $F(1,61) = .68, p = .41$. As such, both null hypotheses were rejected, which indicated there were differences between the three repeated measures of both experiential learning and direct instruction approaches (see Figure 3).

Conclusions

Initially, students who were taught using both experiential learning and direct instruction pedagogies experienced a statistically significant increase in analytical scores. However, that
increase was followed by a statistically significant decrease six weeks following instruction. Students in the direct instruction treatment group appeared to outperform their experiential learning counterparts at all three stages of testing. Differences were not statistically significant at any stage. In addition, neither group (i.e., experiential learning and direct instruction) of students retained a passing knowledge of the content six weeks later.

Specht and Sandlin (1991) noted that, “the key difference in the two learning methods may be in the area of students’ retention of the concepts rather than in their initial perceptions of those concepts” (p. 207). Though the methodology of this study mimicked the six-week deferred post-test, it failed to confirm Specht’s and Sandlin’s (1991) assertion. Not only did students who were in the experiential learning group perform lower on the analytical assessment directly after instruction than those who were taught using direct instruction, but they also retained the information at a lower rate six weeks later in comparison to those who received the information through direct instruction. It is important to note, however, that the analytical scores of students in both direct instruction and experiential learning experienced a steep decline to near pre-test levels six weeks after instruction. Thus, simply, analytical knowledge was not retained. Bransford et al. (2000) would identify this problem as an inability to conditionalize the knowledge; the learners did not see the relevance of the learning and failed to access what they knew when confronted with an opportunity for transfer. Kolb and Kolb (2017) would conclude that semantic memory development, rather than full episodic memory, was the result of both types of instruction.

This finding highlights a critical question for educational leaders to consider in educational reform. As states adopt the common core standards nationwide, and thus implement new high-stakes exams, a greater pressure to conditionalize information will be required. Mere recall will no longer be sufficient. American education, of which agricultural education is subsumed, must carefully establish what the true aims of education should be. As policy directs, so schools should deliver. It is alarming to consider that the American public education system is spending a vast majority of the effort and resources on the banking of analytical knowledge, which this study indicated, is an investment with a rather short half-life.

Recommendations for Practice

This study employed a one-day treatment for 80 students. Teachers should increase the duration of the treatment to ensure proper soak time for their students and ensure that students are personally invested in the subject of interest. Educators should recognize that simply being experiential, also described as active, does not lead to long-term retention. Retention of knowledge is dependent on multi-cycle learning (Kolb & Kolb, 2017). Therefore, instructors are encouraged to slow down and take their time when teaching new concepts to students for better mastery (McIntyre & Munson, 2008). Further, to increase retention of knowledge long term, instructors should consider testing students more frequently over an extended time frame (Carrier & Pashler, 1992; Roediger III & Karpicke, 2006). To offset decay and remind students of what they have learned, teachers should use retrieval cues (Santrock, 2004), especially in instances like the one that occurred in this study where students completed the deferred post-test in a different location than which they learned the content originally.

In addition, teachers should focus more effort on conditionalizing the content by making it meaningful and relevant to the learners (Bransford et al., 2000). Tyler (1949) stated that teachers should make each lesson important for learners by stressing its purpose, writ large. Therefore, focusing on meaning, relevance, and importance of the learning can increase students’ intrinsic desire to learn the content, which may have lasting impacts on their ability to attend to, encode, store, and recall the information years later (Carrier & Pashler, 1992; Schunk, 2012).
Recommendations for Future Research

The treatment for the current study was completed inside one full day with one program in one state. It is recommended that the study be replicated with additional teachers and students across the state and country to determine the long-term effects associated with the type of pedagogy teachers choose to use in their classrooms. In addition, the treatment should be lengthened in terms of days taught to accommodate a more natural duration for delivering a full curricular unit of study at the secondary level. Then, the long-term retention of student knowledge should be reassessed as a result of the longer treatment duration.

Research should investigate the role of student interest and personal connection to the content. This study did not account for students’ interest or felt need for instruction on wind energy blade design. Qualitative analyses regarding both teachers and students should be conducted to determine the strengths, weaknesses, opportunities, and threats associated with employing polar opposite pedagogies in the classroom and their effect on student retention.

Discussion

High stakes testing continues to drive decisions made at the secondary level. Teachers feel the pressure to cover information as a means to expose students to what they will likely see on the standardized test at the end of instruction. Unfortunately, teaching (and specifically, covering) does not equate to student learning. This study provided evidence that, although students can succeed at varying levels regarding a particular test regardless of pedagogy, their long-term retention of that same knowledge six weeks later is abysmal. Perhaps the results of this study were most impacted by authentic student interest? Rogers (1964) posited that learning must have: (a) a quality of personal involvement, (b) be self-initiated, and (c) be evaluated by the learner. Perhaps it is more about the state of the learner than the chosen methods? Good teaching is not as simple as selecting a particular method to get specific results. This study showed that simply choosing a method of instruction will not guarantee that learning will sustain over time. Teaching is much more intricate than selecting a particular method of instruction. Students need time to process information, especially if and when the information is new. Teachers must spend time inspiring students and helping them understand the importance of the lesson if long-term recall of the information is to occur. Teaching students for long-term, sustained learning is an imperative task and will become increasingly important for improving the overall academic standing of American students when compared to other countries.

References


Personal Resilience as a Predictor of Professional Development Engagement and Career Satisfaction of Agriscience Teachers

R. G. (Tre) Easterly III & Brian E. Myers

Abstract

The profession of teaching is inherently stressful. Resilience, or the ability to adapt and develop competence despite exposure to disruptive change, has been shown to be beneficial for teachers. The purpose of this study was to determine if personal resilience is a predictor of professional development engagement and career satisfaction of agriscience teachers. A census of agriscience teachers in four purposefully selected states was taken. Data were collected using the Tailored-Design Method, using multiple points of contact with multiple modes to minimize survey error. The overall response rate was 72.5% (n = 892). The linear combination of independent variables in a stepwise backwards regression model explained 13.7% of the variance of professional development engagement and 21.4% of the variance of career satisfaction. These findings suggested that increasing the resilience of agriscience teachers, specifically in the areas of positive: world and focused, could lead to increased engagement in professional development and career satisfaction, which has been shown to be a factor that increases teacher efficacy. Additional research is needed to explore how to increase the resilience of agriscience teachers and the relationship between teacher resilience and student outcome variables.

Key words: Career satisfaction; inservice; professional development; professional development engagement; resilience

Introduction

Achieving consensus for the ideal professional practice of teachers is somewhat straightforward. Teachers should have a certain set of professional commitments, or set of personal traits, that cause them to strive to constantly improve their practice and grow as a professional (Bransford, Darling-Hammond, & LePage, 2005). Teachers should also base their practice on a body of scholarly knowledge, ground their practice on experience and improvement through reflection, and develop a professional community to foster their growth (Shulman, 1986). However, little is known about the variables that contribute to ideal teacher practice. In the book Mindset: The New Psychology of Success, Dweck (2006) explored the difference between a fixed and a growth mindset. According to Dweck, some individuals are more apt to perceive they can grow, learn, and improve, whereas others tend to become more static in their thinking. While the main crux of Dweck’s work has been applied to child and student behavior, the idea of mindset could be telling for teacher professional development. According to Dweck, individuals do not typically

---

1 Tre Easterly is an assistant professor in the Agricultural and Extension Education Department at New Mexico State University, 105 Gerald Thomas Hall, Las Cruces, NM 88003, easterly@nmsu.edu.
2 Brian Myers is a professor and chair of the Department of Agricultural Education and Communication at the University of Florida, 305 Rolfs Hall, Gainesville, FL, 32611, bmyers@ufl.edu.
have one mindset but instead, fall on a continuum. Dweck also postulated that an individual’s mindset could be changed if he or she is in the right environment.

The idea of a fixed verses growth mindset has been based on the notion that the ability to perform and improve is innate and amenable. Similarly, resilience is an innate characteristic that is related to how individuals cope with stressful or difficult situations. Resilience, or the ability to successfully adapt and develop competence despite exposure to disruptive change, may provide some explanation for how teachers respond to change as it relates to professional development (Henderson & Milstein, 2003; Hoopes & Kelly, 2004; Rirkin & Hooperman, 1991).

The idea of resilience began by examining children who were successful, despite being labeled as at-risk. According to Werner and Smith (2001), some individuals are innately more resilient, and, therefore, are able to overcome disruptive life changes. Henderson and Milstein (2003) applied the concept of resilience to teachers. They indicated that resilient teachers might be better able to cope with stressful situations common to the profession of teaching. Similar to the at-risk children who were successful, some teachers are better able to cope with the stress of teaching and create a meaningful impact for their students. According to Bobek (2002), teacher resilience can enhance teacher effectiveness, improve career satisfaction, and better prepare teachers to adjust to changing conditions.

Richardson, Neiger, Jensen, and Kumfer (1990) explained that resilient individuals are able to reintegrate, or bounce back, and function at a high level after experiencing a finite disruptive event. Gu and Day (2013) purported that normal teaching environments are inherently stressful and disruptive, and, thus, require resilience. This view of resilience rests on two assumptions: teaching is a chronically stressful and taxing career, and some teachers are better than others at dealing with this stress. Some researchers (Gu & Day, 2013; Henderson & Milstein, 2003; Hoopes & Kelly, 2004) have asserted that resilience is not a fixed trait, but can be improved and changed.

Most of the research in the area of teacher resilience has been qualitative. According to Howard and Johnson (2004), teachers rely on agency and a strong professional and personal support system to be able to persist, despite being described as high risk for burnout. Gu and Day (2013) reported that resilient teachers, who had a calling to teach and loved their students, were more connected with their students and their colleagues, worked to improve their self-efficacy, and had positive relationships with the school leaders. Further, teachers in socioeconomically disadvantaged schools were less resilient than their peers in other schools. Gu (2014) noted that when comparing resilient and non-resilient teachers, the former reported having someone who served as a positive support influence at a higher rate than non-resilient teachers.

The research on the resilience of agriscience teachers has been limited (Thieman, Henry, & Kitchel, 2012). Thieman et al. (2012) conducted a synthesis of literature related to resilient agriculture teachers. According to their review, teachers who are more resilient are better able to manage their professional relationships and balance personal relationships. The researchers also stated resilient teachers might be more adept at time management, dealing with difficult students, and responding to difficult relationships. Similarly, Clark, Kelsey, and Brown (2014) found career agriculture teachers relied on professional support and work-life balance to remain in the profession. According to Hoopes and Kelly (2004), one of the factors of resilience is closely related to high self-efficacy. There is also evidence to suggest a link between self-efficacy and career commitment (McKim & Velez, 2015), outcome expectations and interest (Bunch, Robinson, & Edwards, 2012), and coping mechanisms that can lead to resilience (Kelsey, 2006).
Theoretical/Conceptual Framework

This study was guided by the theory of resilience, specifically the characteristics of resilient teachers as described by Henderson and Milstein (2003). These characteristics were operationalized using the factors of resilience described by Hoopes and Kelly (2004) and Conner (1993). Although the resilient factors described by Conner (1993) are intended to describe individuals in the context of organizational change and are not specific to teachers, schools, or teacher professional organizations, the description of resilience has implications for teachers and their capacity to deal with change. The profession of teaching occurs in a stressful environment with constant change from myriad sources (Gu & Day, 2013). Hoopes and Kelly (2004) described resilient individuals as having a capacity to deal with difficult change in stressful environments. Further, Conner’s (1993) personal resilience characteristics, measured using the Personal Resilience Questionnaire (PRQ), have been used in research in the education field, (e.g., Isaacs, 2003). Resilience theory seeks to explore commonalities of individuals who are successful, despite difficult situations, and how others can develop similar characteristics, so they, too, can be successful.

This study drew on Conner’s (1993) work which focused on resilience in the context of organizational change. Conner studied individuals’ reactions to change situations. He noticed that individuals either focus on the risk associated with change or with the opportunity of change. According to Conner, resilient individuals are able to see the opportunity in change situations, and thus, tend to be more successful. These individuals possess similar characteristics. Conner purported these characteristics to be positive, focused, flexible, organized, and proactive. The positive characteristic was further described as positive: world, or being positive toward the environment around the individual, and positive: self, or being positive about one’s own skills and abilities. Flexible was also divided into flexible: thoughts, which involves being open to new ideas, and flexible: social, which describes a person’s ability to draw on resources from others.

This study was guided by a conceptual model that describes the relationship between resilience, career satisfaction, and teacher change (see Figure 1). The characteristics of resilient teachers are explored at the top of the model. The traits of personal resilience in the fields of organizational change management, as described by Hoopes and Kelly (2004), and resilience in schools, as described by Henderson and Milstein (2003), were used in this study. Characteristics of resilient teachers described in the literature were also explained in the model (Huisman, Singer, & Catapano, 2010; Johnson et al., 2015; Mansfield, Beltman, & Price, 2014). Professional development engagement is explained by the teacher change process described by Clarke and Hollingsworth (2002). Fessler and Christensen (1992) also explored the impact of career stage on professional development engagement and informed the study’s model. The actions of participation, value, and implementation were used to describe the process of full engagement in professional development, which embodies the actions in the Clarke and Hollingsworth model. The components of career satisfaction, described by Lester (1987), are explored in the career satisfaction portion of the model. The focus of this inquiry was to explore the relationship between resilience, career satisfaction, and teacher change.
Evidence exists in the literature to suggest a link between professional development engagement, career satisfaction, and resilience. Patterson, Collins, and Abbott (2004) found resilient teachers placed a high premium on professional development and served as mentors for others. Castro, Kelly, and Shih (2010) described being engaged in professional growth as a manifestation of resilient behavior. Leroux and Theoret (2014) found a relationship between teacher reflection and resilience. Tait (2008) found resilient teachers had a high level of career satisfaction through their first year teaching despite reporting high levels of stress. Sorensen and McKim (2014) found a relationship between job satisfaction and professional commitment for agriscience teachers. Some evidence also suggest demographic factors could influence resilience (Rutter, 1979; 1985).

**Purpose and Objectives**

The purpose of this study was to determine if personal resilience is a predictor of professional development engagement and career satisfaction of agriscience teachers. This study explores research in research priority area 5 of the American Association for Agricultural Education national research agenda: efficient and effective agricultural education programs, specifically improving program development, delivery, and evaluation of professional development programs (Thoron, Myers, & Barrick, 2016). The study was guided by four objectives:

1. Describe the personal resilience of agriscience teachers, based on personal and professional characteristics.
2. Describe the relationship between personal resilience, professional development engagement, career satisfaction, personal characteristics and professional characteristics.
3. Determine if personal resilience predicts the professional development engagement of agriscience teachers.
4. Determine if personal resilience predicts the career satisfaction of agriscience teachers.

**Methods**

The population of interest for this study was middle school and high school agriscience teachers in the United States. Four states were purposefully selected to participate in this study. Geographical diversity was the primary selection factor. The American Association for Agricultural Education regions were used to define the regions. Two states, Florida and North Carolina, represented the southern region. Minnesota represented in the North-Central region, and Colorado represented the Western region. Multiple states were also selected by the researcher to represent variations in professional development opportunities and dynamics in the teacher groups that existed from state to state and could have impacted teachers’ professional development participation. A census of agriscience teachers was taken in each state. One-hundred and twenty seven teachers were found in Colorado, 400 teachers in Florida, 243 teachers in Minnesota, and 483 teachers in North Carolina. The sampling frame was obtained from the respective state agricultural education coordinators. The instrument was pilot tested with 110 teachers in West Virginia.

The instrument contained three sections. The Personal Resilience Questionnaire was a preexisting scale comprised of 70 questions with a six-point Likert-type scale with response options ranging from strongly disagree to strongly agree. Ten questions comprised each construct. The proprietary scoring system yielded responses for each construct that ranges on a scale of 0 to 100. Missing scores were imputed based on the average responses from those scales where more than one half of the answers in the scale were available (Enders, 2010). Cronbach’s alpha coefficients on the pilot test were .83 for positive: the world, .81 for positive: self, .82 for focused, .71 for flexible: thoughts, .74 for flexible: social, .68 for organized, and .65 for proactive. According to Nunnally (1978), the acceptable levels of reliability must be above .70. Because two of the subscales fell below the recommendation of Nunnally, Cronbach’s alpha coefficients were calculated post hoc. The subscales positive: world (.80), positive: self (.75), focused (.77), and organized (.71) were found to be in the acceptable range.

The professional development engagement scale was developed by the researchers. Because the objectives of the study required an investigation of professional development participation for agriscience teachers, scales developed by researchers in other fields did not provide sufficient relevance. Moreover, a preexisting scale was not found in the agriscience teacher literature. Therefore, a scale was created using the definition of professional development and core conceptual framework for studying the effects of professional development proposed by Desimone (2009).

The definition of professional development established by Desimone (2009) provided 10 unique areas of professional development practice suitable for contextualization for agriscience teachers, which included (a) workshops related to agricultural education, (b) workshops in the school/district, (c) coaching and/or mentoring, (d) serving in leadership roles, (e) professional reading, (f) formal coursework, (g) informal dialogue, (h) professional learning communities, (i) observing others teach, and (j) feedback from others observing their teaching. The proposed core conceptual framework for studying the effects of professional development on teachers and students provided three levels for each item. The first level measured teachers’ participation in each type of professional development, the second measured the teacher’s perceived value of professional development, and the final measured the level of integration of the professional development practice into each teacher’s instruction. The instrument contained 30 statements designed to measure professional development. The instrument was determined to be a valid
instrument by a panel of experts, including a professor in agricultural education, an assistant professor in extension education, and an associate professor in education. The internal reliability was above the acceptable range with a Cronbach’s alpha of 0.91. Personal and professional characteristics were also collected.

The professional development engagement scale was a five-item semantic-differential developed from the Teacher Job Satisfaction Questionnaire (TJSQ) (Lester, 1987). The TJSQ and the five-item scale were given to the pilot group. The Cronbach’s alpha for the five-item scale was .97 for the pilot group and was found to have a strong positive correlation ($r = .68$) with the TJSQ. Because the researcher-developed semantic differential, career satisfaction scale was found to be a valid and reliable instrument, the TJSQ was not included in the study’s instrument.

A mixed-mode survey that employed a web-preferred approach was delivered according to the Tailored Design Method (Dillman, Smyth, & Christian, 2014). A pre-notice letter with a $1.00 incentive was provided to the Florida, Minnesota, and North Carolina teachers. Store coupons, including a certificate for a free hat from Murdock’s, were provided to the Colorado teachers. Email contacts with a link to the survey instrument were used after the initial contact. A thank-you/reminder post-card was sent after three rounds of email contacts. A postal mailed paper questionnaire was sent to the non-respondents with a business reply envelope after a fourth email contact was made. The usable response rate was 72.5% ($n = 892$). A Chi-square test was not significant when compared to the distribution of non-respondents’ and respondents’ by state ($X^2 = 2.92; p = .57$). Differences in personal and professional characteristics were compared between early and late respondents (Lindner, Murphy, & Briers, 2001). Five-hundred thirteen early respondents responded to the first two contacts and 355 late respondents responded after the first two contacts. No significant differences for age were found with a $\chi^2$ value of 38.46 and a $p$-value of .74. In addition, no significant differences in the number of years of teaching experience were found ($X^2 = 32.36; p = .35$).

Data were analyzed using SPSS version 23. Basic descriptive statistics and correlations were calculated for the major variables in the study. Backwards linear regression was used to determine if the characteristics of resilience was a predictor for professional development engagement and career satisfaction when controlling for personal and professional variables. Two separate regression models were used for each dependent variable. According to Agresti and Finlay (2009), the assumptions of multiple linear regression are linearity exists between the variables, little or no collinearity, normality, and homoscedacity. Correlation coefficients were calculated to ensure collinearity did not exist in the model. Hoyt, Imel, and Chan (2008) explained correlations above .70 should be examined for collinearity. A correlation between the variables positive: world and focused, both from the personal resilience questionnaire, was $r = .76$ and above the threshold. The Pearson $r$ was above .50 for several other variables in the overall PRQ scale as well, which was described by Miller (1998) as a substantial correlation. Collinearity diagnostics were analyzed post hoc in the linear regression analysis using tolerance and Variance Inflation Factor (VIF) values. Both values were established a priori and followed the recommendations of Agresti and Finlay. The assumption of normality was examined by analyzing histograms and by using the indexes of skewness and kurtosis. The assumptions of collinearity and normality were not found to be violated. Skewness and kurtosis were determined to be within the acceptable bounds for inclusion in linear regression models (George & Mallery, 2010). Scatterplots were examined and the assumption of linearity was not violated (Miller, 1998). Residual scatterplots showed no evidence of homoscedacity or heteroscedacity.
Results

The characteristics of resilience of agriscience teachers based on personal and professional factors was determined. Because the subscales that measured flexible: thoughts, flexible: social, and proactive were not found to be reliable, the mean scores were not calculated for those variables. Each characteristic of resilience was calculated as a value from 0 to 100, which represented the range of possible scores. The overall resilience measured for the four subscales was 68.9 (SD = 12.9) for positive: the world, 76.6 (SD = 11.0) for positive: self, 73.1 (SD = 11.9) for focused, and 60.8 (SD = 13.3) for organized (see Table 1).

The PRQ is a widely used instrument with more than 50,000 completed PRQ instruments. Due to the size of the data, standardized percentage (percentile) scores were available for the respondents in this study. These standardized percentage scores show the characteristics of resilience as compared to the general population. The mean standardized percentage scores for the personal resilience characteristics were 41.3 (SD = 28.3) for positive: world, 59.7 (SD = 27.2) for positive: self, 46.1 (SD = 27.8) for focused, and 45.0 (SD = 29.3) for organized. The standardized percentages showed that the agriscience teachers had moderate levels of personal resilience compared to others who had taken the PRQ. The standard deviation scores were fairly high for these areas, especially when compared to the standard deviations of raw scores, which indicated a more erratic distribution of the standardized scores.

Table 1
Mean Scores for Personal Resilience Characteristics

<table>
<thead>
<tr>
<th></th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Participants (n = 892)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive: world</td>
<td>68.9</td>
<td>12.9</td>
</tr>
<tr>
<td>Positive: self</td>
<td>76.6</td>
<td>11.0</td>
</tr>
<tr>
<td>Focused</td>
<td>73.1</td>
<td>11.9</td>
</tr>
<tr>
<td>Organized</td>
<td>60.8</td>
<td>13.3</td>
</tr>
</tbody>
</table>

Note. Characteristics of Personal Resilience are on a scale from 0 to 100

The purpose of objective two was to describe the relationship between the characteristics of resilience, professional development engagement, career satisfaction, personal variables, and professional variables. Pearson \( r \) correlations were used for comparisons between continuous variables. Point-biserial correlations were used for comparisons that included dichotomous variables, such as the categorical variables dummy-coded for entry in the study’s regression model. Although several of the correlations were significant, Miller (1998) explained that statistical significance and practical significance have different implications. Therefore, significant correlations were not reported. The relationship between the teachers’ personal resilience characteristics ranged from \( r = .76 \), a very high and positive relationship between the variables focused and positive: self, and \( r = .23 \), a low and positive correlation between the variables positive: world and organized. Positive: world had substantial and positive correlations with the variables positive: self (\( r = .66 \)) and focused (\( r = .64 \)).

Professional development engagement and career satisfaction had a moderate and positive correlation (\( r = .34 \)). The relationships between the teachers’ personal resilience characteristics, professional development engagement, and career satisfaction ranged from \( r = .41 \) (positive: world and career satisfaction) to \( r = .16 \) (Organized and professional development engagement).
A moderate and negative relationship existed between those teachers who taught middle school students and those who taught high school students \((r_{pb} = -.34)\), where teachers could indicate yes or no for both options. The nature of this relationship indicated more teachers taught high school courses and those teachers who taught high school were more likely to only teach high school courses. A moderate and negative relationship was found between sex and years teaching \((r_{pb} = -.34)\), which showed that more new teachers were female. Years teaching was also correlated to teaching a subject other than agriculture \((r_{pb} = -.29)\), where teachers with less experience were more likely to teach other subjects. A substantial and negative correlation \((r_{pb} = -.34)\) was found between the dummy-coded variable that differentiated between those who earned $40,000-$59,999 in their household to those who earned less than $40,000 with the variable that compared single individuals and married individuals.

A stepwise backwards multiple-linear regression model was used to determine if the personal resilience characteristics and personal and professional characteristics served as predictors for professional development engagement. This type of regression modeling was determined to be the most appropriate because of the exploratory nature of this study (Agresti & Finlay, 2009). The multi-collinearity diagnostics did not indicate any violations of the assumption of multi-collinearity. The regression model contained 26 factors, which included the categorical characteristics as dummy-coded variables. The 18th model was the most parsimonious model and was significant \([F (11, 824) = 12.85; p < .01]\). The linear combination of all independent variables in the final model predicted 13.7% of the variance in professional development engagement, as indicated by the adjusted \(R^2\). The standardized beta coefficients are displayed in Table 2. Because standardized beta coefficients were used, the model should be interpreted using z-scores. As the z-score for each of the variables increased by the amount of each beta coefficient, the predicted professional development engagement score increased by one. The personal resilience characteristics positive: world \((\beta = .18; p < .01)\) and focused \((\beta = .20; p < .01)\) were both significant predictors of resilience.

The statistically significant professional characteristics were years of teaching experience \((\beta = -.09; p < .05)\), and Florida agriscience teachers \((\beta = -.08; p = .02)\). The statistically significant personal characteristics included in the final model were female \((\beta = .09; p < .05)\), having one child \((\beta = -.07; p < .05)\), and non-white and Hispanic \((\beta = .11; p < .01)\). The model indicated that as positive: world increased by 12.9, the predicted professional development engagement increased by 2.41 assuming the other variables remain constant. The model also indicated that as focused increased by 11.9 the predicted professional development engagement increased by 2.68 assuming the other variables remain constant. As years of teaching increased by 9.46 the predicted professional development engagement decreased by 1.20 assuming the other variables remain constant. The model also indicated Florida agriscience teachers, individuals with one child, and white/non-Hispanic individuals were less likely to be engaged in professional development than the study’s comparison groups assuming the other variables remain constant.
Table 2.

Backwards Multiple Regression of Professional Development Engagement on Selected Factors

<table>
<thead>
<tr>
<th>Standardized β</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>81.88</td>
</tr>
<tr>
<td>Positive: World</td>
<td>.18</td>
</tr>
<tr>
<td>Focused</td>
<td>.20</td>
</tr>
<tr>
<td>Years of Teaching Experience</td>
<td>-.09</td>
</tr>
<tr>
<td>Florida Agriscience Teachera</td>
<td>-.08</td>
</tr>
<tr>
<td>Minnesota Agriscience Teachera</td>
<td>.07</td>
</tr>
<tr>
<td>Female</td>
<td>.09</td>
</tr>
<tr>
<td>One Child b</td>
<td>-.07</td>
</tr>
<tr>
<td>Two Childrenb</td>
<td>-.05</td>
</tr>
<tr>
<td>Three Childrenb</td>
<td>.00</td>
</tr>
<tr>
<td>Non-white and Hispanic</td>
<td>.09</td>
</tr>
</tbody>
</table>

Note. Adjusted $R^2 = .137$

The statistically significant professional characteristics were years of teaching experience ($β = -.09; p < .05$), and Florida agriscience teachers ($β = -.08; p = .02$). The statistically significant personal characteristics included in the final model were female ($β = .09; p < .05$), having one child ($β = -.07; p < .05$), and non-white and Hispanic ($β = .11; p < .01$). The model indicated that as positive: world increased by 12.9, the predicted professional development engagement increased by 2.41 assuming the other variables remain constant. The model also indicated that as focused increased by 11.9 the predicted professional development engagement increased by 2.68 assuming the other variables remain constant. As years of teaching increased by 9.46 the predicted professional development engagement decreased by 1.20 assuming the other variables remain constant. The model also indicated Florida agriscience teachers, individuals with one child, and white/non-Hispanic individuals were less likely to be engaged in professional development than the study’s comparison groups assuming the other variables remain constant.

A stepwise backwards multiple regression model was used to determine if the personal resilience characteristics, as well as professional, and personal characteristics served as predictors for career satisfaction. The tests of multi-collinearity did not indicate any violations of assumptions. Twenty-six variables were entered in the initial regression model, which included the categorical characteristic variables as dummy-coded variables. The 24th model was the most parsimonious model and was significant [F (3, 802) = 73.61; $p < .01$]. The linear combination of the variables in the model predicted 21.4% of the variance in career satisfaction as determined by the adjusted $R^2$. The standardized beta coefficients are displayed in Table 3.

The personal resilience characteristics positive: world ($β = .22; p < .01$) and focused ($β = .25; p < .01$) were both significant predictors of resilience (see Table 3). The professional
characteristic years of teaching experience was also a significant predictor in the model ($\beta = .11; p < .01$). The standardized beta coefficients describe the change in predicted career satisfaction score in terms of standard deviation increases in the predictor variables when controlling for the other variables in the model. This model predicted as individuals’ positive: world increased by 12.9, their predicted career satisfaction increased by 0.97; as focused increased by 11.9, their career satisfaction increased by 1.10; and as years of teaching experience increased by 9.46, teachers’ career satisfaction increased by 0.48.

Table 3

<table>
<thead>
<tr>
<th>Backwards Multiple Regression of Career Satisfaction on Selected Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final Model</td>
</tr>
<tr>
<td>Constant</td>
</tr>
<tr>
<td>Positive: world</td>
</tr>
<tr>
<td>Focused</td>
</tr>
<tr>
<td>Years of teaching experience</td>
</tr>
</tbody>
</table>

Note: Adjusted $R^2 = .214$; **$p < .01$

Conclusions and Recommendations

The purpose of this study was to determine if personal resilience was a predictor of professional development engagement and career satisfaction of agriscience teachers. The results revealed the linear combination of personal resilience characteristics positive: world and focused, along with the personal and professional variables, explained 13.7% of the variance in professional development engagement. Thus, as these personal resilience factors increased, the predicted professional development engagement increased. If personal resilience were a static variable, these findings would not hold implications for agriscience teachers. However, because personal resilience can be improved, so too can professional development engagement.

More than 86% of the variance regarding professional development engagement was explained by other variables. Determining these variables should be the focus of future studies. It is important to note, only four personal resilience characteristics were included in this model, and only two were significant. For individuals to improve their resilience, Conner (1993) recommended that individuals focus on the weak areas in their resilience profile and improve those areas. The implications for this finding should be examined on several levels. First, those who are planning and implementing professional development should consider ways to improve the resilience of agriscience teachers in the areas of positive: world and focused. Second, agriscience teachers should consider ways to improve their own resilience and work to become more resilient individuals.

Years of teaching experience served as a significant predictor of professional development engagement and career satisfaction in the study’s regression models. These findings indicated teachers who are later in their careers may be less engaged in professional development. Further research is needed to determine the types of professional development appropriate for teachers at different times in their careers. Fessler and Christensen (1992) proposed similar practices for teacher professional development.

Florida agriscience teachers was a significant predictor in the model, where Florida teachers had lower scores in their professional development engagement when compared to North
Carolina teachers. The possibility of professional development differences was a reason multiple states were selected for the study. An analysis of the effective characteristics of professional development that lead to engagement would illuminate these findings and is recommended. While making comparisons between states was not the purpose of this study, these findings do suggest that variability in professional development exists between states. Because professional development opportunities are unique to each state, school-based agricultural education leaders should examine the professional development offerings in their state to encourage full engagement for teachers and encourage them to develop their resilience. Future studies should be conducted to determine how differences in state professional development structures impact engagement and ultimately influence student learning.

Female agriscience teachers, compared to males, served as a predictor variable in the model. The beta for the variable was positive, which indicated females were more likely to be resilient than males. The mean score for professional development engagement was three points higher for females, which was not tested for significance. The point-biserial correlation between males and females and years teaching was -.33, which matched the findings of Foster, Lawver, and Smith (2014) that showed females are entering the profession at a much higher rate than males. Werner and Smith (2001) and Rutter (1979, 1985) found females tend to be more resilient than males, which was not indicated by the means of the personal resilience characteristics used in this study. However, because sex served as a significant predictor, evidence existed of a possible interplay among the variables.

Having no children compared to having one child under 18 living in the household was a significant predictor of professional development engagement in the model. It is interesting to note that comparisons between no children, two children, and three or more children were not significant predictors. Fessler and Christensen (1992) theorized that a significant life event may lead to change in professional development participation. Although the age of the children was not part of the instrument, the inclusion of this variable in the model raises questions about the impact of having a child on teachers’ professional development engagement. Further studies should be conducted to determine what effects significant life events may have on professional development engagement, and, more important, what support should be provided to help agriscience teachers grow and develop. Resilience affects an individual’s ability to maintain a high level of performance despite difficult or stressful events. Further research is needed to determine if resilience is useful during times of family change or if a decrease in professional development engagement is temporary and should be expected.

The mean scores for professional development engagement were slightly higher for the non-white and Hispanic group than the rest of the population. Despite having a low number ($n = 43$) for this group, these findings showed that non-white or Hispanic agriscience teachers may be more likely to engage in professional development practices, particularly as their resilience increases. Further research is needed to explore the relationship between resilience and ethnicity.

The linear combination of personal resilience characteristics positive: world, focused, and years of teaching experience predicted 21.4% of the variance in career satisfaction. Because this model explained 21.4% of the variance in career satisfaction, resilience should be considered a significant factor in explaining career satisfaction of agriscience teachers. This study did not establish time order; therefore, it cannot be concluded that an increase in these personal resilience characteristics will cause an increase in career satisfaction. It does, however, point to a relationship between these variables.
These data showed that more experienced teachers are more likely to be satisfied in their careers. However, it is reasonable to assume that those who enjoy teaching agriscience are more likely to remain in that career over a longer period of time, and those who are unsatisfied are likely to seek other career opportunities. This also suggests that career satisfaction could be a predictor of career exit or burnout, but drawing conclusions about these variables was beyond the scope of this study.

The areas of positive: world and focused are particularly telling for agriscience teachers. Positive: world describes an individual’s optimism about the world around them. Individuals who are resilient in this area are able to see the positive aspects of disruptive change. Teachers are faced with a high level of change and uncertainty (Henderson & Milstein, 2003). They should be encouraged to develop strategies to cope with disruptive change and to see the positive outcomes that come from change. Although change may seem frustrating and bring about unknowns, it could have positive implications for students.

Focused refers to an individual’s ability to have a purpose or direction that guides his/her actions and is defined by clear goals. Because agriscience programs are diverse and have so many opportunities for students and teachers, it is imperative teachers have a level of focus that guides their programs. Without this focus, it may be easy for some agriscience teachers to become overwhelmed by the myriad available opportunities. Agriscience teachers should be encouraged to set clear, long-term goals and priorities that guide their actions. Organizations that provide support for agriscience teachers should also offer support and structure for helping teachers to establish these goals.

The literature has shown that resilience could be enhanced for teachers, in general, through collegial and collaborative support (Gu, 2014), positive relationships, work-life balance (Gu & Day, 2013), and participation in professional development (Huisman et al., 2010). This study provided quantitative data to support for these qualitative findings. Thieman et al. (2012) conducted a cursory investigation regarding the potential of improved resilience for agriscience teachers. We echo their call for more research on the resilience of agriscience teachers. Agriscience teachers are faced with unique and challenging career responsibilities (Phipps, Osborne, Dyer, & Ball, 2008). Further, they operate in a complex web of professional development and growth systems (Greiman, 2010). Because of these challenges, the individuals involved in these systems, including teachers, teacher educators, school staff, FFA staff, state school-based agricultural education leaders and state and national NAAE leaders, should be encouraged to provide high quality professional development offerings and work with teachers to improve their resilience in hopes of making them more satisfied in their careers.

The PRQ was used because it was an established instrument in an emerging area of study. However, only four constructs of the instrument were deemed reliable. The PRQ has significant value as a commercial instrument to help individuals and groups become aware and improve their resilience. Moreover, because of the issues encountered in this research study, new measures should be developed that accurately measure the resilience of agriscience teachers. Because the flexible: thoughts, flexible: social, and proactive variables were not included in the model, we can only speculate as to their predictive power as related to the study’s other major variables. Further research is needed to develop a comprehensive instrument that provides a valid and reliable measure of resilience for agriscience teachers.

Additional investigation is needed in the area of resilience as it relates to agriscience teachers. This study found that two of the characteristics of resilience were predictors for professional development engagement and career satisfaction. More studies using various measures...
of resilience could be informative. Research related to personal resilience should determine the utility of resilience for agriscience teachers. The data in this study suggested resilient agriscience teachers tend to be more engaged in professional development and more satisfied in their careers. However, resilience could lead to other factors for agriscience teachers. Future studies should examine if resilience is related to student learning outcome variables.

Research related to resilient agriscience teachers should also examine the nature of resilience for agriscience teachers. Hoopes and Kelly (2004) proposed that resilience is amenable. However, how often or how much resilience changes during a person’s career is not known. Future research should investigate how resilience changes for agriscience teachers over time. Research should be conducted to determine effective ways to improve resilience for agriscience teachers throughout their careers. The literature has shown that positive relationships could have an impact on resilience (e.g., Johnson et al., 2015). The findings of this study suggested teachers value mentor/mentee relationships and informal dialogue with peers. Inquiries should be conducted to determine the effects, particularly as they relate to the development of personal resilience, of programs that foster the development of mentor/mentee relationships and informal dialogue between agriscience teachers. Because Henderson and Milstein (2003) postulated that resilience can be fostered in teachers, further research is needed to determine other ways to improve the resilience of practicing and preservice agriscience teachers.

Agriscience teachers are often confronted with change. National policy, local school initiatives, state school-based agricultural education groups, and national and state FFA associations are just a few of the agents that can introduce significant change into the practice of teachers. The findings of this study suggests teachers are more satisfied in their career if they focus on the positives of disruptive change. Agriscience teachers should be encouraged to develop collaborative support systems to help them manage change and focus on its positive impacts for themselves and their students.

The data in this study also showed a connection between the personal resilience characteristic of focused and professional development engagement and career satisfaction. Agricultural education began with the simple purpose of educating boys to be more productive on their farms or in specific agricultural vocations (Phipps et al., 2008). Today, the focus of school-based agricultural education has changed, and agriscience teachers are charged with providing education for diverse students to prepare for a number of careers in the agricultural industry, as well as education to create an agriculturally literate citizenry (Roberts & Ball, 2009). The opportunities for students have multiplied, which can create a burden on teachers to provide as many opportunities for their students as possible. The findings of this study showed that agriscience teachers may benefit from focused goal setting for their programs and themselves. Having a clear aim for their programs and students could encourage teachers to emphasize the opportunities that help meet the overall goals of their program and avoid becoming overcommitted. Mentor relationships or informal dialogue could provide this support. Advisory councils and FFA Alumni chapters also could be a source of such support for agriscience teachers.

References


Examining Student Perceptions of Their Experience in a TBL Formatted Capstone Course

OP McCubins¹, Thomas H. Paulsen² & Ryan Anderson³

Abstract

While shown to be less effective than active learning strategies, traditional methods of content delivery in post-secondary classrooms are the most prominent. Flipped classrooms, an example of an active learning approach, have been shown to be effective in long-term student outcomes. Team-Based Learning (TBL), a specific application of the flipped approach, has been linked to an increase in student performance, engagement, and satisfaction. TBL emphasizes the application of content knowledge through structured problem solving and decision making activities. The capstone farm management course at Iowa State University was recently restructured to implement TBL. This course revision sought to emphasize the development of skills necessary for success in an evolving workforce. The purpose of this study was to examine student perceptions concerning their attitudes and beliefs about learning, their motivation to learn, and their professional development through critical thinking. Pretest and posttest measures were compared and showed statistically significant increases across all three areas. These results offer valuable insight for the adoption of student-centered teaching methods, specifically TBL. Further examination of this teaching method compared to traditional teaching methods is warranted and recommended.

Keywords: team-based learning; flipped learning, active learning, capstone course

Introduction and Literature Review

Lecturing and other teacher-centered instructional approaches are frequently utilized in secondary and post-secondary settings (Balschweid, Knobloch, & Hains, 2014; Smith, Rayfield, & McKim, 2015). In a national study of secondary agricultural education programs concerning the effectiveness of instructional activities, Smith, Rayfield, and McKim (2015) found that a majority of agricultural education teachers devoted most of their class time to lecturing. Puzzlingly, those same teachers reported the effectiveness of lecturing to be relatively low (Smith et al., 2015). Balschweid, Knobloch, and Hains (2014) noted many faculty members perceive teaching as lecturing and that sentiment is “…embedded in their schema” (p. 163). Based on this preconception it may be difficult for faculty members to apperceive other methods of instruction. Whittington and Newcomb (1993) recommended that “[p]rofessors make conscientious changes in their current teaching methodology to reach the cognitive levels to which they aspire for their instruction” (p. 61). Implementing active learning techniques, more specifically a flipped classroom model, may prove useful in improving cognitive levels reached and eliminate the sole reliance on lecture methods.

¹ OP McCubins is an Assistant Professor in the College of Agriculture and Human Ecology at Tennessee Tech University, Box 5034, Cookeville, TN 38505, omccubbins@tntech.edu
² Thomas H. Paulsen is an Associate Professor and Chair of the Department of Applied Agricultural and Food Studies at Morningside College, 108 Buhler Rohlf’s Hall, Sioux City, IA 51106, paulsent@morningside.edu
³ Ryan G. Anderson is a Professor and Chair of the Agriculture Department at Sauk Valley Community College, 173 Illinois Route 2, Dixon, IL. 61021, ryan.g.anderson@svcc.edu.
Flipped classrooms have garnered much attention at all levels of academic instruction in recent years (Barkley, 2015; Bishop & Verleger, 2013). The increased traction of flipped learning in higher education may be explained by a focused effort by instructors to reach higher cognitive levels in student learning processes, increase student engagement, and ensure the development of skills desired by employers (Espey, 2010; Lamm, Carter, & Melendez, 2014; Tucker, 2012). The flipped classroom has also received considerable attention within agricultural education (Barkley, 2015; Conner et al., 2014a; Conner et al., 2014b; Gardner, 2012; McCubbins, Paulsen, & Anderson, 2016). While the popularity may be relatively new, flipped classrooms have existed for several decades in some manner or another (Chen, Wang, Kinshuk, & Chen, 2014). When implementing the flipped approach to teaching, instructors provide basic, introductory content to students prior to a face-to-face class session so that class time is available for meaningful learning activities (Enfield, 2013). Enfield (2013) suggested group discussions, demonstrations, projects, and team building were advantages of the flipped classroom. In the flipped model, students interact with peers and the instructor as they construct knowledge during class time (Bergmann & Sams, 2012; Missildine, Fountain, Summers, & Gosselin, 2013; Kong, 2014). The foundation of the flipped classroom is comprised of constructivist ideologies paired with behaviorist principles; two learning theories that were once viewed as incongruous (Bishop & Verleger, 2013). The material in which students engage prior to class, usually through readings or recorded lectures, fit under the behaviorist principle of direct instruction while the activities carried out during class sessions align with constructivist’s views (Bishop & Verleger, 2013).

One of the earlier documentations of the flipped model in the postsecondary setting occurred at the University of Oklahoma in the late 1970s and was called Team-Based Learning (TBL) (Michaelsen, Knight, & Fink, 2004; Sibley & Ostafichuk, 2014). As noted by McCubbins, Paulsen, and Anderson (2016), a consensus on the origins of the flipped learning model is elusive. TBL has been defined as an active teaching method that emphasizes small-group work and the application of content; in stark contrast with traditional methods of passive content reception (Michaelsen, Sweet, & Parmalee, 2011). TBL, when developed, was reportedly an amalgam of mastery learning and cooperative learning principles (Michaelsen, 1992). Though similar to cooperative learning, important characteristics set TBL apart (Michaelsen & Sweet, 2011). Sibley and Ostafichuk (2014) outlined the four elements essential to the TBL method as: 1) properly formed and managed teams, 2) readiness assurance process to ensure preclass preparation (RAP), 3) learning how to apply course concepts, and 4) the importance of accountability. The teams should consist of five to seven students and be determined by the instructor based on set criteria to ensure heterogeneity (Michaelsen et al., 2004; Michaelsen et al., 2011; Sibley & Ostafichuk, 2014). The RAP includes four steps: 1) preclass preparation, 2) individual readiness assurance test (IRAT), 3) team readiness assurance test (TRAT), and 4) appeals (Michaelsen & Sweet, 2011).

Preclass preparation requires students to engage in the instructor-organized course content via readings, videos, and other forms of media prior to attending class. During the first class session of a module, students are assessed individually via the IRAT, and again immediately following via a TRAT (Michaelsen et al., 2004). The TRAT “…unleashes the power of social learning and immediate focused feedback…” (Sibley & Ostafichuk, 2014, p. 11). This is accomplished by allowing students to discuss the questions and through immediate feedback on their answer selection. Immediate feedback is possible by administering the TRAT via an Immediate Feedback Assessment Technique (IFAT) card (“What is the IF-AT?”, n.d.). For appeals, students are able to provide a written, scholarly argument to recapture points on missed questions. Students must provide an argumentative statement and supporting evidence from the preclass preparation materials (Michaelsen et al., 2004; Michaelsen & Sweet, 2011; Michaelsen et al., 2011). Following the RAP, a targeted, clarifying instruction session is conducted. Clarifying instruction is geared toward the concepts that may remain unclear to the students (Michaelsen et al., 2004). Remaining
class sessions within the module are for students to apply course concepts via application exercises. Application exercises are designed to present students with a significant problem grounded in a real-world scenario where students work together to make a decision (Michaelsen et al., 2004).

The final component highlighted by Sibley and Ostafichuk (2014) is the importance of accountability. The importance is solidified as students determine the grade-weights for the entire course across three categories: 1) individual performance, 2) team performance, and 3) peer evaluation (Michaelsen et al., 2004). Students are held accountable via the IRAT, TRAT, application exercises, and finally through graded peer evaluations. This teaching approach requires “…a shift in the role of the instructor from dispenser of information to manager of a learning process” (Michaelsen, 1992, p.109).

Despite the lack of consensus on when or where flipped learning began, parallels exist between TBL principles and flipped learning principles. Table 1 depicts the parallels found in the Flipping Principles (Jeffries, 2015) and TBL components (Michaelsen et al., 2004).

Table 1
Parallels of the Flipped Course and Team-Based Learning Model

<table>
<thead>
<tr>
<th>Flipping Principles</th>
<th>TBL Component</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge transfer moved outside of the class</td>
<td>Pre-class preparation</td>
</tr>
<tr>
<td>Application of the content in class</td>
<td>Application Exercises</td>
</tr>
<tr>
<td>Peer teaching</td>
<td>Peer discussions during the TRAT</td>
</tr>
<tr>
<td></td>
<td>Intra- and Inter-team discussions during application exercises.</td>
</tr>
<tr>
<td>Contextual learning</td>
<td>Application exercises- Should be relevant and real-world.</td>
</tr>
<tr>
<td>Assessment reinforces learning</td>
<td>IRAT and TRAT</td>
</tr>
</tbody>
</table>

TBL has been touted as an effective means for improving student performance (Baldwin, Bedell, & Johnson, 1997; Johnson & Lee, 2008) and engagement (Balwan et al., 2015; Kelly et al., 2005). However, implementing TBL requires a focused redevelopment of an entire course’s structure (Sibley & Ostafichuk, 2014). Support for the transition from a teacher-centered method to a student-centered method is important. Addo-Attuah (2011) noted the criticality of buy-in from faculty, students, and administration for successful implementation of TBL. That buy-in can often be difficult to achieve when deciding to adopt student-centered instructional practices (Hains & Smith, 2012). Hains and Smith (2012) noted that instructors can be resistant to adopt student-centered teaching methods; administrators may resist the adoption to seemingly allow faculty to focus on research; and students may combat the transition because they are not attuned to the transition of authority within the classroom. Similarly, students may not value working with other individuals based on previous, negative experiences in team settings (Espey, 2010), adding to the difficulty of student buy-in. Conversely, Espey (2010) found that the value students place on working with others increases significantly after a semester of TBL exposure.
Setting

AGEDS 450 – Farm Management and Operation - is a capstone course for students seeking a Bachelor of Science degree in Agricultural Studies from Iowa State University. AGEDS 450 was developed in order to provide students with the opportunity to gain practical farm management skills before leaving college (Murray, 1945). AGEDS 450 is structured around Crunkilton, Cepica, and Fluker’s (1997) capstone course framework, defined as “a planned learning experience requiring students to synthesize previously learned subject matter content and to integrate new information into their knowledge base for solving simulated or real world problems” (p. 3). Crunkilton et al. posited that a true capstone experience “…focuses on complete integration of fragmented disciplinary knowledge, permitting students to bring meaningful closure to their academic experiences” (p. 3) and “…provides students with a rich contextual frame of reference for furthering connection between theory and practice often initiated earlier in their academic experiences” (p. 4). A capstone course should ease a student’s transition into a chosen career or entry into further academic study (Crunkilton et al.). Through the utilization of a student-managed farm and the capstone course framework, students engage in collaborative research to analyze and synthesize information to make informed decisions in a real-world setting (Paulsen, 2010; Perry, Paulsen, & Retallick, 2015). AGEDS 450 has utilized a committee structure to aid in the development of problem-solving and decision-making skills (Vogel & Steiner, 2004). In the TBL format for AGEDS 450 at the time of this study, teams and committees were used simultaneously. The teams were selected using a criterion-based process to ensure heterogeneity while the committee members were elected from within each team. This nesting of committees within teams allowed for two separate learning networks to form. In this format, teams made decisions for the farm and committees carried out those decisions. For example, if a team decided to recommend the purchase a specific brand of seed for planting, they would present necessary information to all other teams. Then if the team’s recommendation was approved for adoption, the crops committee would be responsible for ordering, paying for, and acquiring the seed. Figure 1 depicts the course structure and how teams and committee are distributed.

![Diagram of AGEDS 450 structure with teams and committees.]

The conceptualization of the entire AGEDS 450 in TBL format is depicted in Figure 2. Students arrive in the capstone course with fragmented disciplinary knowledge and through the structured activities and emphasis on applying content knowledge in a team-based setting; students
integrate that new and old knowledge in solving practical problems. The border of the model displays the skills that are emphasized throughout the course activities, which includes problem solving, decision-making, critical thinking, and communication. The center of the model contains the core components of the TBL framework, beginning with preclass preparation and progressing to the assessment phase. The top half of the center portion of the model outlines the activities conducted by the committees, while the bottom half outlines the team activities.

The team and committee activities occur simultaneously throughout the semester. Teams engage with the course content before arriving to class (preclass preparation) where they are tested individually and as a team (readiness assurance) over the course content. Teams are then tasked with solving real-world problems through simple and complex application exercises (application of knowledge) before being assessed in the form of projects or exams (assessment). This process is repeated for each module in the course; five to seven modules are recommended depending on individual course needs (Michaelsen et al., 2004).

Committees prepare for class by identifying several preparation activities, which may include: crop scouting, farm safety and building assessments, or equipment maintenance review. This information is included in official business meeting reports. Committees apply their knowledge by carrying out committee responsibilities, and providing information to teams in order to make farm management decisions. Decisions made during the official business meetings are then carried out by the appropriate committee. Assessment of the committees is completed through written reports. This process is repeated as often as necessary for each committee.
Theoretical/Conceptual Framework

Mezirow’s (2000) Transformative Learning Theory served as the theoretical framework for this study. The transference of authority within the learning environment may aid in the development of transferable skills for workplace success. Students may consider assuming the responsibility for their own learning as a disorienting dilemma; an essential component of transformative learning. Much of what individuals know and believe is dependent upon the embedded nature of biographical, cultural, or historical contexts. Mezirow further identified the importance of developing decision-making skills by analyzing individual experiences, assessing the specific context of the experience, and working to establish informed meaning and justification for resulting interpretations and opinions in adult education. In adult learning, emphasis must be placed on “contextual understanding, critical reflection on assumptions, and validating meaning by assessing reason” (Mezirow, 2000, p. 3).

Transformative Learning Theory is comprised of three common themes which include “…the centrality of the experience, critical reflection, and rational discourse in the process of meaning structure and transformation” (Taylor, 1998, p. 8). In regard to centrality of the experience, Taylor (1998) espoused that student’s experiences are socially constructed, which allows them to be deconstructed and acted upon. Mezirow (1995) noted the beginning of and the subject matter for transformative learning is the learner’s experience. Transformative Learning Theory is grounded in the nature of human communication (Taylor, 2007). Taylor (1998) opined that Tennant’s (1991) description of a learner’s experience offers an incredible deal of congruency with transformative learning. Tennant (1991) stated:

[Shared] learning experiences establish a common base from which each learner constructs meaning through personal reflection and group discussion… The meanings that learners attach to their experiences may be subjected to critical scrutiny. The teacher may consciously try to disrupt the learner’s world view and stimulate uncertainty, ambiguity, and doubt in learners about previously taken-for-granted interpretations of experiences (p. 197).

Critical reflection allows the learner to question assumptions and beliefs that are deeply rooted in their past experiences; while rational discourse is the medium through which transformative learning is promoted and developed (Taylor, 1998).

Mezirow (2000) noted seven factors which must be present in order for learners to fully immerse themselves in rational discourse and included; 1) accurate and complete information, 2) freedom from coercion and distorting self-perception, 3) openness to alternative points of view (empathy and concern about how others think and feel), 4) the ability to weigh evidence and assess arguments objectively, 5) greater awareness of the context of ideas and, more critically, reflectiveness of assumptions, including their own, 6) an equal opportunity to participate in the various roles of discourse, and 7) willingness to seek understanding and agreement and to accept a resulting best judgment as a test of validity until new perspectives, evidence, or arguments are encountered and validated through discourse as yielding a better judgment (p. 14).

Transformative Learning Theory (Mezirow, 2000) seeks to transform frames of reference that are likely based on less reliable assumptions. A frame of reference, as explained by Mezirow (2000), is the structure of individual assumptions that form meaning: “It selectively shapes and delimits perception, cognition, feelings, and disposition by predisposing our intentions, expectations, and purposes” (Mezirow, 2000, p. 16). Mezirow (2000) defined adult educators as those who do not indoctrinate, but create opportunities to shift their authority over the learning
environment. This transition allows passive learners to become collaborative learners, but the traditional power relationships that exist between teachers and learners must be eliminated. When this transition occurs, it allows the learners to become more autonomous within the learning environment (Mezirow, 2000). Many of these notions expounded by Mezirow seemingly align with the TBL format and capstone course framework.

Though originally created as a model for outlining the learning activities within a teaching methods course, the Taxonomy of Learning Activities (TLA) (Roberts, Stripling, & Estepp, 2010) is useful in conceptualizing a transition from teacher-centered activities to more autonomous, student-centered activities, such as with the adoption of TBL. The TLA, depicted in Figure 3, allows instructors to visualize the continuum of learning activities, beginning with teacher-centered activities and moving toward student-centered activities. This transition of learning activities from teacher as authority to autonomous student learners aligns with Mezirow’s (2000) description of educators within Transformative Learning Theory.

Mezirow (2000) espoused that educators must strive to transition authority within the learning environment to their students, and when feasible, to create a collaborative learning environment where students become self-directed learners. In regards to the TLA model, teacher-centered activities include lecturing and demonstration; social interaction activities include questioning, discussion, and cooperative learning; and student-centered activities utilize inquiry and individualized applications (Roberts et al., 2010). The theoretical and conceptual frameworks which served as a foundation for this study were operationalized through the implementation of the TBL teaching method in a capstone course. TBL aims to develop high performing teams, capable of applying course content to solve complex, real-world problems while holding themselves and their peers accountable for learning the material (Michaelsen et al., 2004; Michaelsen et al., 2011).

Figure 3. Taxonomy of Learning Activities Model (Roberts, Stripling, & Estepp, 2010)

McCubbins et al. (2016) developed a crosswalk of the activities found in the TLA with activities in TBL. Table 2 displays those parallels. TBL activities are embedded in each section of the continuum developed by Roberts et al. (2010).
Table 2

Parallels between the Taxonomy of Learning Activities and Team-Based Learning

<table>
<thead>
<tr>
<th>TLA (Roberts et al., 2010)</th>
<th>TBL Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher-Centered Activities</td>
<td>Preparation</td>
</tr>
<tr>
<td>Lecture</td>
<td>Out-of-class reading (or video)</td>
</tr>
<tr>
<td>Demonstration</td>
<td>Out-of-class reading (or video)</td>
</tr>
<tr>
<td>Social Interaction Activities</td>
<td>Preparation/ Application</td>
</tr>
<tr>
<td>Questioning</td>
<td>Individual and team tests</td>
</tr>
<tr>
<td>Discussion</td>
<td>Corrective instruction, application activities</td>
</tr>
<tr>
<td>Cooperative Learning</td>
<td>Team tests, appeals, application activities</td>
</tr>
<tr>
<td>Student-Centered Activities</td>
<td>Application/ Assessment</td>
</tr>
<tr>
<td>Inquiry</td>
<td>Individual application exercises, review</td>
</tr>
<tr>
<td>Individual Application</td>
<td>Individual application exercises, individual exam/ Project</td>
</tr>
</tbody>
</table>


Purpose and Objectives

Following a recommendation from McCubbins et al. (2016), this study sought to explore the impact of exposure a TBL-formatted capstone farm management course had on students’ attitudes and beliefs about learning, motivation to learn, and professional development through critical thinking. This recommendation, as well as TBL’s implementation as a newly-adopted instructional approach within the course, provided a supportive foundation for the present study. The development of research-based pedagogies and “enhanced understanding of learning and teaching environments…” (Edgar, Retallick, & Jones, 2016, p. 39) is of utmost importance in meeting agricultural education’s goal. This study addresses the American Association for Agricultural Education’s National Research Agenda Research Priority Area 4: Meaningful, Engaged Learning in All Environments (Roberts, Harder, & Brashears, 2016) and is explicitly aligned with the research priority question three which seeks to explore educational programs that “…continually evolve to meet the needs and interests of students” (Edgar et al., p. 39). Specific objectives of this study were to:

1. Describe student perceptions regarding their attitudes and beliefs about learning, motivation to learn, and professional development prior to completing the TBL formatted AGEDS 450.
2. Describe student perceptions regarding their attitudes and beliefs about learning, motivation to learn, and professional development after completing the TBL formatted AGEDS 450.
3. Determine if there were changes in student perceptions regarding their attitudes and beliefs about learning, motivation to learn, and professional development after completing the TBL formatted AGEDS 450.
Methods and Procedures

This study was part of a larger research project that sought to examine the effectiveness of the TBL pedagogical practice in an undergraduate capstone course. This study employed a non-experimental, pretest—posttest design in order to measure the impact a TBL formatted course had on student perceptions of their experiences. The researcher identified the target population as all students enrolled in the AGEDS 450 ($N = 121$) for the fall 2015 ($n = 61$) and spring 2016 ($n = 60$) semesters. The course consisted of a combined lecture period, and two laboratory sections, in which the students met on the farm once per week (Paulsen, 2013).

The Student Learning Experiences (SLE) survey developed by Bickelhaupt and Dorius (2016) was utilized to measure student perceptions of their experience in previous group projects and the TBL format. The instrument consisted of 35 Likert-type questions and two open-ended questions for feedback on the structure of the course. The SLE is comprised of three constructs representing three learning domains, and included: 1) beliefs and attitudes about learning, 2) motivation to learn, and 3) professional development through critical thinking (e.g., student perceptions of their development of specific critical thinking activities). Two of the 35 items were classified as independent measures as they did not situate within the established constructs. The researchers utilized Qualtrics, a web-based survey program, to collect student perceptions within the three learning domains. A pretest–posttest design was utilized to measure change in students’ perceptions within three learning domains. The pretest and posttest instruments varied only in how the questions were targeted. The pretest questions focused on previous experience while the posttest focused on the specific experience within the TBL formatted course. For example, a pretest item stated, “When a theory, interpretation, or conclusion has been presented in other courses or in previous readings, I try to decide if there is good supporting evidence,” while the posttest was stated as, “When a theory, interpretation, or conclusion was presented in class or in the readings, I tried to decide if there was good supporting evidence.”

Bickelhaupt and Dorius (2016) established face and content validity by utilizing a panel of experts in survey design and TBL. The instrument was pilot-tested with students ($n = 1039$) enrolled in TBL formatted courses at Iowa State University to measure reliability (Bickelhaupt & Dorius, 2016). After the pilot study, focus groups were conducted with students to further enhance face validity. Following the suggestions of Urdan (2010), the pilot study conducted by Bickelhaupt and Dorius (2016) resulted in construct reliability coefficients deemed acceptable ($\alpha = 0.84 – 0.92$). Additionally, McCubbins et al. (2016) utilized the posttest instrument and deemed the resulting reliability coefficients acceptable ($\alpha = 0.73 – 0.91$). Instruments in the present study were collected from respondents in the fall 2015 ($n = 56$) and spring of 2016 ($n = 54$) for a 91.6% response rate ($n = 110$). Pretest and posttest construct reliability coefficients were deemed acceptable (see Table 3).
Table 3

Reliability Coefficients for Student Learning Experience Constructs

<table>
<thead>
<tr>
<th>Construct</th>
<th>Post hoc</th>
<th>Established Posttest</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cronbach’s Alpha</td>
<td>Cronbach’s Alpha</td>
</tr>
<tr>
<td></td>
<td>Observed</td>
<td>(McCubbins et al., 2016)</td>
</tr>
<tr>
<td>Beliefs and Attitudes about Learning</td>
<td>0.97</td>
<td>0.95</td>
</tr>
<tr>
<td>Professional Development through Critical</td>
<td>0.96</td>
<td>0.93</td>
</tr>
<tr>
<td>Thinking</td>
<td>0.96</td>
<td>0.93</td>
</tr>
<tr>
<td>Motivation to Learn</td>
<td>0.95</td>
<td>0.75</td>
</tr>
</tbody>
</table>

After approval from the Institutional Review Board was received, demographic and academic attributes of students were obtained from the Office of the Registrar at Iowa State University (ISU). To describe students’ academic attributes, university-specific terminology was used, and is described as follows. Semester credit hours were defined as the number of credit hours in which the student was enrolled during the study. Semester grade point average (GPA) was calculated for the semester in which the study occurred. Cumulative credit hours were defined as the total hours received at ISU, and cumulative GPA was calculated from ISU credits only. Total hours were the sum of all credits including those transferred in from other institutions. Method of entry refers to direct enrollment from high school or transfer from an outside institution. Descriptive statistics were used to describe the student demographic data. To address research objective one and two, measures of central tendency and variability were calculated in SPSS for each construct. For objective three, paired-samples $t$-tests were utilized to determine the significance of differences in student perceptions based upon enrollment in the TBL formatted AGEDS 450.

Regarding educational degree pursuit, the results represent a homogenous sample. Care should be exercised when extrapolating results beyond the students enrolled in AGEDS 450. Data gleaned from this study may provide useful insight for instructors of other courses within colleges of agriculture regarding student perceptions towards TBL.

**Results**

Most student respondents were male ($n = 85, 77.3\%$), between 21 and 25 years of age ($n = 93, 83.6\%$), and had direct entry into ISU from high school ($n = 60, 54.5\%$). The average number of credit hours students in which student participants were enrolled was 14.11 ($SD = 3.04$). The average cumulative GPA was 2.82 ($SD = 0.48$) and the average composite ACT was 20.84 ($SD = 0.32$).

**Objective One**

The first objective sought to determine student perceptions regarding their attitudes and beliefs about learning, motivation to learn, and professional development through critical thinking prior to completing the TBL formatted AGEDS 450. Table 4 displays the construct descriptive
statistics for the pretest administration of the SLE instrument. The highest rated construct was Professional Development ($M = 2.56, SD = 1.09$) and the lowest was Motivation to Learn ($M = 2.42, SD = 1.04$).

Table 4

<table>
<thead>
<tr>
<th>Construct</th>
<th>$M$</th>
<th>$SD$</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professional Development through Critical Thinking</td>
<td>2.56</td>
<td>1.09</td>
<td>1.00</td>
<td>5.00</td>
</tr>
<tr>
<td>Beliefs and Attitudes about Learning</td>
<td>2.52</td>
<td>0.99</td>
<td>1.00</td>
<td>4.89</td>
</tr>
<tr>
<td>Motivation to Learn</td>
<td>2.42</td>
<td>1.04</td>
<td>1.00</td>
<td>4.67</td>
</tr>
</tbody>
</table>

*Note. The SLE Instrument utilized two Likert-type scales. 1 (strongly disagree), 2 (disagree), 3 (Neutral), 4 (agree), and 5 (strongly agree). 1 (not at all true of me), 2 (sometimes), 3 (neutral), 4 (mostly), and 5 (very true of me).*

Objective Two

Objective two sought to determine student perceptions after completing the TBL formatted AGEDS 450. Table 5 highlights the descriptive statistics stemming from the posttest administration of the SLE instrument. Like the pretest administration, the highest rated construct was Professional Development ($M = 4.34, SD = 0.61$) and the lowest was Motivation to Learn ($M = 4.09, SD = 0.62$).

Table 5

<table>
<thead>
<tr>
<th>Construct</th>
<th>$M$</th>
<th>$SD$</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professional Development through Critical Thinking</td>
<td>4.34</td>
<td>0.61</td>
<td>1.00</td>
<td>5.00</td>
</tr>
<tr>
<td>Beliefs and Attitudes about Learning</td>
<td>4.28</td>
<td>0.62</td>
<td>1.00</td>
<td>5.00</td>
</tr>
<tr>
<td>Motivation to Learn</td>
<td>4.09</td>
<td>0.62</td>
<td>1.00</td>
<td>5.00</td>
</tr>
</tbody>
</table>

*Note. The SLE Instrument utilized two Likert-type scales. 1 (strongly disagree), 2 (disagree), 3 (Neutral), 4 (agree), and 5 (strongly agree). 1 (not at all true of me), 2 (sometimes), 3 (neutral), 4 (mostly), and 5 (very true of me).*

Objective Three

To address the third research objective, multiple paired-samples $t$-tests were conducted to compare the means from each of the three constructs from the pretest and posttest administration of the SLE instrument. There was a statistically significant, positive difference in the mean scores for each of the three constructs. The professional development construct had a statistically significant increase from the pretest ($M = 2.56, SD = 1.09$) to the posttest ($M = 4.34, SD = 0.61$), $t$
(109) = 14.5, \( p < .001 \), \( d = 0.71 \). Student perceptions regarding beliefs and attitudes about learning was found to have a statistically significant increase from the pretest (\( M = 2.52, SD = 0.99 \)) to the posttest (\( M = 4.28, SD = 0.62 \)), \( t (109) = 14.9, p < .001, d = 0.73 \) as well.

Table 6

<table>
<thead>
<tr>
<th></th>
<th>Pretest</th>
<th>Posttest</th>
<th>Diff.</th>
<th>95% CI</th>
<th>t</th>
<th>p</th>
<th>df</th>
<th>Effect Size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( M )</td>
<td>( SD )</td>
<td>( M )</td>
<td>( SD )</td>
<td>a</td>
<td>b</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Professional Development through Critical Thinking</td>
<td>2.56</td>
<td>1.09</td>
<td>4.34</td>
<td>0.61</td>
<td>1.78</td>
<td>1.53</td>
<td>2.02</td>
<td>14.5</td>
</tr>
<tr>
<td>Beliefs and Attitudes about Learning</td>
<td>2.52</td>
<td>0.99</td>
<td>4.28</td>
<td>0.62</td>
<td>1.76</td>
<td>1.53</td>
<td>1.99</td>
<td>14.9</td>
</tr>
<tr>
<td>Motivation to Learn</td>
<td>2.43</td>
<td>1.04</td>
<td>4.09</td>
<td>0.62</td>
<td>1.66</td>
<td>1.43</td>
<td>1.89</td>
<td>14.2</td>
</tr>
</tbody>
</table>

*Note. CI = confidence interval; LL = lower limit; UL = upper limit.

To determine if there was a statistically significant association between the mean differences and select demographic variables (GPA and credit hours), a correlation was calculated. Since the assumption of normality was not violated, Pearson correlations were computed. There was a slight negative correlation between GPA and the motivation to learn mean difference, \( r (108) = -.26, p = .006 \); attitudes and beliefs about learning mean difference, \( r (108) = -.29, p = .002 \); and professional development mean difference, \( r (108) = -.26, p = .027 \). There were no statistically significant associations between GPA, the number of credit hours taken, and mean difference for each construct. Independent samples \( t \)-tests were computed to determine differences between mean differences for each construct and select demographic variables (gender and method of entry). No statistical differences were found in those computations.

Conclusions and Discussion

TBL is a significant shift in traditional content delivery techniques. Students receive the content prior to attending a class session which frees most of class time for the application of content knowledge in a team setting. This transition of authority in the learning environment could have served as a disorienting dilemma (Mezirow, 2000) for students. Alongside quantitative measures, student voices were heard through two structured open-ended response questions to examine the benefit of this atypical teaching approach. The evaluation of meaningful learning environments is a convoluted task but is essential to guide learning and engagement (Edgar et al., 2016). The authors conclude that the implementation of TBL within the capstone course framework develops an engaging learning environment in which students assume responsibility for their own learning while working collaboratively to solve real-world problems. This particular application of
TBL contributes to the professional development through critical thinking of students, and strengthens their perceived ability to apply course concepts to situations after graduation.

Across all three constructs, statistically significant increases in student perceptions were observed. These results are encouraging as the need for research-based pedagogical practices are important for instructors of agriculture (Edgar et al., 2016). Furthermore, the pretest and posttest results offer valuable insights on overcoming preconceived notions stemming from past negative experiences in working with other students, similar to Espey’s (2010) findings. These findings support the continuation of the TBL instructional approach within AGEDS 450 as well. Like previous research on flipped classrooms in agricultural contexts (Barkley, 2015; Conner et al., 2014a; Conner et al., 2014b; Gardner, 2012; McCubbins et al., 2016), students viewed this TBL formatted course favorably. TBL, in this context, reinforced specific critical thinking abilities, fostered student’s motivation to learn the content, aided in the self-perceived ability to connect theory to practice, and widened students’ frames of reference. Students felt that the time spent working with groups was beneficial in holding them accountable to various assignments and farm-related tasks.

TBL is a useful approach in transformative learning. Mezirow (2000) discussed the importance of analyzing individual experiences in the process of assessing reasoning and making meaning. As is obvious in the open-ended question responses, this iteration of TBL allowed students to engage with other individuals and negotiate throughout the semester. Through the structure of this course, students questioned their previous assumptions–as they related to the course content and the value they placed on working with others–and engaged in rational discourse to widen their frames of reference (Mezirow, 2000).

**Recommendations and Implications**

Mezirow (2000) noted the importance of a trusting, social context to nurture transformative learning, which is supported by the current findings as well as previous research (McCubbins et al., 2016). Continual evaluation of student perceptions in this particular course is recommended. It is further recommended that student outcomes be evaluated alongside similar data. Evaluating student performance on exams compared to their perceptions of TBL would be of interest, and could hold significant implications for the instructional approaches employed by faculty members within agricultural education, broadly defined.

As recommended in McCubbins et al. (2016), critical thinking abilities should be measured before and after exposure to TBL. This data could be compared to national norms, similar to what was conducted in Perry et al.’s (2015) work, who recommended the examination of critical thinking in line with active learning strategies. Additionally, comparison of student performance in TBL formatted courses versus traditionally taught (i.e., lecture based) courses within Colleges of Agriculture is warranted. This could potentially expand the significance and utility of the findings from the present study.

We also recommend considerable attention be given to faculty professional development workshops on designing, implementing, and sustaining student-centered frameworks (Balschweid et al., 2014; McCubbins et al., 2016). With consideration of the potential barriers in the adoption of student-centered course design (Hains & Smith, 2012), it is likely time for faculty members within agricultural education to advocate for more emphasis on teaching and learning in the alignment of institutional responsibilities. Traditionally, “effective teaching has continually been hampered by pedagogical constraints, such as time, materials, and ever changing technological advances” (Edgar et al., p. 38). TBL, while not a panacea, provides a solution to the hampering of
effective teaching practices. It is long past time that those charged with teaching students for a changing world quit handicapping those students by the perpetuation of teaching methods known to be less effective.

References


A Measure of Self-Regulated Learning in Online Agriculture Courses

Steven “Boot” Chumbley¹, J. Chris Haynes², Mark S. Hainline³ & Tyson Sorensen⁴

Abstract

For students to be successful in the online learning environment, change from passive learners to active learners is essential. Students who successfully regulate and change their learning know where and how to acquire the knowledge necessary for success in the online environment. Introducing students early through dual enrollment programs can ensure students have the necessary skills for success. This project sought to determine the self-regulated learning level of students in an online agriculture course. Students were found to have the highest self-regulation within environmental structuring and goal setting. The lowest online learning self-regulation was in the area of task strategies. Females had a higher level of self-regulated online learning while there was found to be little difference by ethnicity. Low correlations were found between student experience with online courses and their perceived online self-regulated learning level. Students in an online agriculture dual enrollment course are encouraged to develop goals and at the conclusion complete a self-evaluation of their learning. Research should continue to help researchers understand and properly identify any personal, behavioral or environmental factors that influence secondary students’ self-regulated learning in an online agriculture dual enrollment course.

Key Words: dual enrollment, self-regulated learning, online

Introduction

The past 20 years have been witness to dramatic change in student learning opportunities. Federal student achievement initiatives designed to quantify student progress towards earned college degrees and certification (Pettitt & Prince, 2010) has resulted in Common Core State Standards (Handley-More, Hollenbeck, Orentlicher, & Wall, 2013), Massive Open Online Courses (MOOCs) (Allen & Seaman, 2013), and online learning courses have realized a 400% increase in educational delivery in the past decade (Allen & Seaman, 2013). Researchers have posited that 13% of all students have taken online courses (Christensen, Horn, Caldera, & Soares, 2011), with enrollment in online courses increasing at a slightly higher rate than traditional courses (Allen & Seaman, 2008). In the fall of 2012 there were more than 7.12 million post-secondary students taking at least one online course, accounting for 33% of the total enrollment in college courses (Allen & Seaman, 2014). This growth in popularity of online classes creates a need for research targeting self-regulated learning in the online environment. This is specifically important in

¹ Steven “Boot” Chumbley is an Assistant Professor in Agricultural education at Texas A&M University-Kingsville, Bishop, TX, steven.chumbley@tamuk.edu
² J. Chris Haynes is an Associate Professor in the Department of Secondary Education/Agricultural Education at the University of Wyoming, McWhinnie Hall 114, Dept. 3374, 1000 E. University Ave., Laramie, WY 82071, jhaynes4@uwyo.edu
³ Mark S. Hainline is an Assistant Professor in the Department of Agricultural Education and Studies at Iowa State University, 209A Curtiss Hall, Ames, IA 50011, mhainlin@iastate.edu
⁴ Tyson J. Sorensen is an Assistant Professor of Agricultural Education in the School of Applied Sciences, Technology and Education at Utah State University, 2300 Old Main Hill, Logan, UT 84322, tyson.sorensen@usu.edu.
Agricultural education, where little research has been conducted on the topic and where online and dual enrollment programming continues to increase.

For students to advance and achieve their educational goals, they must be successful in their courses, be it offered face-to-face, online or in a hybrid model. To be successful in online courses students must have management of their learner autonomy and practice individual responsibility (Andrade & Bunker, 2009; Harrell, 2008). However, students who do not practice individual responsibility, and are not persistent towards achieving their educational goals run the risk of attrition in an online environment (Hart, 2012). According to Hart (2012), multiple factors exist that are associated with the persistence necessary for successful completion of an online educational experience, which include “. . . satisfaction with online learning, a sense of belonging to the learning community, motivation, peer, and family support, time management skills, and increased communication with the instructor” (p. 19).

Students must learn self-regulation skills over time (Schunk, 2005). If expected to autonomously acquire these skills, most students will not be successful at transitioning into an online course (Artino, 2009; Harell, 2008). Lack of appropriate preparation can negatively influence student retention and academic performance (Bol & Garner, 2011; Lynch & Dembo, 2004; Swanson, 2008). For students to be successful in the online learning environment, they must transition from passive learners to active learners (Green & Azevedo, 2007). Passive learning environments, are often seen as the traditional mode of teaching, where the teacher is the primary delivery mode, providing content in the form of lecture (Smart, Witt, & Scott, 2012). Conversely, the active learner model charges students with acquiring knowledge through a constructivist based approach, where the student applies prior knowledge to assist in forming new educational concepts (Prince & Felder, 2006).

Students who successfully regulate and change their learning know where and how to acquire the knowledge needed to be successful in the online environment (Cunningham & Billingsley, 2003). Traits exhibited by students who regulate their learning include: thinking critically, taking responsibility for their own learning, and actively participating in the learning process (Chung, 2000). Self-regulated learning and learner autonomy is critical to student success in the online learning environment (Lynch & Dembo, 2004). Previous research found there is significant value in self-regulated learning in relation to student success, especially in online and blended courses (Hodges, 2005; Kitsantas & Dabbagh, 2010; Kramarski & Gutman, 2006).

In 2006, a study examined effects of self-regulated learning behaviors and epistemological beliefs on learner outcomes in the online learning environment, controlling for student computer self-efficacy and prior academic achievement (Bell, 2006). In a sample of 201 undergraduate students enrolled in a web-based program, the researcher did not find epistemological beliefs to be a significant predictor of academic achievement in the online learning environment. However, evidence was found to support the association of self-regulated learning skills with positive academic achievement among online learners.

Introducing students early to online and blended courses in dual enrollment programs can help ensure students have the necessary skills for success as full-time college students (Swanson, 2008). What is more, dual enrollment courses are benefitting “. . . a wider range of students with respect to race/ethnicity, socioeconomic status, and prior academic achievement” (Kanny, 2015, p. 59). With these benefits in mind, research presented in this article was conducted with the purpose of extending the body of knowledge related to self-regulation theories in online or technology enhanced learning environments.
Dual credit courses allow students to simultaneously earn high school and college credit while taking college coursework through their local community college (Estación, Cotner, D’Souza, Smith & Borman, 2011). Dual credit emerged in the 1970s and 1980s in response to a need to keep talented students challenged, easing the transition between high school and college, to develop vocational readiness, thereby reducing time necessary to obtain a college degree (Bailey & Karp, 2003; Burns & Lewis, 2000). Students who took dual enrollment classes felt better prepared for college and realized increased attainment of certificates or degrees in high school (Anderson, 2010; Hughes, 2010). Enrollment in hybrid and online dual enrollment courses was found to lead to enhanced relationships between high schools and colleges; increased course rigor, relieved student boredom and facilitated student recruitment (Andrews, 2001; Krueger, 2006; Barnett & Hughes, 2010). Programs with this hybrid model have shown to be successful because instructors deliver the same rigorous college content while considering pedagogical strategies better designed to engage secondary students (Whissemore, 2012). The focus of this study was to explore self-regulated learning in these hybrid dual enrollment courses in agriculture.

Theoretical Framework

Within the context of Bandura’s social cognitive theory (1977; 2004), students’ development of self-regulated learning skills and strategies are a function of interaction between personal, behavioral and environmental factors (Schunk, 2001). The process by which these self-regulated learning skills develop is dependent upon previously mentioned factors changing and growing as they interact within the learning environment. If there is satisfactory progress in the learners’ behavior, there will be an increase in self-efficacy and motivation. Social Cognitive theorists feel self-regulated learning includes self-observation and self-reaction (Schunk, 2005). Self-regulated learning is an active, constructive process whereby learners set goals for their learning and then attempt to monitor, regulate and control their behavior, guided and constrained by their goals and the contextual features in the environment (Pintrich, 2000).

Based on the social cognitive theory, Zimmerman (1998) proposed a three-phase model in relation to the development of self-regulated learning skills (see Figure 1). The first phase is forethought, which is the strategic processes that precedes effective learning. This phase includes goal setting and intrinsic motivation, closely paralleling with student success, to perform a learning task. These typically occur before the student enters the learning process. Students inclined to be self-motivated prior to entering the learning process will be efficacious in their beliefs with a clearly defined expectation for their educational outcomes (Zimmerman, 1998). The second phase, the performance control stage, occurs during the learning process. The processes within this include monitoring of learning, attention and task value. Self-observation and self-experimentation is important in this stage as it leads the learner to reflect upon their performance. The final phase of the model is self-reflection in which individuals perform self-evaluations (self-judgements) based upon social comparisons and personal performance, and then adjust their performance for the next learning task (Pintrich, 2000; Zimmerman & Schunk, 2001).
Zimmerman’s model of self-regulated learning suggests that before an individual can change and develop their self-regulated learning skills, an interaction of personal, behavioral or environmental factors must occur. Through interaction of these factors, individuals can change their self-regulated learning skills and strategies (Barnard-Brak, Lan & Paton, 2010). Self-regulated learning and interactions of personal, behavioral, and environmental factors are common in educational settings. For example, a student is accustomed to the educational behavior of studying shortly before a test, and when the student fails the test (environmental feedback) behavior is changed and his or her self-regulation of learning is modified.

Conceptual Framework

Researchers have operationalized the social cognitive theory (Bandura, 2004) and Zimmerman’s (1998) model through the conceptualization of six constructs to capture and measure the essence of online self-regulated learning. Conceptually, we frame this study on these six constructs, which include environment structuring, goal setting, time management, help seeking, task strategies and self-evaluation (Lan, Bremer, Stevens & Mullen, 2004).

Purpose/Objectives

The purpose of this research study was to determine the level of online self-regulated learning with secondary students in hybrid and online dual enrollment agriculture courses. The researchers also sought to explain how demographic variables of the students influence the self-regulated practices. The objectives of this study are as follows:

1. Determine the levels of self-regulated online learning from students in an online agriculture dual enrollment course.
2. Determine differences between students’ self-regulated online learning and demographic characteristics.
3. Determine the effects of previous online course experience upon students’ self-regulated online learning scores
4. Determine the effects of gender and grade classification and the interaction of the two variables on student’s self-regulated online learning score

**Methods**

The study was a descriptive survey that implemented a correlational research design. It was a census of all secondary students enrolled in one of two online *Introduction to Horticulture* and *Introduction to Animal Science* dual enrollment courses (N = 146) during the Spring 2015 in [STATE]. For purposes of this study, dual enrollment courses refer to courses in which high school students simultaneously earn high school and college credit while taking coursework through their local community college courses and taken as part of the high school curriculum. Student participation was optional and did not have any effect on students’ grades. Due to the nature of this study, caution should be taken when generalizing the findings beyond the population. However, generalization with caution may contribute to the knowledge base and the improvement of distance learning with the context of agriculture science and dual enrollment courses.

**Instrumentation**

To measure self-regulation in an online agriculture course, a short form of the Online Self-Regulated Learning Questionnaire (OSLQ) was used (Lan et al., 2004). The short form of the OSLQ is a 24-item scale with a 5-point Likert-type response format with values ranging from strongly disagree (1) to strongly agree (5). Higher scores on this scale indicate better self-regulation in online learning by students (Barnard, Lan, & Paton, 2008). The short form was developed from an 86-item long form of the instrument by examining internal consistency and exploratory factor analyses results for data collected from the long form.

The OSLQ consists of six constructs of self-regulation in online learning: environment structuring, goal setting, time management, help seeking, task strategies and self-evaluation. Researchers have considered measures of central tendency within individual statements and constructs to measure students’ level of self-regulated learning.

Instrument validity was established in previous studies where it has been used to investigate students’ self-regulated learning in online courses through 18 different academic disciplines (Barnard, Lan, To, Patton & Lai, 2009). Previous research of the OSLQ has shown structural stability when comparing results between online and blended courses (Korkmaz & Kaya, 2012). The internal consistency score obtained for the short form of the OSLQ in this study was \( \alpha = .96 \) with post-hoc individual factor reliability yielding sufficiently high coefficients (see Table 1). Nunnally (1978) suggested reliability scores of .70 or better is acceptable when used within the context of social science research, therefore, we felt the instrument was sufficiently reliable for each of the constructs measured.
Table 1

**Internal Factor Reliability of the OSLQ Post-Hoc**

<table>
<thead>
<tr>
<th>Construct</th>
<th>Cronbach’s Alpha Reliability Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environment Structuring</td>
<td>.90</td>
</tr>
<tr>
<td>Goal Setting</td>
<td>.94</td>
</tr>
<tr>
<td>Time Management</td>
<td>.87</td>
</tr>
<tr>
<td>Help Seeking</td>
<td>.90</td>
</tr>
<tr>
<td>Task Strategies</td>
<td>.87</td>
</tr>
<tr>
<td>Self-Evaluation</td>
<td>.90</td>
</tr>
</tbody>
</table>

**Data Collection**

Data was collected online through a link in the students’ online learning shell (e.g. Blackboard). Students selected for this study were students across various schools in [STATE] taking an online dual enrollment introduction to animal science or introduction to horticulture course ($N = 146$). Courses were offered as an online/in-class hybrid model. Students participated in all lab activities in class with their secondary agriculture instructor and completed all assessments (tests, quizzes, discussion posts and final projects) online. The final project consisted of a student-made presentation that was recorded and submitted online. A total of 106 students completed the survey, for a response rate of 72.6%.

**Data Analysis**

Measures of central tendency were analyzed to assess the demographic characteristics of participants in this study. A One-way ANOVA was utilized to examine any significant differences between previous experience in online learning and student’s scores from the Online Self-regulated Learning Questionnaire (OSLQ). Students’ scores served as the dependent variable, and participants’ previous experience in online learning served as the independent variable. Assumptions of normality, independence of errors, and homogeneity of variance (i.e., $F(7, 98) = 1.96, p = .068$) were met for this analysis. The level of significance was set at .05 *a priori*.

To analyze the main and interaction effects of the independent variables (i.e., gender & grade classification) on the students’ self-regulated learning scores, a 2x4 factorial analysis of variance (ANOVA) was conducted. Ary, Jacobs, and Razavieh (2002) indicated a factorial ANOVA serves to partition the variance associated with a treatment and variance associated with error. Assumptions, normality, independence of error, and homogeneity of variance ($F(5,100) = 2.15, p = .066$) were met. The Statistical Package for the Social Sciences (SPSS), version 22, was used to analyze the data in this study. Likert-Scales (summated into constructs) were evaluated using Mean and Standard Deviation guided by the findings of Boone & Boone, 2012. Non-normal distributions of response data can result in a mean score that is not a helpful measure of the data's central tendency. However, statistical experts argue that if there is an adequate sample size (at least 5–10 observations per group) and if the data are normally distributed (or nearly normal), parametric tests can be used with Likert-scale ordinal data. (Jamieson, 2004) and our data was normally distributed along with an adequate sample size.
Findings

To establish credibility, we first sought to identify demographics of secondary school students taking an online agriculture dual enrollment course. Of the participants, there were more males (67.9%) than females (32.1%) enrolled in the online courses. Regarding school grade classification, 9.4% were sophomores, 54.7% were juniors and 35.8% were seniors. When asked about ethnicity, over half (52%) of the participants identified themselves as Hispanic, 33% identified as Caucasian, 14% as Native American and 2% as other. Out of the 106 students who completed the survey, 80% of the students indicated English as their first language. The majority of participants were from small schools with enrollments not exceeding 120 students. Of those surveyed, 75% had taken an online course previously, with 40.2% only taking one course. Of those surveyed, more than three percent had taken more than five online dual enrollment courses previously.

Objective one sought to determine the level of self-regulated learning of students taking an online agriculture dual enrollment course. Table 2 illustrates students’ level of self-regulated learning in their online agriculture courses. Overall, participants mostly agreed with each of the individual items. There were two items with which participants neither agreed nor disagreed which included, “I am persistent in getting help from the instructor through email” and “I work extra problems in addition to the assigned ones.” Overall, the construct of self-regulated learning with the highest mean was environmental structuring, followed by goal setting, time management, self-evaluation and help seeking (see Table 3). Task strategies was the construct yielding the lowest mean.

Objective two sought to describe differences between student demographic characteristics and self-regulated learning in the online environment. Female respondents reported elevated practical self-regulated learning scores overall in general comparison to their peers (i.e., goal setting, environment structuring, task strategies, time management, help seeking, and self-evaluation). Goal setting ($M = 4.01, SD = 0.90$) was the construct for which female dual-enrollment students reported the highest self-regulated learning score (see Table 4). Conversely, male dual-enrollment students scored highest in the construct of environment structuring ($M = 3.77, SD = 0.89$). The task strategies construct had the lowest self-regulated learning scores for both male ($M = 3.27, SD = 1.01$) and females ($M = 3.70, SD = .98$). Regarding self-regulated learning by ethnicity, there was no statistical difference in mean scores (see Table 5). Seniors were found to have the highest mean overall self-regulated learning scores and the lowest variability (see Table 6).
Table 2

Self-Regulated Learning of Online Dual Enrollment Students

<table>
<thead>
<tr>
<th>Construct/Item</th>
<th>Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environment Structuring</td>
<td></td>
</tr>
<tr>
<td>I find a comfortable place to study</td>
<td>4</td>
</tr>
<tr>
<td>I choose the location where I study to avoid too much distraction</td>
<td>4</td>
</tr>
<tr>
<td>I know where I can study most efficiently for my online courses</td>
<td>4</td>
</tr>
<tr>
<td>I choose a time with few distractions for studying</td>
<td>4</td>
</tr>
<tr>
<td>Goal Setting</td>
<td></td>
</tr>
<tr>
<td>I set standards for my assignments in online courses</td>
<td>4</td>
</tr>
<tr>
<td>I keep a high standard for my learning in my online courses</td>
<td>4</td>
</tr>
<tr>
<td>I set short-term as well as long-term goals)</td>
<td>4</td>
</tr>
<tr>
<td>I don't lower the quality of my work because it is online</td>
<td>4</td>
</tr>
<tr>
<td>I set goals to help me manage studying time for my online courses</td>
<td>4</td>
</tr>
<tr>
<td>Time Management</td>
<td></td>
</tr>
<tr>
<td>I try to schedule the same time every day or week to study</td>
<td>4</td>
</tr>
<tr>
<td>Although we don’t meet for class, I still distribute my studying</td>
<td>4</td>
</tr>
<tr>
<td>I allocate extra studying time for my online courses</td>
<td>4</td>
</tr>
<tr>
<td>Self-Evaluation</td>
<td></td>
</tr>
<tr>
<td>I communicate with my classmates to find out how I am doing</td>
<td>4</td>
</tr>
<tr>
<td>I ask myself questions about the course materials when studying</td>
<td>4</td>
</tr>
<tr>
<td>I communicate with classmates to find out if I am learning different</td>
<td>4</td>
</tr>
<tr>
<td>I summarize my learning to examine knowledge gained</td>
<td>4</td>
</tr>
<tr>
<td>Help Seeking</td>
<td></td>
</tr>
<tr>
<td>I find someone who is knowledgeable in course content for help</td>
<td>4</td>
</tr>
<tr>
<td>I share my problems with classmates online</td>
<td>4</td>
</tr>
<tr>
<td>I try to meet my classmates face-to-face</td>
<td>4</td>
</tr>
<tr>
<td>I am persistent in getting help from the instructor through email</td>
<td>3</td>
</tr>
<tr>
<td>Task Strategies</td>
<td></td>
</tr>
<tr>
<td>I try to take more thorough notes for my online courses</td>
<td>4</td>
</tr>
<tr>
<td>I prepare my questions before joining a course discussion</td>
<td>4</td>
</tr>
<tr>
<td>I read aloud instructional materials posted online to fight distraction</td>
<td>4</td>
</tr>
<tr>
<td>I work extra problems in addition to the assigned ones</td>
<td>3</td>
</tr>
<tr>
<td>Summated Mean Score</td>
<td>102</td>
</tr>
</tbody>
</table>

Note. Construct items were measured on a five point scale from 1 “Strongly Disagree” to 5 “Strongly Agree.”
Table 3

Overall Self-Regulated Learning Scores by Construct

<table>
<thead>
<tr>
<th>Construct</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environment Structuring</td>
<td>3.81</td>
<td>0.96</td>
</tr>
<tr>
<td>Goal Setting</td>
<td>3.78</td>
<td>0.95</td>
</tr>
<tr>
<td>Time Management</td>
<td>3.62</td>
<td>0.91</td>
</tr>
<tr>
<td>Self-Evaluation</td>
<td>3.62</td>
<td>0.92</td>
</tr>
<tr>
<td>Help Seeking</td>
<td>3.61</td>
<td>1.02</td>
</tr>
<tr>
<td>Task Strategies</td>
<td>3.40</td>
<td>1.02</td>
</tr>
</tbody>
</table>

Note. Construct items were measured on a five point scale from 1 “Strongly Disagree” to 5 “Strongly Agree.”

Table 4

Self-Regulated Learning Scores by Gender

<table>
<thead>
<tr>
<th>Construct</th>
<th>Male (n = 72)</th>
<th>Female (n = 34)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Goal Setting</td>
<td>3.68</td>
<td>0.95</td>
</tr>
<tr>
<td>Environment Structuring</td>
<td>3.77</td>
<td>0.89</td>
</tr>
<tr>
<td>Task Strategies</td>
<td>3.27</td>
<td>1.01</td>
</tr>
<tr>
<td>Time Management</td>
<td>3.50</td>
<td>0.90</td>
</tr>
<tr>
<td>Help Seeking</td>
<td>3.51</td>
<td>0.99</td>
</tr>
<tr>
<td>Self-Evaluation</td>
<td>3.55</td>
<td>0.95</td>
</tr>
<tr>
<td>Summated Mean Score</td>
<td>85</td>
<td>93</td>
</tr>
</tbody>
</table>

Note. Construct items were measured on a five point scale from 1 “Strongly Disagree” to 5 “Strongly Agree.”
Table 5

Self-Regulated Learning Scores by Ethnicity

<table>
<thead>
<tr>
<th>Construct</th>
<th>Caucasian (n = 35)</th>
<th>Hispanic (n = 55)</th>
<th>Native American and other (n = 16)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>Goal Setting</td>
<td>3.77</td>
<td>0.89</td>
<td>3.74</td>
</tr>
<tr>
<td>Environment Structuring</td>
<td>3.77</td>
<td>1.07</td>
<td>3.79</td>
</tr>
<tr>
<td>Time Management</td>
<td>3.56</td>
<td>0.99</td>
<td>3.61</td>
</tr>
<tr>
<td>Self-Evaluation</td>
<td>3.56</td>
<td>0.90</td>
<td>3.62</td>
</tr>
<tr>
<td>Help Seeking</td>
<td>3.54</td>
<td>0.99</td>
<td>3.63</td>
</tr>
<tr>
<td>Task Strategies</td>
<td>3.26</td>
<td>1.06</td>
<td>3.44</td>
</tr>
<tr>
<td>Summated Mean Score</td>
<td>86</td>
<td></td>
<td>87</td>
</tr>
</tbody>
</table>

Note. Construct items were measured on a five point scale from 1 “Strongly Disagree” to 5 “Strongly Agree.”

Table 6

Self-Regulated Learning Scores by Grade Level

<table>
<thead>
<tr>
<th>Construct</th>
<th>10th Grade (n = 10)</th>
<th>11th Grade (n = 58)</th>
<th>12th Grade (n = 38)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>Goal Setting</td>
<td>3.88</td>
<td>1.01</td>
<td>3.68</td>
</tr>
<tr>
<td>Environment Structuring</td>
<td>3.83</td>
<td>1.19</td>
<td>3.71</td>
</tr>
<tr>
<td>Time Management</td>
<td>3.63</td>
<td>0.98</td>
<td>3.51</td>
</tr>
<tr>
<td>Self-Evaluation</td>
<td>3.45</td>
<td>1.00</td>
<td>3.47</td>
</tr>
<tr>
<td>Help Seeking</td>
<td>3.43</td>
<td>0.78</td>
<td>3.48</td>
</tr>
<tr>
<td>Task Strategies</td>
<td>3.23</td>
<td>0.93</td>
<td>3.30</td>
</tr>
<tr>
<td>Summated Mean Score</td>
<td>86</td>
<td></td>
<td>85</td>
</tr>
</tbody>
</table>

Note. Construct items were measured on a five point scale from 1 “Strongly Disagree” to 5 “Strongly Agree.”

Interpretations of effect size of the Point-Biserial correlational relationship were based on Davis (1971), and are as follows: .01 to .09 – negligible; .10 to .29 – low; .30 to .49 – moderate; .50 to .69 – substantial; and .70 to 1.00 – very strong. The low (Davis, 1971), positive correlation between a student having previous online course experience and the student’s summated score on the Online Self-regulated Learning Questionnaire was significant $r_{pb}(106) = .20, p < .05$ (see Table 5). Additionally, the positive correlation with a low (Davis, 1971) association, between the summated score of the instrument and the students’ grade classification was significant $r_{pb}(106) = .19, p < .05$. 

Journal of Agricultural Education  162  Volume 59, Issue 1, 2018
Objective three sought to determine the effects of previous online course experience upon students’ self-regulated online learning scores. The result of the one-way ANOVA was $F(7, 105) = 1.05, p = .40$, indicating the effects of previous online learning experience upon students’ self-regulated learning scores was not statistically significant (see Table 7). On average, students who had previously taken six online courses ($M = 106.50, SD = 10.08$) received the highest scores on the OSLQ. Conversely, students with no previous online learning experience had the lowest average self-regulated learning scores ($M = 84.78, SD = 20.68$).

Statistically significant correlations were found between students gender and grade level $r_{rb}(106) = -.26, p < .01$, and between a student’s ethnicity and previous online course experience $r_{rb}(106) = -.27, p < .01$. The students’ summated score on the OSLQ did not yield a significant correlation with any aspect of gender, English as a second language, school size, or the ethnicity of the student.

Table 7

<table>
<thead>
<tr>
<th></th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
<th>$\omega^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>2326.65</td>
<td>7</td>
<td>332.38</td>
<td>1.05</td>
<td>.403</td>
<td>-</td>
</tr>
<tr>
<td>Within Groups</td>
<td>31064.11</td>
<td>98</td>
<td>316.98</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>33390.76</td>
<td>105</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note.* Number of online courses range from 0 – 6.

The fourth objective analyzed the combined effect of gender and grade classification on the participants’ self-regulated learning scores (see Table 8). The results of the two-way ANOVA indicated there was not a significant interaction effect between gender and grade classification on the students’ self-regulated learning scores ($F(100, 106) = .51, p = .604$). Although the interaction effect was non-significant in this analysis, Kirk (1995) indicated the analysis of main effects is necessary when no interaction effect is identified. The main effect of grade classification on self-regulated learning scores was also non-significant ($F(2, 106) = 3.02, p = .053$). The effect of grade classification on a student’s self-regulated learning score was not statistically significant. Similarly, the results of the two-way ANOVA indicated there was not a significant main effect of gender on the student’s self-regulated learning score $F(1, 106) = 1.52, p = .22$. 

STATISTICAL ANALYSIS:

**Objective 3:**

Objective three sought to determine the effects of previous online course experience upon students’ self-regulated online learning scores. The result of the one-way ANOVA was $F(7, 105) = 1.05, p = .40$, indicating the effects of previous online learning experience upon students’ self-regulated learning scores was not statistically significant (see Table 7). On average, students who had previously taken six online courses ($M = 106.50, SD = 10.08$) received the highest scores on the OSLQ. Conversely, students with no previous online learning experience had the lowest average self-regulated learning scores ($M = 84.78, SD = 20.68$).

**Table 7**

Comparative Analysis of Students’ Summated Self-Regulated Learning Scores Based on the Number of Online Courses Students Had Taken ($n = 106$)

<table>
<thead>
<tr>
<th></th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
<th>$\omega^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>2326.65</td>
<td>7</td>
<td>332.38</td>
<td>1.05</td>
<td>.403</td>
<td>-</td>
</tr>
<tr>
<td>Within Groups</td>
<td>31064.11</td>
<td>98</td>
<td>316.98</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>33390.76</td>
<td>105</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note.* Number of online courses range from 0 – 6.

The fourth objective analyzed the combined effect of gender and grade classification on the participants’ self-regulated learning scores (see Table 8). The results of the two-way ANOVA indicated there was not a significant interaction effect between gender and grade classification on the students’ self-regulated learning scores ($F(100, 106) = .51, p = .604$). Although the interaction effect was non-significant in this analysis, Kirk (1995) indicated the analysis of main effects is necessary when no interaction effect is identified. The main effect of grade classification on self-regulated learning scores was also non-significant ($F(2, 106) = 3.02, p = .053$). The effect of grade classification on a student’s self-regulated learning score was not statistically significant. Similarly, the results of the two-way ANOVA indicated there was not a significant main effect of gender on the student’s self-regulated learning score $F(1, 106) = 1.52, p = .22$. 

**Table 8**

Comparative Analysis of Students’ Summated Self-Regulated Learning Scores Based on Gender ($n = 106$)

<table>
<thead>
<tr>
<th></th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
<th>$\omega^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>2326.65</td>
<td>7</td>
<td>332.38</td>
<td>1.05</td>
<td>.403</td>
<td>-</td>
</tr>
<tr>
<td>Within Groups</td>
<td>31064.11</td>
<td>98</td>
<td>316.98</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>33390.76</td>
<td>105</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 8

Analysis of Variance Source Table of Effects of Gender and Grade Level on the Students Self-Regulated Learning Scores (N = 106)

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
<th>Partial $\eta^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrected Model</td>
<td>3645.88</td>
<td>5</td>
<td>729.18</td>
<td>2.37</td>
<td>.045</td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>430602.74</td>
<td>1</td>
<td>430602.74</td>
<td>1396.97</td>
<td>&lt;.001</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>467.60</td>
<td>1</td>
<td>467.60</td>
<td>1.52</td>
<td>.221</td>
<td>-</td>
</tr>
<tr>
<td>Grade Level</td>
<td>1863.19</td>
<td>2</td>
<td>931.60</td>
<td>3.02</td>
<td>.053</td>
<td>-</td>
</tr>
<tr>
<td>Gender x Grade Level</td>
<td>312.40</td>
<td>100</td>
<td>156.20</td>
<td>.51</td>
<td>.604</td>
<td>-</td>
</tr>
<tr>
<td>Error</td>
<td>854982.00</td>
<td>106</td>
<td>308.24</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>34469.96</td>
<td>105</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. $R^2 = .106$, Adjusted $R^2 = .061$, *$p < .05$, $a =$ Type III Sum of Squares

Conclusions and Recommendations

The students in this study were of similar demographics when compared to secondary agriculture students in [STATE]. There were higher percentages of Hispanic and Native American students in the dual enrollment courses than were traditionally found taking dual enrollment courses (Karp, Calcagno, Hughes, Jeong & Bailey, 2007; Hughes, 2010). Could this difference be a result of the demographics of [STATE]; or indicative of the suppositions of Kanny (2015) who stated learners, regardless of past contextual variables (i.e., race/ethnicity, socioeconomic status, prior academic achievement), are increasingly benefitting from dual enrollment courses? [STATE] requires students enroll in at least one dual credit or advanced placement (AP) course to successfully meet the requirements for high school graduation. With this requirement, the researchers were not surprised to see most students had taken an online course before. However, the small percentage of students taking more than five different online courses while still in high school was unanticipated. This may relate to the high online self-regulated learning scores of the seniors.

Objective one sought to determine the level of self-regulated learning of the students enrolled in an online agricultural dual enrollment course. Of the self-regulated learning scores, environment structuring was the construct where dual-enrollment students scored the highest. A similar study on self-regulated learning (Davis & Neitzel, 2011) also found structuring of the environment to be the highest rated score in self-regulated learning. With the less restrictive schedule of asynchronous online education, students perhaps feel they have more control over their environment. According to Zimmerman’s model (1998), more control over the environment would contribute to students’ realization of the performance control phase (e.g. self-control). Conversely, participants indicated the lowest level of agreement with the statements related to the task strategies construct. Davis and Neitzel (2011) found a significant relationship between the self-regulated learning task strategies and resistance to web based teaching. The dual enrolment students’ limited experience in the online learning environment might serve as a barrier in the transition from passive to active learning. These findings suggest secondary students, who are accustomed to the pedagogical process of learning, have not yet acquired task strategies needed in the self-directed environment of online learning.
A significant relationship was found between previous experience in online learning and the students overall self-regulated learning. Previous research indicated prior experience with online learning was a positive predictor of satisfaction, perceived learning, and intentions to enroll in online courses in the future (Artino, 2007). Furthermore, Zimmerman and Schunk (2001) indicated self-regulatory skills develop across time and the source of influence appears to shift from environmental to more personal factors. Based on previous research, these findings suggest that as students gain experience in online learning, their levels of self-regulated learning will increase as well. A significant relationship was also found between the summated score of the instrument and the student’s grade classification. Our findings also support the claim that upperclassmen (i.e., juniors and seniors) display higher levels of self-regulated learning due to more experience in the online learning environment. Of the variables explored, no significant relationships were discovered between self-regulated learning and gender, English as a second language, ethnicity or school size.

Based on the findings of this study, we suggest that courses continue to be offered with both university faculty and secondary agriculture science teachers working with students to help them further develop their online self-regulated learning skills. Following Zimmerman’s (1998) guidelines, students should be encouraged to make goals before taking an online dual enrollment course, and at the conclusion of these courses, complete a self-evaluation of their learning. The contextual features of an online hybrid dual enrollment course can provide the necessary environment to guide, and if necessary, correct actions to positively influence students’ development of self-regulated learning skills. Increased rigor from college curriculum combined with the pedagogical guidance of secondary teachers may aid in the active process of self-regulated learning (Pintrich, 2000). We would also encourage teachers and course facilitators to structure courses in a way that allows for student-directed active learning activities to occur. A more constructivist approach can perhaps lead to more effective self-regulated learning. Research exploring self-regulated learning in the context of direct and guided instruction methods should be conducted.

Previous research has shown students develop self-regulated learning skills through problem-based learning and authentic assessments (Iran-Nejad & Chissom, 1992). Course developers are encouraged to incorporate these concepts in course objectives and create assessments that challenge students’ higher order thinking skills. An example of such tasks can include students uploading a presentation that they develop, present in class and upload for grading online. The researchers also suggest that self-regulated learning be supported though the use of consistent course feedback and an established method of self-monitoring (discussion posts, blogs, online journals, etc.).

It is clear that the enrollment of students in blended online learning environments and dual credit courses will continue to increase. Thus, assessing the self-regulatory skills of students in these types of courses is timely. Further research must be conducted to help researchers understand and properly identify any personal, behavioral or environmental factors that influence secondary students’ self-regulated learning in an online agriculture dual enrollment course. By being able to identify which type of factors influence student learning, we can more readily impact the growth and development of their self-regulated learning skills. We suggest future studies be performed that include a broader range of learners, including a comparison of the self-regulated learning of secondary and post-secondary students.

With an increased requirement by school districts in [STATE] specifying at least one dual credit or advanced placement (AP) course to successfully meet the requirements for high school graduation, how do [STATE] students rank academically with other states that have the same
graduation requirements? Have these increased requirements resulted in a higher acceptance percentage for students that choose to pursue higher education degrees? Additional research studies targeting these questions should also be conducted.

More research is needed, especially in regards to blended dual enrollment courses, to examine students’ ability to self-monitor their learning. We suggest future studies also look at effective pedagogical practices that encourage self-regulated learning and ways that secondary and postsecondary faculty can work together to foster this type of learning. Previous research has shown that self-regulated learning behaviors are “highly context dependent” (Schunk, 2001), thus research should be conducted to replicate the results of the current study across several domains in order to cross-validate this study’s findings.

Some questions generated from this research include; what types of interactivity exist in dual enrollment courses? To what extent does instructor–student interaction in the online environment affect learner academic success? Further research should be conducted to determine the levels of academic success that can be correlated to the instructor–student interaction. When increased interactivity is considered detrimental with faculty in online courses, does the level of academic success decline for the learner? Additional research should be conducted in this area.

References


Predicting Consumers’ Local Food Attitude with Personal Values and Local Food Online Videos

Shuyang Qu1, Alexa Lamm2, Joy Rumble3 & Ricky Telg4

Abstract

This study assessed how the personal value associated with local food messages in an online video format influenced U.S. consumers’ attitudes toward local food. To accomplish this, we created two video treatments focusing on how local food supports the local economy and strengthens social connections, respectively. We developed two scales to measure the personal values (personal value of supporting the local economy and personal value of strengthening social connection). These values were associated to the video treatments’ message frames. Descriptive analyses revealed a neutral personal value of supporting local economy and strengthening social connection among U.S. consumers, and a positive attitude toward local food. Multiple regression indicated that the personal value associated with the video treatment was not always a stronger predictor of attitude than the other personal value. In fact, we found that the personal value of supporting the local economy was a more significant predictor of local food attitude than personal value of strengthening social connection in both video treatments.

Keywords: local food, personal values, farming, schema, online video, messages

Introduction

For many years, agricultural companies and organizations have used the phrase “safe, affordable, abundant food” to provide an image of modern agriculture to consumers, however research has found consumers no longer relate to or find such messages credible (Ketchum & Maslansky, 2013). Instead, consumers have become increasingly interested in the long-term health effects and the economic, social and environmental effects of what they eat (Ketchum & Maslansky, 2013). Additionally, people tend to have favorable attitudes toward farmers and ranchers, but not farming and ranching as an industry (Ketchum & Maslansky, 2013). These attitudes are better understood in the context of two competing agricultural paradigms that exist in the U.S.: conventional agriculture and alternative agriculture (Beus & Dunlap, 1990).

Knorr and Watkins (1984) described conventional agriculture as “capital-intensive, large-scale, highly mechanized agriculture with monocultures of crops and extensive use of artificial fertilizer, herbicides and pesticides, with intensive animal husbandry” (p. x). Alternative agriculture...
is more difficult to define because of its vast diversity, such as organic agriculture, sustainable agriculture, and low-input agriculture (Buttel, Gillespie, Janke, Caldwell, & Sarrantonio, 1986). The Alternative Farming System Information Center (AFSIC) has reported that practices and enterprises of alternative agriculture are anything distinguished from conventional agriculture using “direct marketing and other entrepreneurial marketing strategies” (Schuck, 1988, p. 1).

The United State Department of Agriculture (USDA) developed AFSIC to “identify resources about sustainable food systems and practices in support of its effort to ensure a sustainable future for agriculture and farmers worldwide” (USDA National Agricultural Library, 2016, para. 1). Land-grant colleges of agriculture have also been placing emphasis on education, research, and outreach of alternative agriculture (Buttel & Gillespie, 1988; Parr, Trexler, Khanna, & Battisti, 2007).

Placing an emphasis on local food is part of the alternative agriculture. Feenstra (2002) described local community food systems as a way to collaboratively build sustainable food economies that are locally based, making the distribution process one that becomes centered in a certain place in terms of economics as well as environmental and social health. Local food has also been described as a “championed” response to conventional agricultural production and supply (Ilbery & Maye, 2006, p. 352).

Research studies have identified local food’s superior food quality, potential of improving consumers’ nutrition and leading consumers to healthier food options (Ahern, Brown, & Dukas, 2011; Salois, 2011; Martinez et al., 2010; Norberg-Hodge, Merrifield, Gorelick, 2002; Saarinen, Jantunen, & Hahtela, 2010), although other research counter argued that local foods are not necessarily more nutritious or fresh (Edwards-Jones, 2010). Factors such as consumption pattern and food availability should be taken into consideration. Studies have also indicated local food’s ability to empower small scale producers as most local food chains eliminate the middlemen between purchasers and consumers (Norberg-Hodge et al. 2002; Tropp, 2014). However, the capability of meeting the food safety guidelines and sustaining the needs of the consumers from small scale producers were called into question (Godette, Beratan, & Nowell, 2015).

The social benefits of local food have also been documented in the literature, and findings indicate that having people actively engaged in the food system enables individuals in the community to build connections within the community, improve the social awareness, and thus enhance the place they live (Kato, 2014; Perrett, & Jackson, 2015). Some scholars expressed their concerns of linking the social benefits directly to the scale of food (Belliveau 2005; DuPuis & Goodman 2005; Hinrichs, 2003; Johnston & Baker 2005), and the limit of local scale should be considered before implementing local food as the solution of a social issue (Lake, Sisson, & Jaskiewicz, 2015).

Researchers have emphasized the importance of communicating continuously about the local food movement. Bianchi and Mortimer (2015) stressed the importance of developing communication materials explaining how consuming local food supports local businesses and farmers, and suggested effective local food campaigns would reinforce personal values associated with local consumption. Goodwin (2013) suggested message testing could be used to address the local food conversation.

Using the appropriate communication format plays a critical role in effective communication (Webster & Ksiazek, 2012), and video has become a common communication method for promoting products, and has recently been considered the most powerful storytelling medium (Schroeder, 2015) as well as the most utilized content medium by marketers (Borowski,
Online video’s characteristics of being entertaining, informational, and engaging have also gained approval from a variety of audiences (Hagerty, 2008; Schroeder, 2015, Trimble, 2015).

Recently, the United States (U.S.) Farmers and Ranchers Alliance suggested that if consumers’ concerns about food and agriculture continue to go unaddressed, communication efforts will never be able to enhance the credibility of the agricultural industry (Schroeder, 2015). Therefore, it becomes important to examine how deep-rooted values drive the effect of local food messages on consumers’ attitude toward local food. Specifically, this study investigated how two personal values influenced the effect of online video on consumers’ attitude toward local food. This study adds to Priority Five and Six of the National Research Agenda of the American Association for Agricultural Education: “Efficient and Effective Agricultural Education Programs” and “Vibrant, Resilient Communities” (Roberts, Harder, & Brashears, 2016, p. 41, p. 49), and contributes to the research questions under the priorities, “What methods, models, and programs are effective in communicating with diverse audiences?” (p. 43) and “How do agricultural leadership, education, and communication teaching, research, and extension programs impact local communities?” Further, this research was necessary to inform agricultural educators and communicators on how to effectively influence the public about agriculture from the aspect of local food, which enhances economy and social connections in a local community.

Literature Review

Framing theory was one of the theories used to guide this study as we considered the two discourses we were interested in regarding local food: enhancing local economy and strengthening social connections. Shoemaker and Reese (1996) referred to framing as the way journalists and other communicators present information, which resonates with audiences’ existing schemas. Per the assumption of the sociological approach to framing, human beings are incapable of fully understanding the world and rely on the information that is available to them to make sense of the world (Goffman, 1974; Heider, 1959; Scheufele, 2000). The information individuals obtain is largely influenced by how journalists and communicators frame the information (Scheufele, 1999). Framing provides media audiences with “greater apparent relevance to the issue than they might appear to have under an alternative frame” by stressing certain values and facts (Nelson, Clawson, & Oxley, 1997, p. 567). However, framing is not a “magic bullet” to change an audience’s perceptions and attitude (Cantril, Gaudet, & Herzog, 1940). A wide-range of literature on framing has revealed framing effects are not universal and individual characteristics such as demographics and personal experience have a great amount of influence on opinions (Brewer, 2003; Druckman, 2001, 2004; Druckman & Nelson, 2003).

How audiences process and interpret information varies based on their “preexisting meaning structures or schemas” (Scheufele, 1999, p. 105). As indicated in Scheufele’s (1999) process model of framing, existing audience frames moderate the relationship between media frames and their outcome to an audience. Scheufele and Lyengar (2012) stated framing effects vary in strength depending upon audiences’ preexisting schema (p. 14).

Given the effect of personal schema on decisions-making processes, we used schema theory to guide this study in light of its connection between information processing and attitude. Neisser (1976) regarded schemata as “the medium by which the past affects the future; information already acquired determines what will be picked up next” (p. 74). When new information is presented, individuals search for existing schemata for satisfying interpretations (Axelrod, 1973). Those who find satisfying interpretation for the new information may extend usage of the selected schema, upgrade source credibility, and use this schema with more confidence in the future. If the new information fails to match any existing interpretations, people will place blame with either the
old or the new information source. These individuals will either exit the new information processing
with their old interpretation or combine old and new information to find new explanations. If they
are successful in combining information, a person may modify or extend usage of selected schema
and use the interpretation, with more confidence in the future (Axelrod, 1973).

Personal values play important roles in forming schema that guide attitudes and behaviors
(Schwartz & Bilsky, 1987). Rokeach (1973) defined values as “enduring beliefs that a specific
mode of conduct or end-state of existence” (p. 5). Values have often been treated as stable mental
structures that vary little by situation (Hitlin & Piliavin, 2004). This trait of values distinguishes
itself from attitude, where attitude is “an organization of several beliefs around a specific object or
situation” (Rokeach, 1973, p. 18). The values an individual follows play an important role in
consumer attitude and the decision-making process on food choice (Burgess, 1992; Honkanen,
Verplanken, & Olsen, 2006; Vermeir & Verbeke, 2008).

Personal value is also an important indicator of the framing effect of an issue. Previous
literature on public opinion has revealed the receptivity to an issue frame is determined by the
consistency between the message conveyed in the frame and the audience member’s personal
beliefs and values (Haider-Markel & Joslyn, 2001; Ramírez & Verkuyten, 2011; Zaller & Feldman,
1992). When individuals link their attitude of an issue to important values, the communication
messages are usually less effective (Douglas, Westley, & Chaffee, 1970; Johnson & Eagly, 1989).
However, when the message is consistent with the audience member’s personal values, a positive
attitude of the issue can be predicted (Hullett, 2002; Maio & Olson, 1994).

Consumer attitude is a relatively stable state, which implies a degree of resistance to change
(Eagly & Chaiken, 1995), with strong attitudes being more predictive of consequent behavior
(Eagly & Chaiken, 1995). The fact that audience attitudes moderate the relationships between the
received media information and behavioral outcomes makes attitude a valuable concept for mass
media research (Petty et al., 2009). With additional research showing the success of a media
campaign was determined by whether the campaign changed the media recipient’s attitudes in the
desired direction or would lead to the desired behavior change (Petty, Brinol, & Priester, 2009).

Previous research has demonstrated consumers exhibit positive attitudes toward local food
(Bianchi & Mortimer, 2015; Godette et al., 2015) and that local food consistently has been
considered fresher and more nutritious (Chambers, Lobb, Butler, Harvey, & Traill, 2007; Zepeda
& Leviten-Reid, 2004), better for the local community (Morris & Buller, 2003; Qu, Roper, &
Rumble, 2014; Thilmany, Bond, & Bond, 2008), and more environmentally friendly (Gracia &

Purpose and Objectives

The purpose of this study was to assess how a personal value associated with the local food
messages delivered through online videos influenced U.S. consumers’ attitudes toward local food.
Each of the online videos was developed to feature how local food supports the local economy and
builds social connections, respectively. The personal values associated with the two videos were
the personal value of supporting the local economy and the personal value of strengthening social
connection. The specific objectives were:

Objective 1: Describe U.S. consumers’ personal value of supporting the local economy,
personal value of strengthening social connections, and attitude toward local food after watching
an assigned online video about how local food supports the local economy or after watching an
assigned online video about how local food strengthens social connection.
Objective 2: Determine if U.S. consumers’ personal value (personal value of supporting the local economy; personal value of strengthening social connection) associated with the message frame on their assigned video (an online video featuring local food benefiting local economy; an online video featuring local food benefiting local economy strengthening social connection) predicts their attitudes toward local food.

The hypothesis used was that the personal value associated with the treatment message frame was a stronger predictor of attitude toward local food than the other personal value.

Methods

This study was part of a national study examining U.S. consumers’ food-related perceptions and behaviors, where we designed a between-subject post-test only experiment to fulfill the objectives. Two video treatments were developed with one focused on how local food supports local economy, and the other focused on how local food strengthens social connection.

We conducted eight cognitive interviews to ensure that the video treatment was understood as the researcher intended (Dillman, Smyth, & Christian, 2014). Cognitive interviews help researchers revise “wording, question order, visual design, and navigation problems” (Dillman et al., 2014, p. 243). We selected the interviewees from a convenience sample of grocery shoppers residing in California, Florida, Iowa, and Wisconsin. None of the interviewees had an agricultural background. With the feedback provided by the interviewees, we reworded several long sentences for clarity and replaced a few images in the videos to avoid bias.

We also conducted a pilot test in a class within a college of agricultural and life sciences of a large southeastern university to determine instrument reliability and validity. Prior to the pilot test, a panel of experts reviewed the instrument for face and content validity. We selected a panel of experts based on members’ knowledge and experience in the fields of consumer attitudes, communication theory, experimental design, survey design, video production, and health and science messaging. The instruments were deemed reliable from the pilot study (Cronbach Alpha value of local economy scale (pilot study) = .75; Cronbach Alpha value of social connection scale (pilot study) = .85; Cronbach Alpha value of local economy scale (pilot study) = .79; Cronbach’s Alpha value of social connection scale = .85; Cronbach’s Alpha attitude toward local food scale = .88).

Qualtrics, an online survey company, was selected to distribute the survey, and they provide a non-probability opt-in panel sampling method to recruit respondents representative of U.S. residents age 18 or older. To compensate for the possible error of non-probability sampling such as coverage error and non-randomization, this study weighted the sample data using sex, age, and race from the 2010 U.S. Census data (Baker et al., 2013).

We created the videos with messages specifically about how local food supported local economy and strengthened social connections, respectively. We combined still images that fit the messages in the videos, and to control the effect of stimuli, we kept the messages in both videos in the same style of narration, same tone, same technical effects, and utilized the same intro and outro. We inserted manipulation check questions in the survey to ensure the respondents experienced what the researcher intentionally manipulated (Gravetter & Forzano, 2015). In addition, at the beginning of the survey, we asked the respondents to test their audio before the video started playing and respond whether they could view and hear a test video. Respondents who were unable to view or hear the video were directed to the end of the survey. To ensure respondents spent sufficient time
viewing the video, respondents could not progress through the survey until 35 seconds had elapsed while they were supposed to be watching the video.

This study is part of a large study examining U.S. consumers’ food-related perceptions and behaviors. The original survey was launched on April 26, 2016 for a duration of four days, and closed on April 29, yielding 3,097 responses, 1,024 of which were complete (33.1%). Respondents randomly received one of the video treatments. The original study contains a control group and another video treatment group that are not relevant to the objectives of this study. According to the objectives of this specific study, we removed the irrelevant participants, leaving a total of 432 responses relevant for this study. Table 1 displays the frequencies and percentages of the respondents in each treatment group and the links to the video treatments used in this study.

Table 1

<table>
<thead>
<tr>
<th>Respondents of Each Treatment and Video Treatment Link</th>
<th>f</th>
<th>%</th>
<th>Video URL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Support of local economy treatment</td>
<td>215</td>
<td>49.8</td>
<td><a href="https://youtu.be/u-HZXo4GTqE">https://youtu.be/u-HZXo4GTqE</a></td>
</tr>
<tr>
<td>Strengthening social connection treatment</td>
<td>217</td>
<td>50.2</td>
<td><a href="https://youtu.be/wJwHwTGhie4">https://youtu.be/wJwHwTGhie4</a></td>
</tr>
</tbody>
</table>

Researchers of this study developed scales for two personal values (personal value of supporting of the local economy and personal value of strengthening social connection) as well as one attitude toward local food. We measured each of the three scales using responses to a list of statements on a 5-point Likert scale (i.e., 1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree nor Disagree, 4 = Agree, 5 = Strongly Agree). The two personal value scales were worded in a way to address the personal values in general, not as they specifically related to local food. Each of the personal value measurements had two statements negatively worded and the rest positively worded (e.g., “I prefer that money I spend stay in my neighborhood community” and “Social interaction with members of my neighborhood community is irrelevant to me”). We reverse-coded the negatively worded statements for the analysis. Each of the scales was summed and averaged to generate a mean score. The range of each scale was from one to five. The real limits standard set to interpret the scales were: 1.00 – 1.49 = Strongly Disagree, 1.50 – 2.49 = Disagree, 2.50 – 3.49 = Neutral, 3.50 – 4.49 = Agree, and 4.50 – 5.00 = Strongly Agree.

Data Analyses

We used descriptive statistics to address objective one. For objective two, we hypothesized that respondents’ personal value associated with their received video treatment drove the respondent’s attitude toward local food. That is, the personal value associated with the video treatment (either supporting the local economy with the local economy video treatment, or strengthening social connection with the social connection video treatment) was expected to be a more significant predictor of attitude toward local food when compared to the other non-associated personal value. To ensure the comparability of the two value scales, the respondents’ score for each value was converted to z-scores using the formula, \( z = \frac{x-\mu}{\sigma} \). Z-scores convey the standard deviations from their means for a normal distribution (Field, 2013). The z-score assisted in making the two personal value scales comparable in the sense that both respondents’ personal value scores are compared according to the mean and standard deviation of each personal value.
Multiple regression was used to determine how each standardized personal value predicted attitude toward local food in each video treatment group. In both treatment groups, we used the z-score of the two personal values to predict the participants’ attitudes toward local food. Further, we identified if the personal value associated with the video treatment was the stronger predictor of the attitude toward local food. The predictor variables were the standardized personal values of supporting the local economy (ECO) and strengthening social connection (SOC). The response variable was attitude toward local food. Prior to conducting multiple regression analysis, assumptions of normality, independence, homoscedasticity, additivity and linearity, and multicollinearity were tested and satisfied (Field, 2013).

**Results**

**Objective 1**

Objective one was to describe U.S. consumers’ personal value of supporting the local economy, personal value of strengthening social connections, and attitude toward local food after watching one of the assigned online videos about how local food supports the local economy or about how local food strengthens social connection.

For the personal value of supporting the local economy, the mean was 3.44 ($SD = .63$), indicating respondents held a neutral personal value of supporting the local economy (see Table 2). Similarly, for the personal value of strengthening social connection scale, a mean of 3.45 ($SD = .72$) was determined, indicating a neutral value of social connection. Attitude toward local food in the treatment groups was 3.62 and 3.59 respectively, demonstrating a positive attitude toward local food after viewing either of the two video treatments.

Table 2

**Descriptive Analyses of Personal Values and Attitude**

<table>
<thead>
<tr>
<th></th>
<th>Original $M$</th>
<th>Original $SD$</th>
<th>Standardized $M$</th>
<th>Standardized $SD$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value of supporting the local economy</td>
<td>3.44 a</td>
<td>.63</td>
<td>.01</td>
<td>1.01</td>
</tr>
<tr>
<td>Value of strengthening social connection</td>
<td>3.45 a</td>
<td>.76</td>
<td>-.00</td>
<td>0.95</td>
</tr>
<tr>
<td>Attitude toward local food In local economy treatment</td>
<td>3.62 a</td>
<td>.62</td>
<td></td>
<td></td>
</tr>
<tr>
<td>In social connection treatment</td>
<td>3.59 a</td>
<td>.67</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. a 1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree nor Disagree, 4 = Agree, 5 = Strongly Agree; The real limits standard is: 1.00 – 1.49 = Strongly Disagree, 1.50 – 2.49 = Disagree, 2.50 – 3.49 = Neutral, 3.50 – 4.49 = Agree, and 4.50 – 5.00 = Strongly Agree.

A majority of the respondents agreed or strongly agreed with the statements, “The prosperity of my neighborhood community economy is important to me,” and “I prefer money I spend stay in my neighborhood community.” The percentages of combined agree and strongly agree and combined disagree and strongly disagree were both close to 30% with the statements “I am all right if the money I spend does not benefit my neighborhood community,” and “I hardly think about whether or not the money I spend benefits my neighborhood” (see Table 3).
Table 3

**Personal Values of Supporting the Local Economy Scale (n = 432)**

<table>
<thead>
<tr>
<th>Statement</th>
<th>Level of Agreement/Disagreement</th>
</tr>
</thead>
<tbody>
<tr>
<td>The prosperity of my neighborhood community economy is important to me.</td>
<td>SD %  D %  NAND %  A %  SA %</td>
</tr>
<tr>
<td>I prefer that money I spend stay in my neighborhood community.</td>
<td>1.8  3.7  26.5  50.2  17.8</td>
</tr>
<tr>
<td>It is important for me to know that the money I spend benefits those in my neighborhood community.</td>
<td>1.7  6.2  31.5  46.5  14.0</td>
</tr>
<tr>
<td>I am concerned about the economy associated with my neighborhood community shrinking.</td>
<td>2.6  13.2  35.7  35.7  12.8</td>
</tr>
<tr>
<td>I am all right if the money I spend does not benefit my neighborhood community a</td>
<td>5.5  23.7  40.4  24.7  5.7</td>
</tr>
<tr>
<td>I hardly think about whether or not the money I spend benefits my neighborhood a</td>
<td>9.9  25.5  34.0  23.1  7.5</td>
</tr>
</tbody>
</table>

Note. Scale: a Reverse-coded items.

For the personal value of strengthening social connection scale, more than half of the respondents agreed or strongly agreed with the statement, “It is valuable to interact with people whom are different from myself in my neighborhood community,” “It is important for me to be able to discuss issues with others in my neighborhood community,” and “It is valuable to listen to different opinions from people in my neighborhood community” (see Table 4). About half of respondents disagreed or strongly disagreed with the statements, “I do not see the value of interacting with others in my neighborhood community,” and “Social interaction with members of my neighborhood community is irrelevant to me.”
Table 4

*Personal Values of Strengthening Social Connection Scale (n = 432)*

<table>
<thead>
<tr>
<th>Statement</th>
<th>Level of Agreement/Disagreement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connecting with the members of my neighborhood community is important to me.</td>
<td>SD% 15.3  D% 4.1  NAND% 34.2  A% 37.4  SA% 9.1</td>
</tr>
<tr>
<td>It is valuable to interact with people who are different from myself in my neighborhood community.</td>
<td>SD% 2.8  D% 4.6  NAND% 34.9  A% 46.5  SA% 11.2</td>
</tr>
<tr>
<td>It is important for me to be able to discuss issues with others in my neighborhood community.</td>
<td>SD% 3.8  D% 12.3  NAND% 31.5  A% 42.2  SA% 10.3</td>
</tr>
<tr>
<td>It is valuable to listen to different opinions from people in my neighborhood community.</td>
<td>SD% 2.1  D% 3.4  NAND% 33.4  A% 47.2  SA% 13.9</td>
</tr>
<tr>
<td>I do not see the value of interacting with others in my neighborhood community.</td>
<td>SD% 15.4  D% 34.7  NAND% 30.0  A% 16.9  SA% 2.9</td>
</tr>
<tr>
<td>Social interaction with members of my neighborhood community is irrelevant to me.</td>
<td>SD% 13.2  D% 32.6  NAND% 26.9  A% 10.7  SA% 6.5</td>
</tr>
</tbody>
</table>

Note. Scale: *Reverse-coded items.*

Table 5 displays the frequencies of attitude toward local food. Zero respondents in the strengthening social connection treatment group strongly disagreed with the statement “I prefer locally produced food than food produced elsewhere,” while about 60% in both treatment groups agreed or strongly agreed with the same statement. Similarly, more than 60% of the respondents in both treatment groups agreed or strongly agreed with the statements “Having access to locally produced food is important to me,” “I believe consuming locally-produced food has more benefits than consuming non-locally produced food,” “It is necessary for people to have access to local food,” and “Locally grown food is more appealing to me than non-locally-produced food.”
Table 5

Attitude Toward Local Food in Each Treatment Group (N = 432)

<table>
<thead>
<tr>
<th>Attitude</th>
<th>Local economy treatment (n = 215)</th>
<th>Social connection treatment (n = 217)</th>
<th>SD %</th>
<th>D %</th>
<th>NAND %</th>
<th>A %</th>
<th>SA %</th>
</tr>
</thead>
<tbody>
<tr>
<td>I prefer locally produced food than food produced elsewhere.</td>
<td>1.3</td>
<td>1.6</td>
<td>36.3</td>
<td>39.7</td>
<td>21.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Having access to locally produced food is important to me.</td>
<td>.4</td>
<td>2.3</td>
<td>36.1</td>
<td>45.0</td>
<td>16.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I believe consuming locally produced food has more benefits than consuming non-locally-produced food.</td>
<td>1.1</td>
<td>3.2</td>
<td>31.4</td>
<td>43.6</td>
<td>20.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>To me, locally produced food is more valuable than non-locally produced food.</td>
<td>1.8</td>
<td>3.7</td>
<td>36.9</td>
<td>42.8</td>
<td>14.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>It is necessary for people to have access to local food.</td>
<td>1.3</td>
<td>4.5</td>
<td>29.5</td>
<td>45.2</td>
<td>19.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Locally grown food is more appealing to me than non-locally-produced food.</td>
<td>1.1</td>
<td>3.7</td>
<td>28.8</td>
<td>43.1</td>
<td>23.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consuming non-local food does not bother me.</td>
<td>3.3</td>
<td>21.1</td>
<td>32.9</td>
<td>32.7</td>
<td>10.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consuming local food is irrelevant to me.</td>
<td>14.8</td>
<td>49.9</td>
<td>23.0</td>
<td>8.0</td>
<td>4.3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. Scale: *Items were reverse-coded when attitude index was created."
Objective 2

Objective two was to determine if U.S. consumers’ personal value (supporting the local economy or strengthening social connection) associated with the message frame on their assigned video (an online video featuring local food benefiting local economy; an online video featuring local food benefiting local economy strengthening social connection) predicts their attitudes toward local food.

Results showed U.S. consumers’ personal values of supporting the local economy and strengthening social connection significantly predict their attitude toward local food in both video treatment groups (see Table 6).

In the local economy video treatment group, both personal values (supporting the local economy and strengthening social connection) explained 37.4% of the variance of the attitude toward local food. In the social connection video treatment group, both personal values explained 50.9% of the variance of the attitude toward local food.

Table 6

Regression Coefficients of the Multiple Linear Regression Model Predicting Attitude Toward Local Food and Total Variance Associated with Attitude Toward Local Food within Each Treatment Group

<table>
<thead>
<tr>
<th>Group</th>
<th>Variables</th>
<th>β</th>
<th>t</th>
<th>p</th>
<th>Adjusted R²</th>
<th>R²</th>
<th>F</th>
<th>Model p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local Economy</td>
<td>(Constant)</td>
<td>107.06</td>
<td>.00**</td>
<td>.380</td>
<td>.374</td>
<td>64.89</td>
<td>.00**</td>
<td></td>
</tr>
<tr>
<td>Treatment</td>
<td>Z-value of ECO</td>
<td>.43</td>
<td>5.84</td>
<td>.00**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Z-value of SOC</td>
<td>.24</td>
<td>3.25</td>
<td>.00**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social Connection</td>
<td>(Constant)</td>
<td>111.58</td>
<td>.00**</td>
<td>.513</td>
<td>.509</td>
<td>113.14</td>
<td>.00**</td>
<td></td>
</tr>
<tr>
<td>Treatment</td>
<td>Z-value of ECO</td>
<td>.65</td>
<td>10.29</td>
<td>.00**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Z-value of SOC</td>
<td>.09</td>
<td>1.46</td>
<td>.15</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Within the local economy treatment group, both standardized personal values were significant predictors of respondents’ attitudes toward local food (see Table 6). Personal value of supporting the local economy was a stronger predictor of attitudes toward local food than personal value of strengthening social connection for respondents who received the local economy video treatment ($\beta_{ECO} = .43$, $p < .01$; $\beta_{SOC} = .24$, $p < .01$). Among those receiving the video about how local food strengthens social connections, the personal value of strengthening social connection was not a significant predictor of respondents’ attitudes toward local food ($\beta_{SOC} = .09$, $p = .15$), while the personal value of supporting the local economy was significant predictors of attitude toward local food ($\beta_{ECO} = .65$, $p < .01$) (see Table 6).

These results revealed, regardless of which video treatment the respondents viewed, their personal value of supporting the local economy predicted more of their local food attitude than their personal value of strengthening social connection. Because the personal value that associated with the video message frames was not the most significant predictor for the local food attitudes, the hypothesis stating “the personal value that associated with the message frame of the video
treatment was a stronger predictor of attitude toward local food than the other personal value” was rejected.

Conclusions

The findings of this study indicated U.S. consumers held a neutral personal value of supporting the local economy and strengthening social connection. With viewing either video treatment, U.S. consumers’ attitudes toward local food were shifted to positive. The personal value of supporting the local economy was a significant predictor of a consumer’s attitude toward local food after they were exposed to either video featuring local food’s benefits of supporting the local economy or strengthening social connection. Additionally, the personal value of strengthening social connection was also a significant predictor of local food attitude for those who watched the video about how local food supports the local economy, but not a significant predictor of local food attitude for those who watched the video about how local food strengthens social connection. In other words, for those who watched the video presenting local food’s benefits on social connection, their attitude toward local food was not driven more by their personal value of strengthening social connection than other personal values. This finding aligned with previous research findings that communication messages about an issue are less effective when individuals already link the issue with their important values (Douglas et al., 1970; Johnson & Eagly, 1989).

These findings demonstrated that the personal value associated with the media frame could be a significant predictor of local food attitude, but may not be the most significant predictor. In fact, the personal value associated with the media frame of a video treatment can even be an insignificant predictor of attitudes toward local food. It also implies that individuals do not rely on their personal values most directly associated with the media message frame to inform their attitudes toward local food. The local economy value—the stronger predictor of local food attitude in both treatment groups—is consistent with previous findings that consumers mainly associate local food with supporting the local economy (Thilmany et al., 2008; Zepeda & Leviten-Reid, 2004). This finding also is consistent with previous studies about values and attitude, which is that a positive attitude can be predicted when communication messages agree with the audience members’ values (Hullett, 2002; Maio & Olson, 1994).

Additionally, these findings indicate that when an individual’s personal value of supporting the local economy increased, videos showing local food’s benefits of supporting the local economy or strengthening social connection yielded a more positive attitude toward local food. Agricultural communicators should expect a more favorable local food attitude among people who care more about supporting their local economy if showing them a video demonstrating supporting the local economy or strengthening social connection media frames about local food.

Recommendations

The message frames about local food benefits on the video treatments did not seem to trigger consumers’ corresponding personal values to influence their attitudes toward local food. In fact, results showed personal value of supporting the local economy is a stronger predictor of attitude toward local food, regardless of the local food benefit message frame presented. Therefore, future research should use a qualitative approach to explore the rationale behind this finding. Focus groups should be conducted where participants are shown the two videos and asked to discuss what they think about local food after viewing the videos. Focus group research would provide an opportunity to discover why the personal value of supporting the local economy is the most important when local economy-related information is not even discussed in the social connection.
video. Such findings would be insightful and help researchers better understand the dynamic between media materials, individuals’ values systems, and attitude formation.

This study found the personal value of strengthening social connection does not predict local food attitudes when respondents received the social connection video treatment. More interestingly, the personal value of strengthening social connection did significantly predict local food attitude when the video was about benefits to the local economy, but not the social connection treatment. Future research should use qualitative study to explore if the personal value strengthening of social connection scale in this study accurately measured this personal value.

In addition, the videos should be tested with different populations. For example, testing them with populations who have different levels of experience purchasing local food or individuals who have an agricultural background versus those that do not could be informative. Testing the same video treatment with diverse populations could help to create targeted communication materials about local food to different groups of people.

A major finding from the study was that personal values of supporting local food was a significant predictor of local food attitudes in both video treatment groups. This finding indicated local food attitudes can be expected to increase when personal value of supporting the local economy increases. Because individuals’ personal value of supporting the local economy was also found neutral, communication and education strategies should be implemented to increase consumers’ local economy values. It is important to recognize value is a stable mental structure that varies little by situation (Hitlin & Piliavin, 2004). Therefore, agricultural communicators should not expect personal values to be modified easily and quickly. Other types of media format or long-term communication or education plans should be studied to examine how to increase consumers’ personal values effectively, further increasing consumers’ favorable attitudes toward local food. We should also use this approach to explore the connection between personal values and consumers’ attitude toward other agricultural issues.

Reference


Ketchum & Maslansky. (2013). From the farm belt to Facebook and beyond: America’s farmers and ranchers are leading the food dialogues. Public Relations Society of America. Retrieved from http://cite.nwmissouri.edu/ic/29-460/2013_SilverAnvils/From_The_Farm_Belt_to_Facebook_and_Beyond_America.pdf


National Participation in School-Based Agricultural Education: Considering Ethnicity, Sex, and Income

Jonathan J. Velez1, Haley Q. Clement2 & Aaron J. McKim3

Abstract

An empirical understanding of the value school-based agricultural education (SBAE) offers has been limited due to lack of widespread, longitudinal studies addressing the impacts of student participation in SBAE. Grounded in the theory of involvement, data from a nation-wide, longitudinal study were analyzed to explore ethnicity and income among students with varying levels of vocational club and SBAE involvement. Results indicated Black males had high involvement in non-SBAE vocational clubs but low involvement in SBAE-vocational clubs. Black and Hispanic females enrolled in SBAE at rates close to the percentages in the high school population; however, Black and Hispanic females rarely attained officer roles in SBAE-vocational clubs. White females, on the other hand, dominated officer roles within SBAE vocational clubs. Results also indicate females enrolled in SBAE who served as officers earned an additional $10,507 annually compared to non-SBAE, female officers. However, regarding the impact of involvement in SBAE on males who serve as officers, results indicate decreased income compared to their non-SBAE peers. Findings are discussed in relation to the theory of involvement, with an emphasis on recommendations for further research.

Keywords: school-based agricultural education; student involvement; student ethnicity; club participation; income

Introduction

Student participation in the National FFA Organization is a critical component to a complete school-based agricultural education (SBAE) program experience; yet, little has been done to evaluate participation in, and the long-term impacts of, FFA involvement on a national scale. In the absence of such knowledge, stakeholders to SBAE are unable to holistically evaluate the current realities and future possibilities of the National FFA Organization and the diverse students served by this organization.

Historically, SBAE and FFA have been viewed as vocational approaches to education with the aim of preparing individuals for agriculture, food, and natural resource (AFNR) occupations, innovations, and informed community engagement (Phipps, Osborne, Dyer, & Ball, 2008). As a catalyst to SBAE, the Smith-Hughes Act spurred several pieces of legislation supporting vocational education across the country and, by 1982, 97% of high school graduates had completed at least one vocational course during high school (Boesel, 1994) a percentage which fell to 80% of high school graduates in 2009 (Nord et al., 2011). Today, vocational education (i.e., now referred to as

1 Jonathan J. Velez is an Associate Professor of Agricultural Sciences, Education and Leadership in the Department of Agricultural Education and Agricultural Sciences at Oregon State University, 108 Strand Agriculture Hall, Corvallis, OR 97331, jonathan.velez@oregonstate.edu.
2 Haley Q. Clement is a graduate teaching assistant in the Department of Agricultural Education and Agricultural Sciences at Oregon State University, 108 Strand Agriculture Hall, Corvallis, OR 97331, haley.clement@oregonstate.edu.
3 Aaron J. McKim is an Assistant Professor in the Department of Community Sustainability at Michigan State University, 480 Wilson Road, Room 131, East Lansing, MI 48824, amckim@msu.edu.
“Career and Technical Education” [CTE]) continues with the mission of career preparation (Association for Career and Technical Education, 2016). Within the larger scope of career preparation, disciplines like SBAE have identified a growing importance in recruiting and training a more diverse population of students (Stripling & Ricketts, 2016). To address the mission of career preparation in tandem with increasing diversity, SBAE needs nation-wide research on who is currently being served, and underserved, within SBAE as well as the economic impact of SBAE and FFA engagement. The current study addressed these needs by evaluating the sex and ethnic distribution of student participants in SBAE and vocational4 clubs as well as post-graduation income of students with varying levels of SBAE and vocational club involvement.

Literature Review

Income

A dearth of research has directly evaluated employment earnings in relation to SBAE involvement (McKim, Velez, & Sorensen, 2017). However, research within this line of inquiry has identified SBAE coursework to be a significant positive predictor of postsecondary income, with each additional Carnegie unit of SBAE relating to $1,850.67 more annual income for students who did not pursue postsecondary schooling and $457.40 additional annual income for students who earned a postsecondary diploma (McKim et al., 2017). The McKim et al. study, however, did not explore income in relation to level of leadership involvement in FFA. Expanding the scope to include all CTE courses, several studies have evaluated economic outcomes associated with involvement. Unfortunately, consensus has not been reached, with some studies suggesting an increase in employment earnings (Gustman & Steinmeier, 1982; Silverberg, Warner, Fong, & Goodwin, 2004) while others suggest higher earnings achieved among students not taking CTE coursework (Meer, 2007). Yet, even among research identifying a positive relationship between CTE coursework and employment earnings, benefits appear to vary substantially by sex and ethnic characteristics (Gustman & Steinmeier, 1982) as well as postsecondary attendance and timing (i.e., short, medium, and long-term) of effect (Silverberg et al., 2004).

A similar story unfolds as we transition to the economic impact of club participation, with no research evaluating the relationship between employment earnings and Career and Technical Student Organization (CTSO) participation, including FFA (Bird et al., 2012; Croom & Flowers, 2001; Rose et al., 2016). Broadening the scope to include all student clubs at the secondary level reveals positive outcomes for students involved in clubs (Costa, 2010; Kosteas, 2010; Lipscomb, 2007; Rouse, 2009, 2012). While the focus of research has been on non-economic outcomes (e.g., higher test scores, postsecondary degree attainment), studies have linked club participation with higher employment earnings (Costa, 2010; Kosteas, 2010). Further, research has identified holding a student club leadership position is related to higher employment earnings (Eren & Ozbeklik, 2010; Rouse, 2009); however, as was the case with coursework, the economic impact varies by sex (Rouse, 2009).

Ethnicity

Historically, SBAE has predominantly been comprised of White males (Gordon, 2014). Data provided by the National FFA Organization (FFA), the largest agriculture-based vocational
club, reported 649,355 student members in 2016 with 41% males, 32% females, and 27% who did not report their sex. Ethnicity distribution included 41% identifying as White, 13% Hispanic, 3% Black, 1% American-Indian, 1% Asian, Native Hawaiian or Pacific Islander, 1% two or more races, and 40% who did not report their ethnicity (National FFA Organization, 2016a). The higher proportions of White males are mirrored throughout additional literature (e.g., Lawrence, Rayfield, Moore, & Outley, 2013; Talbert & Larke 1995); however, female involvement in SBAE appears to be increasing in recent decades (Retallick & Martin, 2005; Balschweid & Talbert, 2000). Research specific to CTE enrollment in 2014 revealed 53.7% of students enrolled in CTE were males and 46.7% were females. White was the predominant ethnicity (51.9%) followed by Hispanic/Latino (23.7%), Black (16.2%), and Asian (4%) (U.S. Department of Education, 2016).

Although several studies investigated benefits and barriers for ethnic minorities to enroll in SBAE, we found no studies exploring ethnicity and sex by varying levels of vocational club (i.e., participant and officer) and SBAE involvement. Studies exploring reasons why minority students enroll in SBAE identified encouraging and passionate SBAE teachers, high parent involvement and family influences, job preparation and skill development, hands on learning environment, response to social pressure, and academic achievement as motivators for enrollment (Balschweid & Talbert, 2000; Jones & Bowen, 1998; Roberts et al., 2009; Sutphin & Newsom-Stewart, 1995; White, 2015). Alternatively, Balschweid and Talbert (2000) identified negative perceptions of the agriculture industry and a lack of encouragement by teachers as factors that discourage some ethnicities from participation in FFA.

Analysis of the available literature revealed a lack of national data exploring the ethnicity and sex of students who enroll in SBAE, participate, and assume officer roles as well as the relationship between SBAE participation and income. Acquisition of such knowledge would illuminate populations of students underserved within SBAE, and associated leadership opportunities, as well as the economic benefits of SBAE participation. The current study leveraged a national, longitudinal dataset to address the identified limitations of existing research while also supporting the National Research Agenda’s call to examine the short, medium, and long-term outcomes and impacts of educational programs within agriculture and natural resources (Roberts, Harder, & Brashears, 2016).

Theoretical Framework

Given the focus on SBAE enrollment, ethnicity, sex, and income in relation to levels of involvement, the current study is grounded in the theory of involvement (Astin, 1999). Astin postulated student involvement in co-curricular activities will result in desirable outcomes in learning and personal development. Astin defined involvement as “the quantity and quality of the physical and psychological energy that students invest to the academic experience” (Astin, 1999, p. 518). Although Astin recognized student motivation, and other internal constructs such as feelings or thoughts as important aspects of involvement, he placed more emphasis on student behavior, actions, and decisions when defining involvement. In our study, we theorize student behavior, actions, and decisions are linked to choices to enroll in SBAE and participate at various levels.

Astin (1999) stated involvement can take many forms, including but not limited to: coursework and studying, school clubs and organizations, and interaction with faculty and peers on campus. The theory of involvement includes five main postulates: (a) involvement is identified as both physical and psychological investment by students, (b) involvement is not concrete, but rather exists on a continuum, and students will manifest involvement in different objects at different times, (c) involvement can be measured both quantitatively (i.e., how many hours a student spends on
A large body of research over the past two decades confirms positive direct and indirect influences of student involvement experiences on students. Consistent evidence concludes a variety of experiences positively impact developmental learning outcomes, including moral development, cognitive development, and vocational aspirations on college students (Hernandez, Hogan, Hathaway, & Lovell, 1999; Moore, Lovell, McGann, & Wyrick, 1998; Terenzini, Pascarella, & Blimling, 1996). Further, studies show involvement specifically in leadership activities during college result in positive growth in numerous areas including civic responsibility/citizenship, multicultural awareness, collaboration, and personal and societal values (Cress, Astin, Zimmerman-Oster, & Burkhardt, 2001; Dugan & Komives, 2007; Foubert & Grainger, 2006).

Although literature has provided ample evidence of Astin’s theory with college students, limited research has explored these phenomena in secondary school students. Further, although personal and learning outcomes are seen as positive outcomes of involvement, little is known about how involvement contributes to future economic outcomes, in particular how positional involvement, such as becoming an officer in an organization versus simply participating in a club impacts future income. The current study explored how income, ethnicity, and sex relate to levels of involvement in a vocational club and SBAE.
Purpose of the Study

According to the U.S. Department of Education (2004), the Educational Longitudinal Study of 2002 (ELS: 2002), “offers the opportunity for the analysis of trends in areas of fundamental importance, such as patterns of course taking, rates of participation in extracurricular activities, academic performance, and changes in goals and aspirations” (p.11). Leveraging the ELS: 2002 dataset, the purpose of this study was to examine SBAE course participation, vocational club participation, ethnicity, and sex in relation to income after high school. The current study addressed the following research objectives:

Objective 1: Compare percent participation of vocational club (i.e., participant and officer) and SBAE involvement by ethnicity and sex.

Objective 2: Compare income of vocational club (i.e., participant and officer) and SBAE involvement by ethnicity and sex.

Methods

In order to address the established research objectives, a nationally representative sample of high school students was sought with corresponding club participation and income data. Data were utilized from the ELS: 2002 which collected baseline data from high school sophomores, beginning in 2002 and culminating in a 2012 collection. Given the scope of the ELS: 2002, we will only present a general overview of the methods in this paper. We encourage review of the U.S. Department of Education, National Center for Educational Statistics, Education Longitudinal Study of 2002: Base Year Data File User’s Manual (2004) for more detailed methodological information.

One of the challenges of using a longitudinal data collection method is the passage of time between collection points. However, longitudinally tracking a nationally representative sample of students allowed us to examine high school involvement and corresponding income levels six years after graduation. Given the size and scope of this study, the complete dataset was not released for analysis until April 2015.

Target Population and Frame

The overall target population was students within all secondary schools, including public schools, charter schools, Catholic, and other private schools serving sophomore students in the United States during the 2002-2003 school year, including all 50 states and the District of Columbia (U.S. Department of Education, 2004). A representative sampling frame of schools, stratified by U.S Census divisions, and further substratified by urban, suburban, and rural, was selected resulting in an initial sample frame of 800 schools. Probability proportional to size (PPS) sampling was utilized so the schools and students selected had equal probability of being sampled and were reflective of the national population of high school sophomores in 2002.

Data Collection

Based on an initial sampling frame of students within 800 high schools, 752 agreed to participate resulting in a 94% sample realization. Of these 752 schools, 580 were public, 95 were Catholic, and 77 were other private schools. As part of the large data collection effort, data were collected from students, parents, teachers, administrators, librarians, and facilities managers. In the current study, we focus solely on the student data which was requested from 17,591 students of whom 15,362 elected to participate.
Data Analysis

Based on the overall collection methods, our intent was to examine only students enrolled in high schools where there was an option to participate in agricultural education, thus limiting our generalizability to high schools, within the United States, who offer SBAE. We did not analyze private, religious, or charter schools. All the data, findings, and conclusions are reflective of this particular student population. Of the overall 15,362 participants, 4,050 were included in the sample. The data utilized in this study were weighted to enable the generalizability of the 4,050 participants. While weighting is simply a multiplier that adjusts a respondent’s contribution to account for different probabilities within the sample (Solon, Haider, & Wooldridge, 2013), it is important to recognize the weighting multiplier is only applied to those in the original sample. Thus, as is the case in this study, if there were no Hispanic females enrolled in SBAE who also served as officers in vocational clubs in the original frame, the weighted results will still reflect none enrolled.

To address our research objectives, we utilized the Statistical Package for the Social Sciences (SPSS) to analyze descriptive variables and report ethnicity percentages, based on participation levels, including the differences between observed ethnicity percentage and overall ethnicity percentages in the high schools included in our frame. Given the potential influence of sex on both income and participation levels, we have chosen to delineate our results by male and female (McKim et al., 2017).

The income data used for analysis in this study were collected in 2011, nine years after the collection of initial demographic data. We recognize the role of many mediating and confounding factors that may influence annual income. However, since there are no current or prior nationally representative studies in SBAE that address income and participation, we have chosen to start by focusing solely on our two research objectives.

Participation levels were categorized and reported for those enrolled in SBAE and those not enrolled in SBAE. Under each of these main categories, we analyzed the sub-categories of no vocational club involvement, vocational club participant, and vocational club officer. Although the term “vocational club” has since been replaced by Career and Technical Student Organization (CTSO), we chose to utilize the same language that was used in the original questionnaire. Additionally, students enrolled in SBAE and concurrently enrolled in a vocational club, would likely be members of the National FFA Organization, a large agriculturally-based youth leadership organization. The National FFA has a membership of almost 650,000 members representing 7,859 local high school FFA chapters in the U.S., Puerto Rico and the U.S. Virgin Islands (National FFA Organization, 2016a). Enrollment in FFA requires students to be enrolled in at least one SBAE course during a given academic school year (National FFA Organization, 2016b). Unfortunately, the ELS: 2002 data has identifiers for involvement in vocational clubs, but not a specific identifier for FFA participation. It does however, on the student questionnaire, list four example student vocational education clubs (i.e., DECA, VICA, FHA, and FFA), of which FFA is included. While we cannot definitively quantify the impact of student involvement in FFA, we can distinguish between those students who were not enrolled in SBAE yet are involved in a vocational club and those who are both enrolled in SBAE and involved in a vocational club. Presumably, those who are enrolled in SBAE and involved in a vocational club have a greater likelihood to be members of the National FFA Organization.

Findings

For the first objective, we analyzed the involvement levels of students, both enrolled (n = 910) and not enrolled in SBAE (n = 3,140), by ethnicity and sex (see Figures 2, 3, & 4). We detailed
the participation percentages by Black/African American, Hispanic, and White students and utilized a horizontal line denoting the population percentage we would expect to see based on the ethnicity percentages present throughout high schools where SBAE was offered.

Black males (expected 12.1%) who are not enrolled in SBAE, participate in vocational clubs at a high rate (21.3%), however, when enrolled in SBAE, participation in vocational clubs drops to 7.3% (see Figure 2). While low in participation, it appears Black males in SBAE do assume officer roles in vocational clubs at a rate commensurate with overall high school percentages (11.3%). For Black females, participation percentages in non-SBAE vocational clubs (14.3%) and SBAE vocational clubs (13.0%) exceeds the expected percentage of 10.4%. However, unlike their male counterparts, Black females enrolled in SBAE and in a vocational club, comprise only 6.6% of the female officer roles. This is not the case for non-SBAE enrolled Black females who do assume officer roles in other vocational clubs at a 10.4% rate.

Figure 2. Percent participation of Black or African American students by sex.

For Hispanic males, where we would expect 11.9% enrollment in SBAE, participation in vocational clubs is low (5.1%); however, once involved, Hispanic males do assume officer roles at a 14.9% rate (see Figure 3). Females, expected to enroll at 13.8%, enroll in SBAE at greater than expected percentages (16.8%) and participate at a greater rate than males (11.3% to 5.1% respectively). Still, Hispanic females hold fewer officer positions; in fact, within the sample there were no Hispanic females, enrolled in SBAE, who concurrently assumed officer roles in a vocational club.
Figure 3. Percent participation of Hispanic students by sex.

White males (68.4%) and females (69.4%) enroll in SBAE near the expected 71.2% (see Figure 4). White males participate in SBAE and vocational clubs at a greater than expected rate (84.7%) and White females slightly exceed the participation rate (73.1%). However, we see a decrease in White male SBAE enrollees who assume office roles (68.8%) and a sizeable increase in White females who are SBAE enrollees and assume officer roles (90.8%).

Figure 4. Percent participation of White students by sex.

When analyzing the income data (see Figure 5) for our second objective, we see that males who are SBAE enrollees start at a higher annual income ($M = $30,049, SD = $22,024), but as they increase in participation and assume officer roles, they make less money ($M = $35,995, SD = $27,105) than their non-SBAE peers ($M = $40,081, SD = $60,179). Females, who are enrolled in
SBAE, make less money initially ($M = 15,136, SD = 14,975), but rise above their non-SBAE counterparts at both the participation level ($M = 19,994, SD = 14,341) and the officer level ($M = 29,758, SD = 17,192).

![Figure 5. Annual income for SBAE enrollees and non-SBAE enrollees, based on vocational club involvement.](image)

**Discussion, Implications, and Conclusions**

The methodology used in this study allows description of both income and ethnicity percentages and patterns or areas of discrepancy. While our methodologies limit the breadth of our conclusions, we will address some initial insights and conclusions and identify four major phenomena emerging from the data. We also want to clarify that, at times, we have chosen to refer to the National FFA Organization as it represents the largest and only vocational club directly linked to SBAE. For our study, students enrolled in SBAE and concurrently enrolled in a vocational club, meet the criteria for FFA members. However, we do want to be clear that anyone in FFA would meet the SBAE/Vocational club enrollee parameters, but potentially not everyone in the SBAE/Vocational club enrollees would be, necessarily, in FFA.

Our first research objective explored the participation levels of male and female students both enrolled and not enrolled in SBAE by ethnicity. For comparison purposes, we examined all levels of actual participation compared to the high school population percentage of the same ethnicity. When examining the data for Black and Hispanic males, we observed what we are terming the Black and Hispanic Male Leadership Phenomena.

**Black and Hispanic Male Leadership Phenomena**

We found Black males have high involvement in non-SBAE vocational clubs but low involvement in SBAE-vocational clubs. These individuals have demonstrated a willingness and
commitment to participate in vocational clubs, just not SBAE-based. In SBAE, we recommend examining the structures of other vocational clubs who enroll a higher percentage of Black males. In addition, qualitative research should explore why Black males, specifically, are choosing not to enroll in SBAE. It is also intriguing that while, for those enrolled in SBAE, participation in a vocational club is low, officer participation is on par with participation levels outside of SBAE. Once Black males do become involved in SBAE and presumably FFA, they hold officer positions at a disproportionally high percentage compared to their participation levels.

Similar to Black males, Hispanic males in SBAE participate in vocational clubs at a disproportionately low rate. Yet, as observed among Black males, once involved, they ascend to officer positions at a rate far higher than would be expected. Future research should examine why Hispanic males chose to participate in FFA and what enhances or limits their participation and leadership. Although additional recruitment is needed, once they become participants, both groups pursue officer positions at an accelerated rate. This is encouraging for the National FFA Organization as it illuminates what may be an initial recruitment hurdle but also provides evidence these select groups perceive benefit once involved. As Astin (1999) indicated, the quality and quantity of involvement will be proportionate to the learning and personal development a student receives. In the case of Black and Hispanic males, their disproportionate rise to officer roles indicates that, once involved, they are both learning and engaging in personal development.

White males, on the other hand, enroll in SBAE near the population percentage (71.2%), yet, once enrolled, participate at rates greater than would be expected (84.7%). Despite high participation rates, White males assume officer roles at a rate lower than the population percentage. However, White males not enrolled in SBAE, do pursue officer positions in vocational clubs at a rate greater than expected. For some reason, White males chose not to pursue the number of officer roles we would expect, given the participation percentages, within SBAE-vocational clubs. According to Astin’s theory of involvement (1999), White males who do not assume officer roles are not obtaining the highest level of personal development possible. A potential clue may rest on the rate of White female participation in officer roles, discussed later as White Female Leadership Empowerment. Future research should explore potential barriers for White males to assume officer positions within the FFA.

Minority Female Leadership Barrier

In contrast to the involvement levels of Black and Hispanic males, Black and Hispanic females display a phenomenon we refer to as the Minority Female Leadership Barrier. Both Black and Hispanic female groups enroll in SBAE at rates close to the percentages in the high school population, and some participate, yet there is a precipitous decline in officer roles. It seems Black and Hispanic females rarely serve in officer roles. Based on Astin’s theory (1999), females in these groups may not be experiencing the learning and professional development they need and are therefore not involved. Alternatively, perhaps there are cultural or organizational structures, policies, or practices limiting or even discouraging involvement. Further research is needed to examine why Black and Hispanic females are not attaining officer positions.

White Female Leadership Empowerment

We term our next observed phenomenon as White Female Leadership Empowerment. White females participate in SBAE and are involved in vocational clubs at, or very near, the expected rate. Yet, for officer roles, we see participation exceed the expected rate by 20% among SBAE enrollees. It appears White females dominate officer roles within an SBAE-related vocational club, presumably FFA. What is it about the organizational structure and cultural
dynamics which are both appealing and highly beneficial to White females? For a potential explanation, we turn to our second objective, which identified SBAE enrolled female officers make, on average, more money than their non-SBAE enrolled fellow vocational club officers. White female SBAE officers, given their high rates of participation, may realize a financial benefit at a proportionally greater percentage than both the Black and Hispanic female SBAE officers. Further research should examine what aspects of the current culture and structure support White females, and how we can design a system to equally support all females.

Objective two sought to highlight the income levels, based on level of involvement, for students in this sample. Males enrolled in SBAE who are officers in vocational clubs annually make $4,086 less than males who are officers in vocational clubs outside of SBAE. For some reason, the impact of involvement in SBAE on males results in decreased income compared to their non-SBAE peers. One potential influencer to these results may be socioeconomic status (SES). Prior research by McKim et al. (2017) revealed that proportionally, students enrolled in SBAE have a lower SES than students not enrolled in SBAE. This disproportionate SES enrollment may relate to and influence the overall earnings observed.

Female SBAE Income Effect

For females, we observed an interesting phenomenon we are labeling the Female SBAE Income Effect. Namely, enrollment in SBAE provides tremendous additional earning potential compared to their non-SBAE peers. Females who do not enroll in SBAE make $8,242 more than females who are enrolled in SBAE. At first glance, this appears concerning. However, when we look at the effects of participation, we see rapid gains in annual income for females involved in SBAE. The clearest gains are for SBAE enrolled female officers who make $10,507 more than their fellow officers from non-SBAE vocational clubs. For females, enrollment in SBAE makes a positive economic difference, provided they either participate in a vocational club or serve as an officer. Unfortunately, despite the benefits associated with female participation, female annual income still lags behind their male counterparts.

Data revealed some surprising results when examining female income for those not enrolled in SBAE. Namely, as participation level increased from no club involvement to involvement in a vocational club, to officer involvement, income decreased. These results show an opposite trend from both overall males and females enrolled in SBAE. For some reason, participation in a vocational club, outside of SBAE, results in decreased income for females.

We recommend future research examine income to specifically account for additional variables. While our research focuses solely on identifying what is, and we are limited in speculating as to why we are seeing these results, it is important to note females are gaining more from enrollment in SBAE than their male colleagues. What is it about the structure of SBAE and concurrent involvement in a vocational club that enhances the success of females? What are the organizational practices, structures, reward systems, and activities that promote the earning success of females? What are female students gaining, through enrollment in SBAE that is distinctive from their non-SBAE peers?

We recognize, in this paper, we focus on involvement and income as it may relate to the potential structures, policies, and practices of a national organization. Specific to income, ethnicity, and sex, we acknowledge that upbringing, SES, size of school, and cultural distinctives may play a role in the results we are seeing. However, detailed analysis of these areas is outside the scope of the current study. Astin (1999) reminds us the effectiveness of any program is directly proportionate to its capacity to increase student involvement. As we assess SBAE, we need to develop the
capacity to increase student involvement across all ethnicities and sexes. We now know where we are at in relation to income, sex, and ethnicity in SBAE. What remains is to determine where we need to be and how we are going to get there.

References

Association for Career and Technical Education. (2016). CTE funding. Retrieved from https://www.acteonline.org/funding/#.WG6JfWeQyHs


Organizational Change in the Land-Grant System: A Qualitative Evaluation

Kevan W. Lamm1, L. Rochelle Sapp2 & Alexa J. Lamm3

Abstract

Individuals representing different organizations within the Land-Grant University System (LGUS) were asked to provide their insights on organizational change using a focus group approach. The study focused on three key components to organizational change in the LGUS: what initiates change, the hindrances to change, and what sustains change. Themes were analyzed relative to the existing literature and synthesized into a new conceptual model of organizational change in the LGUS. Results indicated change can be effectively initiated at lower levels of the organization where individuals have the appropriate span of control to drive change. Bureaucratic inertia was identified as the primary hindrance to change in the LGUS. Finally, relationships were identified as most important for sustaining change. Based on the results recommendations suggest that organizations within the LGUS employ a balance between proactive and reactive change and establish a clear communication plan and to ensure the plan emphasizes the respect due to those that will be involved or affected. Furthermore, to mitigate the effects of bureaucratic inertia, any organizational change effort within the LGUS should be accompanied by enough time to analyze the culture and build organizational support and buy-in. Additional recommendations were provided based on the results of the study.

Keywords: organizational change, land grant university system, evaluation

Funding from the LEAD21 program supported this research

Introduction

In late 2007 Alan Deutschman published the book, Change or Die: The Three Keys to Change at Work and in Life. Almost ten years later, the premise of his work remains both relevant and critical for individuals and organizations; specifically, change is inevitable and must be embraced to mitigate obsolescence (Deutschman, 2007). The need for meaningful change and adaptation is especially critical in an environment where society questions the need, value, and importance of long standing institutions such as bureaucratic organizations and institutions of higher education (Kellerman, 2012).

Institutions of higher education generally (Zusman, 2005), and the land grant university system (LGUS) more specifically (Lamm, Lamm, & Strickland, 2013) have been identified as organizations where change and adaptation is critical. The need for universities and their leaders to embrace change has been well established in the literature. For example, the observations Kerr and Gade (1986) made regarding universities over 30 years ago is consistent with the observations and

1 Kevan W. Lamm, is the president of LR Brand, inc. 4441 SW 85th Way, Gainesville, FL 32608
2 L. Rochelle Sapp, is the LEAD21 program director at the University of Georgia’s College of Agricultural and Environmental Sciences, 102 NESPAL Bldg, Tifton, GA, 31793, rsapp@uga.edu.
3 Alexa J. Lamm is an assistant professor in the Department of Agricultural Education and Communication and the associate director of the UF/IFAS Center for Public Issues Education at the University of Florida, 121F Bryant Space Science Center, Gainesville, FL 32611, alamm@ufl.edu.
recommendations with more contemporary literature (e.g. Lamm, Sapp, & Lamm, 2015). Specifically, change and crises are the norm for organizations of higher education (Zusman, 2005).

Higher education, including the LGUS, must continue to change and address several noteworthy expectation shifts (Creative Destruction, 2014). For example, there has been the need to simultaneously provide affordable education options to students while improving infrastructure, hiring and retaining talent, and increasing the number of amenities and resources available to learners (Creative Destruction, 2014). The juxtaposition of needs creates an environment of tension that organizations such as the LGUS generally struggle to adequately address without embracing meaningful change (Heifetz & Linsky, 2002).

Although there has been research into the change process (e.g. Kotter, 2012), there has been a limited amount of research specifically focused on the change process within the LGUS system (Lamm et al., 2013). However, based on Kotter’s (2012) recommendations, it may be appropriate to examine organizational change from the perspective of leaders within the organization of interest. Specifically, change is typically identified and undertaken by leaders within an organization based on their access to organizational insights and external trends (Heifetz & Linsky, 2002; Kotter, 2012). Leaders within the LGUS may therefore be able to provide a unique perspective on organizational change (Fish, 2003; Lamm et al., 2013).

Priority area two of the National Research Agenda: American Association for Agricultural Education 2016 – 2020 (Roberts, 2016) addresses new technologies, practices, and products adoption decisions, and specifically begs the question, “what methods, models, and practices are most effective in leading change?” (p. 21). Consequently, a study focused on change within the LGUS from the perspective of LGUS leaders could provide valuable insights regarding creating and sustaining the organizational change needed within the LGUS to ensure it continues to exist and serve stakeholders in relevant ways.

Theoretical Foundation

Organizational change was the theoretical foundation for this study and is a well-established field of inquiry and one with an extensive literature base (Hayes, 2014). A comprehensive review of the literature is provided followed by a conceptual mapping of theoretical models representing the theoretical lens for the inquiry.

One of the most prominent models of organizational change is the three-step model proposed by Lewin (1951). The core model presents three main stages. The first stage is a period of time where the existing patterns are unfrozen within an organization. The unfreeze process is followed by a movement stage where change occurs. Finally, once moved the third stage is a time when new patterns are re-frozen. The model tends to be well understood because it is consistent with practical experience regarding change; however, the conceptual nature of the model is also a limitation as there is little tactical or operational direction on implementing change (Cameron & Green, 2015).

Similar to Lewin (1951), Bullock and Batten (1985) proposed a model for planned change that was both practically relatable and conceptually sound (Cameron & Green, 2015). Specifically, the Bullock and Batten (1985) model includes an initial phase for exploration. Next, there is a phase for planning to occur. Once plans are established there is the need to take action. Finally, after the action has taken place there is a period of integration where the change becomes interwoven into the fabric of the organization. The planning and action stages provide greater pragmatic insights for change to occur than Lewin’s (1951) second, or move, stage (Cameron & Green, 2015).
Unlike Lewin (1951) or Bullock and Batten (1985) the Nadler and Tushman (1997) congruence model considers the internal organizational factors that provide context for organizational change. Specifically, the Nadler and Tushman (1997) model includes considerations for the work, the people, the formal organization, and the informal organization. Although the model considers the organizational context for change, it does so at a conceptual level insofar that specific characteristics or functions within the broad conceptual categories are not explicitly defined (Cameron & Green, 2015).

The Burke-Litwin (1992) organizational change model is similar to the organizational context considerations from the Nadler and Tushman (1997); however, unlike Nadler and Tushman (1997) the Burke-Litwin (1992) model includes the specific factors and functions within the organizational context. The model includes 12 distinct factors organized into two main categories. Within the transformational category the external environment, mission and strategy, leadership, and organizational culture are organized. Within the transactional category the management practices, structure, systems including policies and procedures, work unit climate, task and individual skills, motivation, and individual needs and values are organized. There is one factor shared between both categories, specifically individual and organizational performance. The Burke-Litwin (1992) model has been shown to relevant to change behaviors within the Extension service which is subsumed within the larger LGUS (Lamm, 2011).

One of the most prominent change theories within the contemporary and popular literature (Cameron & Green, 2015), as well as within agricultural education (Roberts, 2016) has been Kotter’s (1995) eight-steps of change. Unlike Lewin (1951) and Bullock and Batten (1985) that remain at the conceptual level, the Kotter (1995) model included very prescriptive steps for leading change efforts. From this perspective, the Kotter (1995) model is similar to Nadler and Tushman (1997) based on the acknowledgement of the organizational context. Additionally, the Kotter (1995) model might be associated with the leadership factor within the Burke-Litwin (1992) model with the prescribed steps logically subsumed within the factor.

According to the Kotter (1995) model, there is the need for a change leader to first establish a sense of urgency around the change. Next, a powerful guiding coalition should be established to support the change. Once urgency and a coalition are established there is the need to create a vision for the change. After the vision is developed it should be communicated to those associated with, or effected, by the change. Following the communication stage, it is important to empower others to act on the communicated vision. Next, there should be a plan to create short-term wins to build momentum for the change. As short-term wins are accumulated the improvements should be consolidated and reinvested to produce more change. Finally, the new approaches should be institutionalized within the organization. The fidelity of the steps, and track record of success within organizations provides credibility to the process; however, the process can also be restrictive if there is not sufficient time or resources to complete all steps in sequence (Cameron & Green, 2015).

Similar to the eight-steps proposed by Kotter (1995), Carnall (1990) proposed a change model that tended to be leader-centric. From an organizational change perspective, the Carnall (1990) managing transitions model has three focus areas. First, transitions should be managed effectively. Second, it is important to appreciate and acknowledge organizational cultures. Third, it is necessary to manage organizational politics. The acknowledgement of the political nature of organizations is consistent with other organizational theories such as the political frame suggested by Bolman and Deal (1991) and is unique amongst the other change theories.

In addition to organization change theories that address specific process steps and sequences once change is initiated, there are other models that tend to focus on the need for change,
or the conditions for change to occur. For example, the Beckhard and Harris (1987) change formula stipulates that change will only occur when level of dissatisfaction with the status quo multiplied by the desirability of the proposed change multiplied by the practicality of the change has a perceived cost less than that of not changing. The model provides clarity regarding the antecedents for change, by way of the arithmetic conditions, that are necessary for change to occur successfully (Cameron & Green, 2015).

As a supplement to the identified theories and models there are additional models that provide suggestions and organizational change insights. For example, model offered by Bridges (1991) is on managing the transitions associated with change. Specifically, change can be conceived as cyclical, with the end of one cycle serving as the start for the next. The ending stage is representative of the current state within the organization. The neutral zone is where change, and organizational transition occurs. This neutral zone is when organizations are most vulnerable because it is a departure from the known to the unknown. Eventually the change is clarified and internalized by the organization and a new beginning emerges. According to Bridges (1991) the new beginning should be grounded in the purpose behind the experienced change, a clear vision for the new organization, a well-defined and executed plan, and roles for everyone to have contributed to the change. The new beginning, once embraced by the organization, then serves as the ending state for the next change cycle. The model proposed by Bridges (1991) is less focused on the conceptual, or prescriptive, concepts associated with the change; instead it tends to highlight the disquiet that one should expect during change and the cyclical nature of change within organizations (Cameron & Green, 2015).

The ambiguity associated with change identified by Bridges (1991) is consistent with the organizational change observations provided by Senge et al. (1999) in their systemic model of change. The Senge et al. (1999) model is focused on the challenges that should be expected throughout the change process. The model suggests that change begins small and then grows. Because of the evolving nature of change, it is not possible to plan for the entire process, instead a practical and iterative approach will be more effective. Finally, any change should expect to encounter resistance and challenges. The more set-backs are expected, the less likely they are to obstruct the process.

Consistent with the themes of ambiguity and challenge in the Bridges (1991) and Senge et al. (1999) models, both Stacey (2001) and Shaw (2002) have identified the complexity associated with organizational change. Both suggest that change must be considered within a dynamic environment and persist that change is not possible to initiate within a static organization. Once change is initiated, it is not possible to confidently predict the consequences and outcomes associated. Additionally, for a leader engaged in the change process it may be difficult to objectively observe the consequences of their actions and to modify their actions accordingly. The complex responsive process (Cameron & Green, 2015), identified by Stacey (2001) and Shaw (2002), between actors and environment provides additional insights into organizational change.

Despite the insights and value associated with the organizational change literature, the specific theoretical foundation for this study was Hayes’ (2014) change process theory. According to Hayes (2014), change generally follows a predictable process. First, the organization experiences an external change, or is catalyzed to act based on internal, persistent, problems or opportunities. Next, the organization recognizes the need for change and initiates the change process. Once underway, the change process includes a diagnostic stage where both the present state and future state are identified. Next, organizations plan and prepare to change. Following the planning and preparation stage the organization then implements the change. Finally, the organization must take steps to sustain the change over time.
The change process theory proposed by Hayes (2014) was selected based on the balance between high-level concepts and specific process steps. Additionally, the model provided an appropriate framework within which to synthesize organizational change theories (Creswell, 2012). A conceptual mapping of examined theories and models within the Hayes (2014) model is provided in Figure 1.
<table>
<thead>
<tr>
<th>Hayes (2014)</th>
<th>External or Internal Change</th>
<th>Recognize Need for Change</th>
<th>Diagnosis (Present and Future)</th>
<th>Plan and Prepare for Change</th>
<th>Implement Change</th>
<th>Sustain Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lewin (1951)</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Bullock &amp; Batten (1985)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Nadler &amp; Tushman (1997)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Burke-Litwin (1992)</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Kotter (1995)</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Carnall (1990)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Beckhard &amp; Harris (1987)</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bridges (1991)</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Senge (1999)</td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stacey (2001)</td>
<td></td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shaw (2002)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
</tbody>
</table>

*Figure 1. Conceptual mapping of organizational change theories within the Hayes (2014) model.*
Purpose & Research Questions

The purpose of this study was to develop an understanding of organizational change within the LGUS from the perspective of leaders within the LGUS. The study was guided by the following research questions:

1. What initiates change in the LGUS?
2. What are the hindrances to change in the LGUS?
3. How does the LGUS sustain change over time?

Methodology

Epistemological and Theoretical Perspective

This study was undertaken from a constructionism epistemological perspective representing the “theory of knowledge embedded in the theoretical perspective and thereby in the methodology” (Crotty, 2003, p. 3). Constructionism allows for individuals to create meaning collectively as it relates to an area of inquiry (Crotty, 2003). Constructivism (Koro-Ljungberg, Yendol-Hoppey, Smith, & Hayes, 2009) was selected as the theoretical perspective for the study. The theoretical perspective provided the “philosophical stance informing the methodology… providing context for the process” (Crotty, 2003, p. 3). Within the context of this study, constructivism allowed the researchers to focus on the experiences of leaders in the LGUS and their collective insights regarding organizational change within the LGUS.

Research Design

A generic or basic qualitative methodology was used based on the epistemological and theoretical perspective selected (Merriam, 1988). A basic qualitative methodology identifies emergent themes and patterns to describe the phenomenon of interest (Merriam, 1988). Based on recommendations from the literature (Krueger & Casey, 2000), three focus groups were conducted with representatives from three LGUS organizations; one at a large government organization – the National Institute of Food and Agriculture (NIFA), one at an 1862 institution – the University of Tennessee (UT), and one at an 1890 institution – Prairie View A&M University (PVAM). The organizations were selected as having the largest number of alumni from the LEAD21 program within their respective organizational categories.

Focus groups were chosen as the data collection method for the study based on their use within the academic literature generally (e.g. Chalofsky, 1999; Stewart & Shamdasani, 2014) and agricultural education literature more specifically (e.g. Bailey, Arnold, & Igo, 2014). A total of 28 individuals participated in the three focus groups; 10 individuals from NIFA, 10 individuals from UT, and eight individuals from PVAM. For data analysis purposes, identifying information was removed to ensure confidentiality. A minimum of three focus groups are recommended in the literature to ensure data saturation; however, the nature of the inquiry limited the reach (Krueger & Casey, 2000). Therefore, consistent with previous qualitative studies (Lamm, Sapp, & Lamm, In Press), the intent of this research was to provide insights from an exploratory perspective that would provide a foundation for future inquiry.

A 14-question moderator guide was developed based on the organizational change model proposed by Hayes (2014). The moderator guide was reviewed by a panel of experts and institutional review board approval was obtained. During the focus groups the moderator used the guide to steer the conversation; however, to elicit rich descriptions and detailed experiences,
participants were encouraged to engage amongst each other and dwell on topics as appropriate. Consequently, the scope of the data collected between groups varied based on the emergent nature of the group interaction. The subsequent analysis was limited to only those thematic areas where there was consistent discussion and questioning amongst all three groups (Creswell, 2012).

LEAD21 program alumni from NIFA, UT, and PVAM were contacted by the LEAD21 program director and invited to attend. Acknowledging that not everyone would be able to attend, several time slots were offered and the one indicated as most popular was used (Creswell, 2012). All three focus groups were conducted using the Zoom videoconferencing tool based on recommendations in the literature for virtual focus groups (Stewart & Shamdasani, 2014). Most participants had cameras and could see the moderator and other participants; however, a few in the UT group were on conference call and unable to see others. Additionally, the focus groups were audio recorded and transcribed verbatim. In addition, the moderator took notes throughout for triangulation purposes (Stewart & Shamdasani, 2014). The focus group transcriptions were used as the primary data source for the analysis.

A content analysis of the focus group transcriptions was completed to identify themes associated with the research questions. Holsti (1969) defined content analysis as a process “carried out on the basis of explicitly formulated rules and procedures” (p. 3). The content analysis process was used to thematically group the data into categories a priori based on the theoretical model of organizational change (Hayes, 2014). Content analysis allows for “reliable, valid inferences from qualitative data” (Krippendorff, 2013, p. 418).

Data from the focus groups were coded based on recommendations within the literature (Creswell, 2012). Specifically, the coder first listened to the recordings of each focus group independently. Next, the coder read through each focus group transcript twice to become familiar with the material. The transcripts were then imported, opened, and analyzed in the Dedoose software program (Dedoose, 2016). During the coding process, important words and phrases were identified as codes. Throughout the coding process an audit trail was maintained as themes were identified and grouped (Lincoln & Guba, 1985).

Following the data analysis process, the primary coder conducted a peer debrief with the other researchers on the project. Peer debriefing was conducted to review the proposed analysis and themes and mitigate the potential for bias and ensure rigor throughout the process (Lincoln & Guba, 1985; Mays & Pope, 1995). As a final step, member checking was completed to verify interpretation of the data was correct and consistent with the participants’ intent (Lincoln & Guba, 1985). Specifically, findings were shared with participants through a preliminary report. Peer debriefing and member checking were conducted to provide additional rigor and trustworthiness to the study (Cresswell, 2012).

Subjectivity Statement

In qualitative research, it is essential to recognize the bias that may exist from a researcher’s previous experience and its contribution to the data analysis and interpretation. Therefore, it is important to note that at the time data were collected and analyzed the primary researcher was pursuing a Ph.D. in Leadership Development within the Department of Agricultural Education and Communication. He has a master’s degree in Leadership Development from the University of Florida and a Bachelor’s degree in Mechanical Engineering from Colorado State University. He worked as a program consultant for the LEAD21 program and completed the program as a participant observer in 2013. Prior to attending graduate school, the researcher was a consultant and manager with a global consulting organization where he was responsible for managing
organizational change initiatives with Fortune 500 organizations. He was also influenced by his parents, who were both faculty members and administrators at a large land grant university located in the western United States.

Results

What Initiates Change in the LGUS

Participants were asked to describe what they believe initiates change in their institution. The primary theme participants identified was that change was usually initiated by a need, either internal or external to the organization. One participant summarized the theme when they said,

A lot of that [change] is based on resources, or lack of resources, or having a lot of resources that don’t quite make sense, and we try to make sense of them. [Organization] wide in terms of our processes is where I think change occurs because things aren’t working well…so that change needs to occur.

Participants also indicated that change can be initiated by the desire to improve. One individual said, “You want to improve your process, your outcomes.” A second participant added,

I think it also begins with our failures, with our shortcomings, and with us not being satisfied with the results that we currently have. We don’t want to keep doing the same thing and getting the same result, so we attempt to move in a different direction.

A second subtheme that emerged was that change is initiated at lower levels where leaders have supervisory support and are given an appropriate span of control. For example, one participant said, “change is easier at a micro level. As you work up through the organization then it certainly becomes much more challenging.” A second participant said,

…where all the real changes come from, from that grassroots level within [an organization]. It’s far easier to get the critical mass so that you can implement a change, at least within that sphere of influence. Often times I think we’ll find that we can leverage that in the greater organization.

A third participant indicated that support was critical to empowering change, “You have to have a supportive supervisor in order for something like that to happen, and having the benefit of somebody who tells you the program, recognizes that and gives us, the staff, some of those opportunities.”

An additional subtheme emerged indicating the conditions necessary for change also included a combination of intentionality, communication and respect, and purposeful effort. At the beginning stages of the change process one participant said, “I think that one of the things that initiates change is that intent. When you can get a consensus in an organization that we need to make a change.” Throughout the change process another participant described the need for communication and respect to impel the change, “I do know that respect of one another, valuing the contributions of each other, and [participant] always says being transparent, but also, the key is communicating. We can make or break anything with communication.” Finally, the need to put forth the effort necessary to initiate and sustain change was stated by another participant, “I think the way that we’ve led change in the [organization] has been effective. We were able to do it. We
were able to get buy in from leadership. It does work, but it took a lot of work.” Another participant stated,

…change is like retail politics. It’s not global. It’s not slogans. It’s not some magic bullet solution. It’s not some charismatic leader. It’s groups of people putting forth the effort to individually talk to people and get the shared understandings and the decisions framed and made and things implemented. It all takes a lot of one-on-one-on-one. It’s complicated.

Hindrances to Change in the LGUS

Participants were then asked what they believe hinders change within their organization. Overall, the dominant theme that emerged was that change within universities and large government agencies associated with the LGUS is hindered by bureaucratic inertia. One participant said, “That’s where we see ourselves getting bogged down in bureaucratic, lengthy dialogue and decision making that impedes that change.” A second participant provided a similar description, “At the larger, organizational level…initiating change is hard to assume you have the buy in, everybody is clear on what the change needs to be. It’s the sheer management of the logistics sometimes, lack of resources.”

A third participant commented on the inertia aspects of change, “If there’s not a change agent to initiate that change, people will keep on in that same vein. They won’t change at all, because you become accustomed to it.” Another participant addressed the nuance of change in a university environment,

I think that’s systemic among a lot of institutions, especially in academia. In private industry or in business, if a product isn’t selling, your clients are going to make you change, or you are going be out of business. With academia, change is not as—it’s a little more subtle. It takes time to get to a certain place…We continue to do program planning around what we know and what we assume the needs are at the moment, and don’t really get the kinds of response that private industry gets when something is not selling.

A second primary theme that emerged was that change has been frequently hindered by a lack of clarity and vision. One participant summarized the challenge saying, “one of the things I miss about where I’m at now, we don’t have a good strategic plan mapped out for change. We need to make that something that we work towards.” The lack of vision and strategy was noted as causing a number of other hindrances to change. For example, another participant associated lack of vision with failing to develop “a sense of urgency. I think that in many instances we fail to share a vision of how important it is to get something done.”

A secondary theme that emerged was that lack of clarity can lead to confusion. One participant described the challenges associated with trying to push a change within their organization, “It has been very challenging, in pulling all of the parties together, to make sure we’re all on the same page. Even the parties are not clear. They’re confused in some areas regarding policy and procedures and processes.” A second participant stated that lack of strategy was preventing organizational change from occurring, “We have the change that’s occurring in pockets, but we’re not always very good at being able to connect those to what could become or should be strategic change.” One participant described how lack of clarity, or transparency, may result in a lack of trust that may then manifest into a hindrance to change. They stated,
I think one of the biggest obstacles that we had, that we encountered was these were issues of trust. They were in within programs that the bigger issues were the trust issues between program and our financial side. There were a lot of obstacles that were erected because of the assumption that we were going to change something of someone else’s, and not willing to change ourselves. That’s a whole organizational mindset that you have to try and address that it’s really challenging.

An additional theme was that individuals within the organization may hinder change based on fear or other motives. One participant summarized the challenge by saying, “It can be just individuals, depending on their role, within an office or department. Depending on the personality of that individual, that can be a hindrance, definitely.” A second participant described some of their observations of why individuals may be a hindrance to change by saying,

I think the biggest issue is there is a fear that they’re going lose something in this. They’re going lose something as a department. They’re going lose autonomy. They’re going lose resources. They’re going lose control. I think it’s that fear of loss that people will—they’ll blow up on you and they’ll not support or even work against it.

Sustaining Change Over Time in the LGUS

Participants were asked what steps they have taken to ensure changes they have been involved with are sustained over time. The primary theme that emerged was change is sustained and most successful based on relationships. One participant stated,

I don’t think that we can underestimate the importance of relationships in building trust and being able to move forward. Coming from an Extension background, that’s always been my mantra. If we want producers to change what they do, we need to develop a relationship and trust. It doesn’t matter what the change is, that’s still a critical component.

A second participant noted the importance for maintaining relationships in being able to sustain change over time saying,

Either establishing or maintaining those relationships is really important. You start to get a sense of how is this working for people. Then you can also get a sense of what’s not working so well or what did you not foresee and start nipping that in the bud before it really becomes too problematic.

A second theme was that change is sustained when it has relevance. A participant identified the need for an ongoing focus on change saying, “For those activities changes that we know are ones that we want to continue to invest in, to grow, I think it’s imperative that we capture the outputs and impacts.” A second participant noted,

[Change] has to be relevant and it has to be meeting a need. It has to be meeting the objectives that our funders and also for our stakeholders because, if not, what we’re doing is irrelevant, and we certainly won’t be effective.

A final subtheme that emerged was the need for ongoing communication and consistency for change to be sustained over time. For example, when describing an experience of sustaining change within their organization, a participant identified the need for “putting in the effort for
consistent communication and one-on-one meetings.” Another participant said, “We purposely tried to go slow. We had focus sessions. We had listening groups. We talked to external people. We tried to build some support for it.” A third participant had a similar perspective when describing on ongoing change from output to outcome programming,

The only way you can make that change happen is just to stay with it and continue to build programming around outcome programming, rather than reverting back to output programming. Just continue to emphasize that our goal is to have outcomes.

Conclusions

The results of the study provided several insights regarding the organizational change process within the LGUS. Many of the themes that emerged from the focus groups were consistent with the theories and models reviewed in the literature; however, there were multiple instances where the LGUS context provided unexpected results. The first research question was focused on what initiates change in the LGUS. The results indicated that change in the LGUS is usually initiated by a need within the organization, either internal or external. This theme is somewhat predictable given the antecedent conditions for change within almost every organizational change theory, whether the unfreezing process described by Lewin (1951) or the external environment identified by the Burke-Litwin (1992) model. Generally, a catalyst or stimuli initiates change in the LGUS. Although many changes in the LGUS may originate as a response to an external condition, a sub-theme emerged which indicated change also occurs organically or as a function of reflection or communication as proposed by Stacey (2001) or Shaw (2002).

Some change within the LGUS was initiated by the desire to improve. The desire to improve serving as a catalyst to change is noteworthy as it relates to the organizational change arithmetic proposed by Beckhard and Harris (1987). Specifically, that change will only tend to occur when the perceived cost associated with the change is less than the product of the current level of dissatisfaction multiplied by the desirability of the proposed change multiplied by the practicality of the change. Changes that originate from internal desires to improve require a commitment from organizations to both explore (Bullock & Batten, 1985) and recognize the need for change (Hayes, 2014). Additionally, internal change tends to require more fortitude and commitment to execute successfully as opposed to external pressures that tend to mandate, rather than encourage, change (Heifetz & Linsky, 2002).

Another theme that emerged is that change tends to be initiated at lower levels within the LGUS, specifically as levels where leaders, or change agents, have supervisory support and are given an appropriate span of control. This finding was consistent with the recommendation to start small provided by Senge et al. (1999) and addressed the formal organization (Nadler & Tushman, 1997) and structure (Burke & Litwin, 1992) considerations associated with the LGUS.

There was also acknowledgement that change within the LGUS is also dependent on several supportive conditions being in place. Specifically, the results indicated change in the LGUS required a combination of intentionality, communication and respect, and purposeful effort. The results are similar to Kotter’s (1995) recommendation to establish a sense of urgency around change. The conditions for change in the LGUS are also consistent with the literature as it related to managing transitions and boundary conditions while undertaking change (Bridges, 1991) as well as taking context into consideration (Shaw, 2002; Stacey, 2001).

Participants also provided their insights regarding hindrances to change within the LGUS. The most prominent theme was that organizational change in the LGUS is hindered by bureaucratic
inertia. Successful organizational change requires dealing with organizational cultures (Carnall, 1990) as well as both the formal and informal organization itself (Nadler & Tushman, 1997). Consequently, this result provided insight into the organizational peculiarities associated with the LGUS.

A second hindrance to organizational change in the LGUS was the general lack of clarity and vision for the change. Both Kotter (1995) and Hayes (2014) identified a vision for the desired end state as a necessary step within the change process. The results of this study confirm this recommendation. Specifically, the results indicated that a lack of clarity around organizational change can lead to confusion amongst those in the LGUS that the change will impact. Communicating a clear vision is necessary to ensure a common understanding (Kotter, 1995).

In addition to the organizational and vision-related hindrances identified, the results also indicated that specific individuals within a LGUS organization may hinder change. The results were consistent with the literature that identified organizational politics (Carnall, 1990) and people (Nadler & Tushman, 1997) as important considerations for organizational change. This result illuminated one of the contextual aspects of change within the LGUS. Specifically, the high levels of autonomy and control expected by LGUS faculty and personnel may run counter to change efforts (Fish, 2003).

The third research question centered around how the LGUS sustains change over time. The primary theme that emerged, that change is sustained and most successful based on relationships, was consistent with Kotter’s (1995) recommendation to form a powerful guiding coalition. The results indicated that unlike other theoretical recommendations proposed within the literature that are intended to sustain change, relationships were identified as the most critical. This theme was further reinforced by the people aspect of change identified by Nadler and Tushman (1997).

In addition to the need for relationships to sustain change, the results of the study indicated that change in the LGUS was sustained when it had relevance. This finding was conceptually similar to the recommendation offered by Senge et al (1999) that it is important to start small and grow steadily as well as Kotter’s (1995) suggestion to plan for and create short-term wins and consolidate improvements to produce more change. The intent of the theme was to ensure organizational change was relevant within the organization, not simply theoretical, or administratively.

Lastly, the final theme to emerge from the study relating to sustaining organizational change was the need for ongoing communication and consistency. The consistency aspect of the result was akin to the re-freeze stage identified by Litwin (1951). The change must be internalized and integrated into the organization; however, the only way for this to occur was through consistency. This theme also acknowledged the systems aspect of organizations, including policies and procedures, that Burke and Litwin (1999) identified. Without an adequate structure to support the change, including both procedures for communication as well as consistent application, it is unlikely organizational change will be successful.

**Implications and Recommendations**

The results indicated organizational change within the LGUS shared characteristics consistent with the existing literature. However, the nature of the LGUS provided a unique context that is not specifically addressed within the existing theory base. Although the current study indicated that organizational change within the LGUS experiences many of the same challenges and opportunities associated with change elsewhere; the emphasis on identified triggers for change,
supporting conditions for initiating change, hindrances to change, and supporting conditions for sustaining change are of particular importance.

To assist with the interpretation of the study results a conceptual model for organizational change in the LGUS was developed (see Figure 2). The three core components for the model (initiating change, hindrances to change, and sustaining change) were emphasized as conceptual markers within the model; however, the primary intent and value of the model were the conditions and antecedents that were related to the three core components. The recommendations and implications are thus focused on the themes surrounding the core components.

Figure 2. Conceptual model of organizational change in the LGUS.

The first set of recommendations and implications focused on the triggers for change within the LGUS. The results indicated that changes can originate from the internal or external
environment; however, the results also found that a desire to improve can serve as a trigger for change. It is recommended that organizations within the LGUS employ a balance between proactive and reactive change. Internal or external change might be thought of as requiring a reactive change, a move necessary to address a need. However, a reactive change approach is very defensive and limits the ability to grow and pursue excellence from the desire to improve (Heifetz & Linsky, 2002). The proactive nature of change cultivated through the desire to improve should also be encouraged.

The second set of recommendations are related to the supporting conditions for initiating change. The results indicated change initiated at the lower levels can be very effective. This finding is unique to the LGUS. The organizational change literature tends to indicate that change is most effective when initiated from the top down (e.g. Lewin, 1951). Therefore, the LGUS context may require a bottom up approach. It is recommended that changes within the LGUS are encouraged at lower levels within the organization, whether in a lab, a classroom, or for an Extension program. When individuals are empowered to make changes within their area of control they tend to have a higher level of commitment and resilience when approaching the change process. Change at the micro-level can then gain momentum and visibility with the possibility of affecting change at the organizational level.

In addition to changes initiated at lower levels within the LGUS, a second set of supporting conditions emerged. Specifically, organizational change in the LGUS required intentionality, communication and respect, and purposeful effort. Based on this theme it is recommended that any change efforts at the organizational level have a specific plan to address these areas. The first recommendation is that change should be done with the intention of seeing it through to completion. It is not sufficient to desire a change and then fail to provide the resources, or support, necessary to make it successful. A second recommendation is to establish a clear communication plan and to ensure the plan emphasizes the respect due to those that will be involved or affected. A third recommendation is to be purposeful in the change effort; specifically, the focus on the change should not be distracted. Maintaining focus will provide the appropriate conditions for the initiated change to have a higher likelihood for success.

The second core component of the conceptual model focuses on the hindrances to organizational change within the LGUS. There were three main themes that emerged from the study; however, the most prominent theme was that of bureaucratic inertia. Unlike for-profit organizations that are required to respond to market conditions to maintain relevance and solvency, the LGUS is further removed from market forces (Fish, 2003). It is recommended this theme be interpreted in a judgement agnostic manner, instead it is more appropriate to acknowledge the contextual realities of the LGUS and plan accordingly. Based on this finding, it is recommended that any organizational change effort within the LGUS be accompanied by a sufficient amount of time analyzing the culture of the organization and taking the time to build organizational support and buy-in. Ensuring the supporting conditions for initiating change may also help to mitigate the effects of bureaucratic inertia.

A second thematic hindrance area was the lack of clarity and vision for organizational change. The prominence of this theme within the existing literature is both noteworthy and intuitive. In order for change to be successful there must be some expected and well understood end state. Based on this theme, it is recommended that a clear vision for the organizational change be communicated frequently and consistently using multiple communication channels. Previous research has found that different audiences may prefer and assimilate information more readily from different channels (Lamm, Rumble, Carter, & Lamm, 2016).
The third theme associated with hindrances to organizational change in the LGUS referred to individual fears and motives. Maintaining consistency and predictability is a strong motive for human behavior, even if the motive is operating at the sub-conscious level (Heifetz & Linsky, 2002). It is recommended that in addition to an organizational culture assessment an assessment of the political climate within the organization be conducted. Understanding the politics of the organization (including social capital, networks, and power sources) should provide both value and insights. The information obtained through this process could help to inform which key-individuals have the ability to delay or derail a proposed change. Identifying these actors and working with them initially could help mitigate the potential for both change hindrance or abandonment.

The final core component of the conceptual model is related to sustaining organizational change over time. The primary theme that emerged was the importance of relationships to sustain change. Based on this finding it is recommended that organizational change within the LGUS be completed through a consortium of individuals that are committed to seeing the change executed successfully. Additionally, it is recommended that the consortium consist of individuals from different domains and with different areas of expertise. A broad and unified network of individuals should help to maintain the vision for the change and provide the resources, from social capital to monetary support, necessary to sustain the change.

Conceptually linked to the relationships necessary to sustain change, ongoing communication and consistency was identified as an important theme. It is recommended that any change efforts are supported by frequent and transparent communication that is provided even after the change has been implemented. For example, case studies or vignettes regarding the benefits of the change at the individual level should lead to increased understanding and support for the change.

Lastly, change must continue to be relevant to be sustained over time. Based on this finding it is recommended that change be thought of as an ongoing cycle where the end of one change serves as the starting point for a new iteration of change when the old change is no longer relevant (Bridges, 1991). From this perspective, it is recommended that organizational change in the LGUS is periodically assessed and evaluated to ensure it is still relevant and appropriate.

Although the results, conclusions, and recommendations from this study are consistent with the existing organizational change literature, it is necessary to identify a number of limitations. First, the limited number of focus groups should be acknowledged. It is not possible to reach full data saturation with only three focus groups; therefore, all the associated results and recommendations should be considered exploratory. Additionally, the composition of the focus groups should be addressed. As alumni of the [Program], participants have been identified as leaders within the LGUS. Their perspective may not be consistent with all personnel with the LGUS. Nevertheless, the results of the study provided insights regarding organizational change within the LGUS, and by association have implications for departments of agricultural education and affiliated agricultural educators.

References


Agriscience Education Through Inquiry-Based Learning: Investigating Factors that Influence the Science Competence of Middle School Students

Peter Skelton1, J. Joey Blackburn2, Kristin S. Stair3, Natalie Levy4 & Thomas J. Dormody5

Abstract

Inquiry-based teaching methods have been found to enhance students’ abilities to understand the process of scientific inquiry. The purpose of this study was to determine if middle school students taught through an inquiry-based teaching approach consisting of scientific skill development, scientific knowledge, and scientific reasoning were more likely to meet their respective science grade level expectation. Participants consisted of predominantly Hispanic sixth and eighth grade students enrolled in school enrichment programs through the MMSAECC. Inquiry-based instruction was integrated within science classes using lessons in soil pH and water quality. Overall, sixth grade students scored highest on items related to science skill, while the eighth grade students scored highest on the science knowledge portion of the instrument. Regarding the sixth grade students, science reasoning and science skill were found to be significant predictors of grade level expectation, while science skill was significant for the eighth grade data. It is recommended that teachers incorporate inquiry-based learning strategies into their classrooms to encourage students to ask questions and refine their ability to think critically and solve problems. Further research is needed to clarify the role of science comprehension and the associated sub-dimensions with the ability to predict grade level expectation.

Keywords: agriscience, inquiry-based learning, science competence, science comprehension

This research was supported in part by a grant from the Office of the Vice President for Research at New Mexico State University.

Introduction

According to a report published by the National Science Board (NSB) (2015), upwards of 26 million workers, from sub-baccalaureate through doctoral levels of education, are employed in jobs that require significant knowledge in the science, technology, engineering, and math (STEM) fields. This represents nearly one-fifth of all jobs in the United States (NSB, 2015). Additionally, a 17% increase in STEM employment opportunities has been projected by the year 2020 (White

1 Peter Skelton is an Associate Professor in the 4-H Youth Development Department and Director of the New Mexico State University Extension and Research Youth Agricultural Science Center, New Mexico State University, skelton@nmsu.edu
2 J. Joey Blackburn is an Assistant Professor in the Department of Agricultural and Extension Education and Evaluation at Louisiana State University, jjblackburn@lsu.edu, 129 J.C. Miller Hall, Baton Rouge, LA  70803
3 Kristin S. Stair is an Associate Professor in the Department of Agricultural and Extension Education and Evaluation, Louisiana State University, 135 J.C. Miller Hall, Baton Rouge, LA  70803. kstair@lsu.edu
4 Natalie Levy is a Doctoral Candidate in the Department of Agricultural and Extension Education and Evaluation, Louisiana State University, 225 J.C. Miller Hall, Baton Rouge, LA  70803, nlevy3@lsu.edu
5 Thomas J. Dormody is a Regents Professor in the Department of Agricultural and Extension Education, New Mexico State University, 111 Gerald Thomas Hall, tdormody@nmsu.edu
House Initiative on Educational Excellence for Hispanics [WHIEE], n.d.). Currently, there is a shortage of qualified employees for current STEM positions and not enough students are pursuing education in STEM to provide an adequate workforce to meet future growth in the field (WHIEE, n.d.). Even more alarming is the lack of representation of minorities in STEM (National Science and Technology Council, 2013). Clearly, it is imperative to build student interest in STEM fields in a way that will encourage the eventual pursuit of a STEM career.

Research has indicated that attitudes and interests of students as young as middle school aged can be positively influenced by the integration of STEM (Wyss, Heulskamp, & Siebert, 2012). This integration has been especially important as a method of developing student engagement in the science fields (National Academy of Sciences, National Academy of Engineering, and Institute of Medicine, 2007). Science, in particular, often disengages students with scientific concepts that fail to connect to their daily lives (Diaz & King, 2007). As an alternative, educational reform has suggested a more hands-on approach to science integration that engages students in active learning, problem solving, and exploration (Satchwell & Loepp, 2002). Career and technical education (CTE) programs, such as agricultural education, can enable students to learn science skills by embedding content in authentic contexts (Conroy & Walker, 2000; Pearson, Young, & Richardson, 2013; Roberts & Ball, 2009; Roegee & Russel, 1990; Zirkle, 2004). Additionally, teaching science in context further develops students’ critical thinking and problem solving skills (Phipps, Osborne, Dyer, & Ball, 2008; Myers, 2004; Thoron & Myers, 2011; Thoron & Myers, 2012).

Inquiry-based teaching methods have also been found to enhance a student’s ability to conduct experiments and help them gain a better understanding of the process of scientific inquiry (National Research Council [NRC], 2007). Inquiry-based instruction is rooted within the constructivism paradigm popularized by educational philosophers such as Piaget, Vygotsky, and Dewey (Doolittle & Camp, 1999). In fact, Dewey (1910/1997) outlined steps of reflective thinking, which align very closely to the scientific methods utilized in modern inquiry-based learning. Effective inquiry-based learning is derived from scientific thinking and realistic problem solving and its flexible approach allows teachers to modify the structure of lessons based on particular educational goals (NRC, 2000). As a student-centered approach to learning, inquiry-based instruction begins with students’ current knowledge, then proceeds with instructor support in developing knowledge of scientific inquiry (NRC, 2000). This differs from traditional teaching methods that focus on the teacher as an expert (NRC, 2000; Parr & Edwards, 2004). Problem-solving and higher-order thinking skills are enhanced when students are encouraged to expand their knowledge through active engagement and reflection (NRC, 2000; Von Secker & Lissitz, 1999).

Following the NRC’s (2000) publication on the scientific inquiry teaching method, the prominence of inquiry-based science instruction increased in an effort to reform science education in the U.S. (Thoron & Meyers, 2011). Inquiry-based methods align well with CTE and agricultural education courses as these subjects have been shown to be an innovative means for improving core content achievement by allowing students to apply these concepts to real-world situations (Parr, Edwards, & Leising, 2008; Pearson, Young, & Richardson, 2013; Young, Edwards, & Leising, 2008; Thoron & Meyers, 2011). Thoron and Meyers (2011) conducted a quasi-experimental study to determine the effects of an inquiry-based approach versus a subject matter approach on high school students’ achievement in agriscience instruction. This study found that students who were taught using the inquiry-based teaching method scored higher on content knowledge assessments than students taught using the subject matter approach (Thoron & Meyers, 2011).

Teachers should purposefully select methodologies when integrating STEM content into the context of agriculture (Baker, Brown, Blackburn, & Robinson, 2014). When successfully implemented in the classroom, inquiry-based teaching can lead to an authentic learning experience.
that encourages students to think critically (Parr & Edwards, 2004; Thoron, Meyers & Abrams, 2011). However, successful inquiry-based teaching requires adequate professional development and teacher training (Thoron et al., 2011; Thoron and Meyers, 2011). Teacher in-service programs, such as the National Agriscience Teacher Ambassador Academy (NATAA), teach educators to utilize pedagogy that encourages students to engage in scientific thought, conduct detailed observations, and ask open-ended questions (Thoron et al., 2011). Thoron et al. (2011) interviewed NATAA teacher participants after they received inquiry-based instructional training to gain a deeper understanding about their perceptions of implementing these techniques into their classrooms. They found that implementing inquiry-based instruction in the classroom was an individual process for each teacher and that inquiry-based instruction was a more rewarding teaching method, despite increased lesson preparation time (Thoron et al., 2011). Additionally, focus group respondents indicated the use of inquiry-based teaching methods helped the teachers form positive associations with other instructors and administrators. Overall, this method was regarded as an asset to agriscience teachers, especially when combined with adequate preservice training and professional development that allowed them to implement this strategy in their classrooms (Thoron et al., 2011).

The Memorial Middle School Agricultural Extension and Education Center (MMSAEEC) in Las Vegas, NM is an agriscience education program developed by the New Mexico State University (NMSU) Cooperative Extension Service in partnership with the public school system to integrate inquiry-based and experiential learning methods into the classroom (Skelton & Seavers, 2010; Skelton, Seevers, Dormody, & Hodnett, 2012; Skelton, Stair, Dormody, & Vanleeuwen, 2014). The mission of this sixth through eighth grade STEM education program is to prepare students to think critically about complex concepts and become aware of careers in the STEM fields (Skelton & Seevers, 2010; Skelton et al., 2012; Skelton & Stair, Dormody, & Vanleeuwen, 2014). The program employs the skills of a NMSU faculty member to deliver instruction, conduct classroom based experimental studies, plan field trips, and provide demonstrations (Skelton & Seevers, 2010; Skelton et al., 2012; Skelton et al., 2014). The MMSAEEC seeks to achieve its mission through contextualized instruction and hands-on learning within the subjects of agriculture and natural resources (Skelton & Seevers, 2010; Skelton et al., 2012; Skelton et al., 2014).

Studies by Skelton, Dormody, & Lewis (In Press) and Skelton et al. (2014) have been conducted to measure the science achievement and comprehension of middle school students participating in the MMSAEEC program. Skelton et al. (2014) conducted a quasi-experimental study to determine if there was a difference in student achievement in science, as well as agriculture and natural resources. This study also analyzed differences in student interest in STEM careers between the MMSAEEC program and two comparison middle schools. Student achievement in science, and agriculture and natural resources was determined from New Mexico standardized test scores. A comparison of performance on the science standardized test indicated that the MMSAEEC students’ overall test scores were higher than the comparison schools in overall science comprehension, as well as the sub-dimensions of science and people, scientific investigations, and physical science. However, the life science and earth science sub-dimension scores were not significantly different (Skelton et al., 2014). Overall, MMSAEEC students had improved performance and higher scores; however, interest in STEM careers was not significantly different between the groups. In fact, all students indicated a similarly strong interest; however, the MMSAEEC students were twice as likely to be interested in agricultural careers (Skelton et al., 2014).

One important factor of the MMSAEEC program is the demographics of the students involved. Overall, 88% of students in the program are Hispanic, a demographic that is underrepresented in STEM (Lopez et al., 2005). Hispanics represent nearly 20% of the U.S.
population, however they represent less than two percent of the total STEM workforce (WHIEE, n.d.). Although Hispanics in [State] have not traditionally been considered a minority within the state, the overall Hispanic community in the U.S. is a minority group that has shown a lack of educational attainment. The drop-out rate for Hispanic students, age 25 years or less, is 27% and is attributed to issues such as language barriers, needing to work to supplement their family’s income, and a lack of family support for education (Gasbarra & Johnson, 2008).

There is also a socioeconomic trend within the Hispanic community in which 23% of the population lives below the poverty level, with an average family income of $34,396 (Lopez et al., 2005). However, as the population of Hispanics is projected to increase in the U.S., their buying power and their overall economic contribution is projected to increase (Lopez et al., 2005). It will be important to increase engagement in STEM careers through education that also prepares Hispanic students for employment (Gasbarra & Johnson, 2008; Lopez et al., 2005).

The shortage of Hispanics in STEM and science related fields has been associated with several factors, including (a) the methods that are used to teach science in schools, (b) the lack of qualified instructors teaching these subjects, and (c) under-funded schools that are deficient in proper supplies to effectively teach these subjects (Gasbarra & Johnson, 2008). There is a need for Hispanic students to have access to more hands-on STEM education that can provide better access to education for this community (Gasbarra & Johnson, 2008). In order develop interest in STEM careers, alternative methods of teaching science may be necessary to reach diverse populations and actively engage learners.

**Conceptual Framework**

Experiential and inquiry-based learning programs employ a process by which knowledge is created through experience (Kolb, 1984). Through this process, experiential learning creates an environment for students to carry out investigations in a real-world context. According to Kolb (1984), effective engagement in curriculum requires: (a) concrete experience; (b) reflective observation; (c) abstract conceptualization; and (d) active experimentation. The conceptual framework for this study is developed from the interaction of these four principles through a model of application involving scientific knowledge, scientific skills, and scientific reasoning developed by Skelton et al., (2012) (see Figure 1). The interconnection of all three concepts forms a broader contextual understanding and improves science comprehension (Skelton et al., 2012).

![Figure 1. A conceptual model for improving science comprehension (Skelton et al., 2012).](image)
The content of the program is based on the New Mexico public school grade level expectation (GLE), STEM curriculum, as well as the 4-H Science, Engineering, and Technology curriculum (Skelton & Seevers, 2010). The teaching methods used within this program are based on a conceptual model consisting of inquiry-based activities and the experiential learning process (Skelton et al., 2012; Skelton et al., 2014). The combination of inquiry and experiential learning provides an opportunity for higher level thinking skills to be developed and be retained by students (Skelton et al., 2014). The process model begins with science skill and/or knowledge development or acquisition, and proceeds to higher order thinking skills that allow students to demonstrate mastery of the content and then form scientific conclusions (Skelton et al., 2012).

The purpose of this research aligns closely with the AAAE National Research Agenda, specifically Research Priority Area 3: Sufficient Scientific and Professional Workforce that Addresses the Challenges of the 21st Century, as well as Research Area Priority Area 4: Meaningful, Engaged Learning in All Environments (Roberts, Harder, & Brashears, 2016). Deepening our understanding of how core content integration influences the achievement of minority students enrolled in agricultural education programs can assist the profession in meeting the demand for a scientifically prepared workforce that is well represented by all ethnic and racial groups.

**Purpose and Objectives**

The purpose of this study was to determine if middle school students taught via an inquiry-based teaching approach consisting of scientific skill development, scientific knowledge and scientific reasoning, were more likely to meet their respective science grade level expectation (GLE). The following research objectives guided the statistical analyses of the study:

1. Determine the level of science comprehension (i.e., science knowledge, science skill, and science reasoning) by grade level.
2. Determine whether science comprehension subdimension scores (i.e., science knowledge, science skill, and science reasoning) can predict if students are more likely to meet their respective science GLE.

**Methodology**

**Research Design**

This study represents data collected as part of a larger study (Skelton et al., In Press). Participants in this study consisted of six classes of 6th grade students and five classes of 8th grade students enrolled in school enrichment programs through the MMSAAEC. Students in 6th grade received enrichment as part of their earth science curriculum which consisted of soil pH. Students in 8th grade received programming targeted at analyzing water chemistry. These topic areas fit within the New Mexico standardized science curriculum and were identified as ideal areas for inquiry-based teaching. MMSAAEC programs are designed as educational enhancements, similar to 4-H school enrichment programs, and are delivered through the traditional classroom. Broadly, the experiments examined the relationships between plant growth and soil pH (6th grade) and plant growth and water quality (8th grade). Researchers spent the first week teaching basic principles and applications for testing pH of solutions (i.e., litmus paper, pH paper, meters) and water chemistry (i.e., dissolved oxygen, pH, total dissolved solids, nitrate, ammonia-nitrogen, phosphorous, electrical conductivity, and chlorine). During this process, content was introduced, techniques were demonstrated, and students practiced collecting data. Then, using a guided-inquiry approach, students were provided with a problem to investigate and the materials necessary to carry
out the investigation. In teams of 3, the students developed hypotheses and devised their own procedures to test their hypotheses. Following their procedures, the students designed and conducted their own experiments. Upon completion of the experiments, they were required to explain the problem, their hypothesis, procedures utilized, and present conclusions to their classmates (Skelton et al., In Press).

In order to measure science comprehension, an instrument was developed that reflected the New Mexico agriculture, food, and natural resource content and performance standards. Pre-test and post-test assessments were designed to measure change in scientific knowledge, science skill development, and scientific reasoning ability (see Table 1). Skelton et al. (In Press) offers an in-depth discussion of the pre-test and post-test differences. Overall science comprehension was determined as a result of each program treatment through the aggregation of the sub-dimension scores. For each grade level, a researcher-created instrument, consisting of nine multiple-choice items, was developed with three questions measuring each sub-dimension. A panel of experts established face and content validity of the instruments. The panel made no recommendations, therefore the instrument was utilized as presented.

Table 1

<table>
<thead>
<tr>
<th>Grade Level</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sixth Grade (n = 88)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science Knowledge</td>
<td>0.75</td>
<td>0.75</td>
</tr>
<tr>
<td>Science Skill</td>
<td>1.82</td>
<td>0.88</td>
</tr>
<tr>
<td>Science Reasoning</td>
<td>1.06</td>
<td>0.79</td>
</tr>
<tr>
<td>Science Comprehension Total</td>
<td>3.62</td>
<td>1.57</td>
</tr>
<tr>
<td>Eighth Grade (n = 43)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science Knowledge</td>
<td>1.86</td>
<td>0.86</td>
</tr>
<tr>
<td>Science Skill</td>
<td>0.98</td>
<td>0.87</td>
</tr>
<tr>
<td>Science Reasoning</td>
<td>1.23</td>
<td>0.84</td>
</tr>
<tr>
<td>Science Comprehension Total</td>
<td>4.07</td>
<td>1.88</td>
</tr>
</tbody>
</table>

*Note. Categories of knowledge, skill, and reasoning comprised of three items each.*

Regarding the sixth grade students, 77 (87.50%) were of Hispanic origin and 41 (46.59%) were female. A total of 36 (83.72%) of the eighth grade students were of Hispanic origin and 19 (44.18%) were female. Additionally, student Measure of Academic Proficiency and Progress (MAPP) scores were obtained from Las Vegas City Schools to determine if students were at or below their respective GLE (see Table 2). The MAPP is administered three times per year to track students’ academic progression. For this study, the students’ mid-year test data was utilized, as it was administered during the same time of year as the study’s intervention.
Table 2

*Personal Characteristics and Grade Level Expectations of Students Participating in MMSAECC* (Skelton et al., 2016)

<table>
<thead>
<tr>
<th>Grade Level</th>
<th>F</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sixth Grade <em>(n = 88)</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hispanic Origin</td>
<td>77</td>
<td>87.50</td>
</tr>
<tr>
<td>Gender (Female)</td>
<td>41</td>
<td>46.59</td>
</tr>
<tr>
<td>At Grade Level Expectation</td>
<td>36</td>
<td>40.90</td>
</tr>
<tr>
<td>Below Grade Level Expectation</td>
<td>52</td>
<td>59.10</td>
</tr>
<tr>
<td>Eighth Grade <em>(n = 43)</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hispanic Origin</td>
<td>36</td>
<td>83.72</td>
</tr>
<tr>
<td>Gender (Female)</td>
<td>19</td>
<td>44.18</td>
</tr>
<tr>
<td>At Grade Level Expectation</td>
<td>29</td>
<td>67.40</td>
</tr>
<tr>
<td>Below Grade Level Expectation</td>
<td>14</td>
<td>32.60</td>
</tr>
</tbody>
</table>

**Data Analysis**

Data associated with objective one were analyzed via descriptive statistics, specifically the mean, standard deviation, and percentage. Logistic regression was utilized to meet the needs of objective two. Logistic regression is appropriate when the outcome variable is categorical in nature (Field, 2009). Specifically related to this study, the outcome variable was whether or not the students met their respective GLE. Due to the exploratory nature of this study, the alpha level utilized to determine statistical significance was set at 0.10. Nagelkerke’s $R^2$ was employed to determine the practical significance of the regression model. The value of Nagelkerke’s $R^2$ ranges between zero and one, making its interpretation similar to the classical $R^2$ utilized to measure effect size in multiple regression (Field, 2009; Nagelkerke, 1991).

**Findings**

Objective one of this study sought to determine overall science comprehension of students after participating in an inquiry-based science program. Sixth grade students had an overall science comprehension mean of 6.35 (SD = 1.52) out of a possible nine items (see Table 3). The highest mean was in the area of science skill (M = 2.48; SD = 0.66). The lowest mean was for science reasoning (M = 1.76; SD = 0.71).
Table 3  

*Performance on the Science Comprehension Examination Post-Test for 6th Grade (n = 88)*

<table>
<thead>
<tr>
<th>Test Category</th>
<th>M</th>
<th>%</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Science Knowledge</td>
<td>2.11</td>
<td>70.33</td>
<td>0.82</td>
</tr>
<tr>
<td>Science Skill</td>
<td>2.48</td>
<td>82.67</td>
<td>0.66</td>
</tr>
<tr>
<td>Science Reasoning</td>
<td>1.76</td>
<td>58.67</td>
<td>0.71</td>
</tr>
<tr>
<td>Science Comprehension Total</td>
<td>6.35</td>
<td>70.56</td>
<td>1.52</td>
</tr>
</tbody>
</table>

*Note.* Categories of knowledge, skill, and reasoning comprised of three items each.

Regarding performance of the eighth grade students, the overall mean of science comprehension was 6.05 (SD = 1.59) out of a possible nine items (see Table 4). The highest mean was in the area of science knowledge (M = 2.37; SD = 0.76) and the lowest was science reasoning (M = 1.74; SD = 0.79).

Table 4  

*Performance on the Science Comprehension Examination Post-Test for 8th Grade (n = 88)*

<table>
<thead>
<tr>
<th>Test Category</th>
<th>M</th>
<th>%</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Science Knowledge</td>
<td>2.37</td>
<td>79.00</td>
<td>0.76</td>
</tr>
<tr>
<td>Science Skill</td>
<td>1.93</td>
<td>64.33</td>
<td>0.94</td>
</tr>
<tr>
<td>Science Reasoning</td>
<td>1.74</td>
<td>58.00</td>
<td>0.79</td>
</tr>
<tr>
<td>Science Comprehension Total</td>
<td>6.05</td>
<td>67.22</td>
<td>1.59</td>
</tr>
</tbody>
</table>

*Note.* Categories of knowledge, skill, and reasoning comprised of three items each.

Objective Two sought to determine if science comprehension sub-scores could predict science GLE. Prior to employing logistic regression, the Hosmer and Lemshow Goodness of Fit (HLGF) Test was calculated to determine how well the model fits the data. Table 5 lists the results of the HLGF by grade level. Regarding the sixth grade data, the HLGF was determined not to be statistically significant at the $\alpha = .05$ level, indicating the model fit the data well (see Table 5). Similarly, the HLGF was calculated prior to analyzing data associated with the eighth grade students. The HLGF for this group was determined to not be statistically significant at the $\alpha = .05$ level (see Table 6).
Table 5

Results of the Hosmer and Lemeshow Goodness of Fit Test for 6th Grade

<table>
<thead>
<tr>
<th></th>
<th>$\chi^2$</th>
<th>df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1 – 6th Grade</td>
<td>4.54</td>
<td>7</td>
<td>0.72</td>
</tr>
<tr>
<td>Step 1 – 8th Grade</td>
<td>6.87</td>
<td>8</td>
<td>0.55</td>
</tr>
</tbody>
</table>

The regression model associated with the sixth grade data predicted 70.5% of the cases correctly versus 59.1% predicted in the initial constant model. Nagelkerke’s $R^2$ was calculated to determine the significance of the overall model. Specifically, Nagelkerke’s $R^2$ was 0.36 for the data associated with the sixth grade students. Science knowledge was determined to not be statistically significant ($p = 0.45$). Both science skill ($Wald = 3.11; p = 0.08$) and science reasoning ($Wald = 10.84; p = 0.00$) were determined to be statistically significant at the $\alpha = 0.10$ level (see Table 6). The science skill and science reasoning odds ratios were 2.38 and 4.17, respectively.

Table 6

Logistic Regression of 6th Grade Test Areas on Grade Level Expectation

<table>
<thead>
<tr>
<th>Variable</th>
<th>$B$</th>
<th>SE</th>
<th>Wald</th>
<th>df</th>
<th>p</th>
<th>Odds Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Science Knowledge Score</td>
<td>0.26</td>
<td>0.34</td>
<td>0.58</td>
<td>1</td>
<td>0.45</td>
<td>1.29</td>
</tr>
<tr>
<td>Science Skill Score</td>
<td>0.87</td>
<td>0.49</td>
<td>3.11</td>
<td>1</td>
<td>0.08</td>
<td>2.38</td>
</tr>
<tr>
<td>Science Reasoning Score</td>
<td>1.43</td>
<td>0.43</td>
<td>10.84</td>
<td>1</td>
<td>0.00</td>
<td>4.17</td>
</tr>
</tbody>
</table>

Note. $\alpha = .10$

The regression model associated with the eighth grade data predicted 74.4% of the cases correctly versus 67.4% in the initial constant model (see Table 7). Nagelkerke’s $R^2$ was calculated to be 0.25 for the overall model. Science skill was the only sub-score determined to be statistically significant ($Wald = 6.05; p = 0.01$) at the $\alpha = 0.10$ level. The science skill odds ratio was 3.20.

Table 7

Logistic Regression of 8th Grade Test Areas on Grade Level Expectation

<table>
<thead>
<tr>
<th>Variable</th>
<th>$B$</th>
<th>SE</th>
<th>Wald</th>
<th>df</th>
<th>p</th>
<th>Odds Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Science Knowledge Score</td>
<td>-0.045</td>
<td>0.53</td>
<td>0.70</td>
<td>1</td>
<td>0.40</td>
<td>0.64</td>
</tr>
<tr>
<td>Science Skill Score</td>
<td>1.16</td>
<td>0.47</td>
<td>6.05</td>
<td>1</td>
<td>0.01</td>
<td>3.20</td>
</tr>
<tr>
<td>Science Reasoning Score</td>
<td>-0.064</td>
<td>0.53</td>
<td>1.46</td>
<td>1</td>
<td>0.23</td>
<td>2.30</td>
</tr>
</tbody>
</table>

Note. $\alpha = .10$

Discussion and Implications
Objective one sought to determine the level of science comprehension by grade level. Regarding the sixth grade students, there was a 31.5% increase in the number of correct items on the post-test instruments (Skelton et al., 2016). Eight-grade students completing the water chemistry unit demonstrated a 40.79% increase in the items they answered correctly (Skelton et al., 2016). The overall score on the 9-item science comprehension instrument could be considered low average (i.e., roughly 70% correct) for both sixth and eighth grade students. The sixth grade students performed best on items related to science skill, while the eighth grade students scored highest on the science knowledge portion of the instrument (Skelton et al., 2016). Results from this study indicate that the inquiry-based methods used in this program were beneficial to overall science comprehension of both grade levels. This is consistent with several prior studies that have investigated the merits of inquiry-based learning (Parr et al., 2008; Pearson et al., 2013; Young et al., 2008; Thoron & Meyers, 2011).

The purpose of objective two was to determine if the science comprehension sub-dimensions (i.e., science knowledge, science skill, and science reasoning) could predict whether students would meet their respective GLE, as measured by the MAPP. Regarding the sixth grade students, science skill and science reasoning were found to be statistically significant predictors. Per analysis of the odds ratios of these sub-dimensions, it was determined that the higher students scored, the more likely they were to meet their GLE. Science knowledge was not a significant predictor of GLE of the sixth grade students.

Regarding the eight-grade students, science skill was found to be a statistically significant predictor. Analysis of the odds ratio indicated that as scores in the science skill sub-dimension increased students were more likely to meet their GLE. The sub-dimensions of science knowledge and science reasoning were not significant predictors for this group of students.

In both the 6th grade program and the 8th grade program, over 85% of students were identified as being Hispanic and over 45% of the students were female (Skelton et al., 2016). An increase in science comprehension, especially for students that are typically identified as underrepresented in the science field is an important finding (NRC, 2007; Barron, 2003). Active learning has been recognized as being one of the most influential factors to student success, being even more impactful than student background and previous academic performance (Barron & Darling-Hammond, 2008). Identifying specific ways that inquiry-based learning can be used to help all learners advance in science fields can not only be beneficial for students, but could inform the development of impactful pre-service teacher education and in-service professional development opportunities.

**Recommendations**

Active learning and engagement in hands-on learning strategies have been identified as effective methods of science instruction (Rutherford & Ahlgren, 1990; Barron & Darling-Hammond, 2008). Results from this research demonstrate that inquiry-based learning strategies benefit students and it is recommended that teachers should incorporate inquiry-based learning strategies as a regular part of their classroom instruction. However, integration can be a challenge, particularly because teachers may not have received formal training in how to incorporate inquiry-based learning within the agriscience classroom (Linn, Slotta, & Baumgartner, 2000). Because successful inquiry-based learning requires extensive student support and teacher training, adequate planning is crucial for successful integration (Rosenfeld & Rosenfeld, 1999).

Guskey’s Model of Teacher Change (2002) describes successful professional development as being a complex process that requires more than just individual training sessions. This model...
describes ideal professional development as having four key stages: (a) learning about the professional development topic in depth; (b) putting the professional development to practice; (c) determining how students learn as a result of the change in teaching methods; and (d) addressing any change in behavior that results from implementation. Professional development in inquiry-based learning cannot stop after introducing the concept, but rather, should allow teachers to learn about the topic, implement inquiry-based learning and then analyze how inquiry-based learning can impact their classroom. The MMSAEEC program should be utilized to teach agriculture teachers across New Mexico to better incorporate inquiry-based and experiential learning. Studies that actively analyze inquiry-based learning in programs, such as this one, may be helpful for teachers to learn about inquiry-based teaching strategies and better understand how to incorporate this teaching method into their content.

Because agriscience is often known for the experiential nature of its programs (Achieve, Inc., 2015), actively including hands-on and inquiry-based learning strategies may be an excellent opportunity for agriscience and science teachers to develop partnerships that can benefit both teachers and students. Through active partnerships, teachers can provide opportunities for students to better understand scientific principles within the context of agriculture. Similar partnerships have been discussed related to the integration of mathematics into agricultural education (Parr et al., 2008; Young et al., 2008). Pearson et al. (2013) partnered science and CTE teachers together to develop a community of practice whereby they developed curriculum maps and ensured each lesson was science enhanced. Utilizing these types of partnerships could create stronger collegial relationships and ensure students receive the most accurate, up-to-date science content delivered in the context of CTE.

Regarding future research, further investigation is warranted into the predictive power of the science comprehension subdimensions. This exploratory study utilized a small sample and liberal alpha value in determining significance; therefore, future studies should utilize large samples of students and utilize a more conservative alpha value to determine statistical significance. We also worked with limited variance for both the independent variables, which were measured by only three indicators each, and the dependent variable (GLE) which was a dichotomous variable in this study. Expanding the number of indicators measuring the three-science comprehension subdimensions before regressing them on overall science score instead of a dichotomous GLE variable could give us a clearer picture of the potential of the model. It is also recommended that future experimental research should be conducted to determine precisely how inquiry-based learning influences student science comprehension. Within the MMSAEEC future studies should include a delayed post-test to understand the long-term effects of this educational model. While this study analyzed science knowledge within a small aspect of science education, larger studies that address more aspects of science and CTE would be beneficial to teacher education programs. Additionally, other models of inquiry-based education should be studied to identify which methods are most effectively integrated within agriscience programs.

It is also recommended that in addition to studying the overall benefits of inquiry-based learning on student achievement, specific aspects of science integration should be examined. The ability to generate accurate hypotheses, for example, has been connected to the development of efficient and effective problems solvers (Blackburn & Robinson, 2016; Johnassen, 2000). In MMSAEEC and other similar program models, a better understanding of student achievement in areas such as these could help to increase understanding of student success in STEM programs.

Lastly, specific research should be conducted to more closely examine inquiry-based learning models on students from diverse backgrounds. Programs such as MMSAEEC that work with a large number of students from traditionally underrepresented populations can provide unique
opportunities to study both student achievement and student interest in STEM. Longitudinal research, in particular, should be conducted to determine if programs like these do increase the number of diverse students that enter the STEM workforce. In a study conducted by Oakes (1990), three factors were determined to be necessary for underrepresented students to pursue careers in science: (a) students’ opportunities to learn science and math; (b) their achievement in science and math; and (c) the students’ decisions to pursue careers in these areas. The MMSAECE model as designed by Skelton et al. (2016) provides opportunities within each of these three areas, therefore, this program and similar models should be investigated to determine the long-term impact of successful student achievement in science and math, student interest in these areas, and their decision to eventually pursue careers in these fields.

References


Skelton, P., Stair, K. S., Dormody, T., & Vanleeuwen, D. (2014). Determining the science, agriculture and natural resources, and youth leadership outcomes for students.

Skelton, P., Dormody, T., & Lewis, M. (In Press). Examining the effects of an extension youth science center on underserved middle school student science comprehension. *Journal of Extension*


Is There an App for That?: Describing Smartphone Availability and Educational Technology Adoption Level of Louisiana School-Based Agricultural Educators

H. Eric Smith¹, Kristin S. Stair², J. Joey Blackburn³ & Madelyn Easley⁴

Abstract

The purpose of this study was to describe smartphone availability and usage for teaching by agricultural educators in Louisiana. Further, this study sought to describe the level of educational technology adoption of these teachers. Data were collected at each Louisiana FFA Leadership Camp session during the summer of 2016. Teachers were asked to indicate the availability of smartphones for instructional purposes at their school. Teachers also indicated instructional technologies they are using currently, as well as their self-perceived level of adoption of educational technology. Over half of the teachers indicated their district policy allowed teachers to employ smartphones for educational purposes. Less than one-third of the teachers were in districts that allowed students to use smartphones for learning. The classroom computer and digital projector were the most commonly utilized educational technologies. The highest percentage of teachers perceived themselves as letting others adopt technologies before they are willing to try. The results of this study are in line with the Diffusions of Innovations theory in terms of percentages of teachers in the adopter categories. It is recommended that teacher professional development opportunities be developed following the model of teacher change to ensure agriculture teachers receive up-to-date information to further their practice.

Keywords: technology, smartphone availability, technology adoption, agricultural education teachers

Introduction

Technology is often emphasized as being a critical component of both educational reform and classroom innovation (Palak & Walls, 2009). As a result, considerable resources are allocated each year by local school districts to purchase technology and provide teacher training. In fact, public education spent approximately three billion dollars on digital content for teachers to utilize in their programs in 2015 (Herold, 2016). As a result of these increased resources, teachers and

¹ Eric Smith is the Executive Director of the Louisiana FFA Association. 244 John M. Parker Coliseum, Baton Rouge, LA 70803.
² Kristin S. Stair is an Associate Professor of Agricultural Education in the Department of Agricultural and Extension Education and Evaluation at Louisiana State University, 135 Knapp Hall, 110 LSU Union Square, Baton Rouge, LA 70803, kstair@lsu.edu
³ J. Joey Blackburn is an Assistant Professor of Agricultural Education in the Department of Agricultural and Extension Education and Evaluation at Louisiana State University, 129 J.C. Miller Hall, 110 LSU Union Square, Baton Rouge, LA 70803, jjblackburn@lsu.edu
⁴ Madelyn Easley is an undergraduate student in the Department of Agricultural and Extension Education and Evaluation at Louisiana State University, 137 JC Miller Hall, 110 LSU Union Square, Baton Rouge, LA 70803, measle6@lsu.edu
students are experiencing more opportunities for technology integration (Cuban, Kirkpatrick, & Peck, 2001).

In modern classrooms, computers are commonplace, with 98% of schools having one or more in the classroom and 84% having high-speed Internet connections (Statisticbrain, 2015). Investigations into how schools acquire technology are not new, in 2009 the average student to computer ratio was 3:1. This was true even in school systems with fewer resources (Gray, Thomas & Lewis, 2010). While the availability of technology is ever increasing, individual teachers may not integrate at the same rate. Many factors may contribute to a lack of technology integration. Specifically, issues such as (a) a lack of support, (b) a lack of technical access, (c) student issues, (d) technical problems, and (e) teacher attitude can all impact a teacher’s willingness to integrate technology into the classroom (Wood, Mueller, Willoughby, Specht & Deyuoung, 2005). Hew and Brush (2007) conducted a meta-analysis of 48 empirical studies to determine what teachers at all levels perceived as the greatest barriers to technology integration. From these studies, three main barriers were established: (a) resources, (b) teachers knowledge and skills and (c) teachers attitudes and beliefs. In a study of agricultural education teachers in North Carolina, some of the greatest barriers to technology integration in the classroom were (a) the cost of technologies, (b) implementation issues, and (c) time needed to develop lessons to incorporate technology (Williams, Warner, Flowers & Croom, 2009). Additionally, some teachers are simply unsure of how to employ educational technologies to enhance their pedagogy (Murphrey, Miller, & Roberts, 2009).

Ertmer (1999) described barriers to technology integration as being hierarchical in nature; first order barriers include availability and teacher knowledge, while second order barriers are defined as intrinsic factors such as teacher beliefs. While the availability of technology is critical to incorporation, a teacher’s willingness to include the technology within the classroom is often the determinant of a teachers’ practice (Ertmer, 1999; 2005). Similarly, Palak and Walls (2009) found that teachers who already have ready access to resources, materials, training, and are comfortable with technology may still choose not to implement that technology in their classroom. The study concluded that teacher attitudes towards technology do not necessarily change because of the availability of technology (Palak & Walls, 2009).

An added variable in the technology integration issue is that even when available, teachers may not necessarily apply that technology in student-centered classroom instruction. For many teachers, technology is used to supplement current teaching practices or for administrative purposes (Palak & Walls, 2009). A study conducted by Broekhuizen (2016) found 52.7% of teachers who have readily available access to technology showed no evidence of employing technology to allow students to gather, evaluate, or apply information toward learning. Further, only 36.7% of teachers implemented technology that allowed students to solve problems or create original works and only 35.4% used technology for collaborative learning (Broekhuizen, 2016). Similar results have been reported across various educational levels and programs. For example, a study of faculty members in social work programs at land-grant universities revealed that professors most often integrated educational technology at low levels, and primarily used technology such as email, internet, and course management systems (Buquoi, McClure, Kotrlik, Machtemes, & Bunch, 2013).

Similarly, previous studies in agricultural education have found teachers most regularly use technology that is teacher focused rather than student focused. In a 2003 study, the most commonly utilized technologies reported by Louisiana agricultural education teachers were interactive DVDs or CDs, digital cameras, video/CD/DVD players, laser disc players or standalone DVD or CD players (Kotrlik & Redmann, 2009). A more recent study in Tennessee found the most frequently used technologies were personal desktop computers, digital projectors, laptops, and cellular phones (Coley, Warner, Stair, Flowers, & Croom, 2015). Additionally, Williams et al.
(2014) found 65% of North Carolina teachers utilized projectors, as well as a teacher computer on a daily basis. These technologies all indicate a trend toward using technology to present information passively.

Passive uses of educational technologies are not always what is envisioned when teachers are asked to incorporate technology to reach students in today’s classroom. Blaire (2012) called for a re-envisioning of how educational technology is utilized, specifically, the learners of today are capable of engaging through technology at a very different level than students in the past and that the classroom simply having an interactive whiteboard is no longer sufficient (Blaire, 2012). This push toward innovation may be intimidating as teachers work to acquire and make resources available to students, then implement them in their lessons (Schrum, 1999).

The incorporation of technologies into the learning process is not a new phenomenon (Whisenhunt, Blackburn, & Ramsey, 2010). For example, Reiser (2001) noted the invention of lantern slides in the early 1900s sparked the movement to incorporate visual images to improve learning. Instructional technology has evolved to the present day where computers, interactive whiteboards, and digital projectors are the norm (Whisenhunt et al., 2010). The secondary students of today are labeled digital natives and have been surrounded by technology for most, if not all, of their lives (Prensky, 2001). Effectively incorporating educational technologies into instruction is one means of increasing motivation and interest of digital native students (Heafner, 2004). Further, technology rich environments have been shown to influence teacher attitudes and increase student engagement, achievement, motivation to learn in all content areas, and technology integration has been identified as a characteristic of effective agricultural educators (Bialo & Sivin-Kachala, 1996; Christensen, 2002; Peake, Briers, & Murphy, 2005; Roberts & Dyer, 2004). Further, Murphrey et al. (2009) concluded that some agriculture teachers perceived educational technologies as being beneficial and complementary to their teaching. As technology continues to advance, teachers should look for new and innovative means for incorporating it into instruction to improve their practice. One such advancement in technology that holds potential for increasing student achievement, motivation, and/or engagement is the smartphone.

The computing capabilities of current smartphones far exceed that of the mobile phones from just a decade ago (Traxler, 2009). A modern smartphone has more processing capability than NASA had in 1969 when Neil Armstrong became the first person to set foot on the moon (Kaku, 2011). Despite the continued upward trend in computing power, approximately 69% of schools in America ban cellular phones from campus (Commonsense Media, 2010). These widespread bans on smartphones in schools has been attributed to what Thomas and O’Bannon (2015) called the new digital divide where students, millennial teachers, and non-millennial teachers and administration have conflicting perceptions of how smartphones could or should be incorporated into the learning process. Further, research has shown that student perceptions of utilizing smartphones for learning tend to be more positive than the perceptions of teachers (Kalinic, Arsovski, Stefanovic, Arovski, & Rankovic, 2011; Tindell & Bohlander, 2011; Thomas & O’Bannon, 2015; Berry & Westfall, 2015).

The all-encompassing connectivity of smartphones allows students to learn ubiquitously (Traxler, 2009), while allowing teachers to customize instruction (Steel, 2012). Bridging this digital divide could allow both parties to work together more efficiently (Corbeil & Valdes-Corbeil, 2007). However, similar to previous studies of other educational technologies, smartphones are often not used to their full potential. Basic functions such as calculator, Internet access, calendar, and clock are used more often than cutting-edge functions that enable students to create material (Thomas & Muñoz, 2016). Similar to presentation and collaboration technology, the more sophisticated uses
of smartphones may improve student achievement (Liu, Scordino, Renata, Navarrete, Yujung, & Lim, 2015) and motivation (Su & Cheng 2015) when compared to traditional teaching methods.

Various concerns arise when teachers consider the allowance of smartphones in the classroom (Thomas & O'Bannon, 2015). A survey of 675 college students from 26 states revealed that on average students spent about 20% of class time using smart devices for purposes unrelated to class (McCoy, 2013). Further, texting during class is linked students to 30% lower scores on quizzes (Froese et al., 2012). However, sending and receiving Tweets related to material being taught has resulted in gains of understanding between 10% and 17% (Kuznekoff, Munz, & Titsworth, 2015).

Other concerns that have contributed to the banning of smartphones in the classroom include (a) cheating, (b) sexting, and (c) cyberbullying (Keengwe, Schnellert, & Jonas, 2014). Cheating is a major concern among teachers and students (Thomas & Muñoz, 2016; Thomas & O'Bannon, 2015; Tindell & Bohlander, 2011). A CommonSense Media (2010) poll indicated 35% of students have used their phone to cheat. Sexting refers to the sending of inappropriate photos and sexually suggestive content via text message (Obringer & Coffey, 2007). According to Lenhart (2009), 4% of young people aged 12-17 have sent sexually explicit material via text and 15% have received sexually explicit text messages. Cyberbullying is threatening harm or attempting to shame a fellow student on social networks or other type of internet forum. Most cyberbullying is initiated off-campus, but results in disruptions on-campus. This has sparked debate to expand the jurisdiction of school punishment and some schools have begun incorporating off campus behavior policies into their handbooks (Keengwe et al., 2014).

Technology integration is not as simple as technology acquisition; added factors play into teachers actively using technology in their program. Often teachers are intimidated or anxious about incorporating educational technology into their classrooms (Redmann, Kotrlik, & Douglas, 2003). Further, teachers may not be engaging in the most appropriate professional development opportunities to learn to incorporate educational technologies into their pedagogy effectively. Murphy and Terry (1998) concluded that the time necessary to become proficient at incorporating educational technologies into the agriculture classroom could be a barrier to the adoption of these tools into the classroom.

While some teachers seek professional development opportunities such as workshops or conferences to increase their knowledge of educational technologies, many teachers are self-taught (Kotrlik & Redmann, 2009; Kotrlik, Redmann, Harrison, & Handle, 2009; Redmann et al., 2003). Due to the ever-changing nature of technologies available to educators, research must be conducted periodically to assess how teachers are incorporating these technologies into the educational process (Thomas, Adams, Meghan, & Smith, 2002). It is imperative that those individuals charged with providing professional development – teacher educators, state instructional staff, and local school districts, have the most up-to-date information regarding teachers’ classroom practices. Further, it is crucial that these individuals design and implement professional development opportunities through methods that have been shown to influence teacher behavior in the classroom.

**Theoretical Frame**

The theoretical underpinning that guided this study was Roger’s (2003) Diffusion of Innovations theory. The premise of the theory is that for diffusion of a technology to occur, the potential adopters must perceive certain attributes of the innovation. These attributes include (a) relative advantage, (b) compatibility, (c) complexity, (d) trialability, and (e) observability (Rogers,
2003). Specifically, relative advantage refers to the perception of how much better the innovation is than the idea it will replace. Compatibility is how well the innovation fits within the potential adopters’ current situation, while complexity is the perception of the level of difficulty of the innovation. Trialability is the “degree to which an innovation may be experimented with on a limited basis” (p. 16). Finally, observability is how visible the results of the innovation are to others. Rogers (2003) noted that innovations that are perceived as low in complexity and high in the remaining categories are likely to be adopted at a more rapid rate than those perceived as complex.

Rogers (2003) also discussed categories of potential adopters. These categories include (a) innovators, (b) early adopters, (c) early majority, (d) late majority, and (e) laggards. Rogers (2003) compared the categories of adopters in a given system to the bell curve to show their relative relationship. Innovators comprised of 2.5% of a system and are described as venturesome, those who push boundaries of the current paradigm to create new and different ideas. Early adopters make up 13.5% of the population in a system and are those who are likely considered to be opinion leaders within their social circle, meaning others are likely to seek the advice of the early adopter before adopting a new innovation (Rogers, 2003). The early majority comprises 34% of the individuals in the system and are characterized as being deliberate in their adoption of an innovation. This group tends to let the kinks of an innovation get worked out before they adopt (Rogers, 2003). The late majority comprises the next 34% and are labeled as skeptical. This group normally holds out on adopting an innovation until the pressure of their social system causes them to give in and adopt (Rogers, 2003). The final 16% are known as laggards who are characterized as being traditional. They are the most isolated individual or group within their social system and are highly suspicion of change agents and innovators. Laggards may choose not to adopt for a variety of reasons, ranging from resource availability to the perception of the innovation interfering with their values (Rogers, 2003).

**Conceptual Framework**

Conceptually, this study was framed by Guskey’s (2002) model of teacher change. This model can help explain the discrepancy between teacher technology availability and technology use. According to Guskey (2002), teachers must first be trained in any professional development initiative before implementing change in their classrooms. Once a change is integrated into practice, there must be an opportunity for teachers to see a change in student learning. Teacher attitudes and beliefs will only change when a practice has been implemented and they have the opportunity to study the impact of the initiative further. Resources may be provided in programs, but as described by Kotrlik & Redmann (2009) the majority (92%) of agriculture teachers are self-taught, therefore there is little pressure (or support) from school systems when implementing change.

Existing research on instructional technology integration into secondary agricultural education has focused on adoption, sources of training, accessibility/usage and perceived barriers (Coley et al., 2014; Kotrlik & Redmann, 2009; Kotrlik et al., 2009; Redmann et al., 2003; Williams et al., 2014). However, as technology has rapidly evolved and has become increasingly more mobile, so too have teachers’ needs changed. In order to better understand the technology availability and integration opportunities available to teachers, more recent research is needed.

The purpose of this research aligns with the AAAE National Research Agenda, specifically Research Priority Areas (RPA) 2 and 4. Specifically, RPA 2 is New Technologies, Practices, and Products Adoption Decisions (Lindner, Rodriguez, Strong, Jones, & Layfield, 2016), while RPA 4 is Meaningful, Engaged Learning in All Environments (Edgar, Retallick, & Jones, 2016).
Purpose and Objectives

The two-fold purpose of this study was to describe the smartphone availability and usage by agriculture teachers in Louisiana for educational purposes and to describe the level of educational technology adoption of these teachers. The following research objectives guided this study:

1. Describe smartphone availability (i.e., physical access and district policy) of Louisiana agricultural education programs (i.e., teachers and students).
2. Describe Louisiana agricultural educators openness to utilizing smartphone technology for teaching and learning.
3. Identify educational technologies that Louisiana agricultural educators incorporate into instruction.
4. Describe Louisiana agricultural educators self-perceived level of educational technology adoption.

Methods

Data collected for this study was part of a larger research project to determine differences in achievement of students in a technology enhanced curriculum versus those taught via direct instruction. The target population of this study was all Louisiana agricultural educators actively working during the 2015-2016 academic year (N = 238). The Louisiana agriculture teacher directory obtained from the Louisiana FFA website was used to determine the target population. Data were collected, face-to-face via hardcopy instrument by the researcher at each of the three Louisiana FFA Leadership Camp sessions. Per state legislative policy, all agriculture teachers employed on a 12-month contract must attend state FFA camp and bring at least two active FFA members. After registering for camp, a meeting for teachers is held in the conference area. During this meeting, an informed consent statement was read aloud by the researcher and the teachers were allowed time to voluntarily complete the survey. In all, 177 advisors registered for camp and 157 agriculture teachers completed the survey, which yielded 88.7% response rate, representing 66.0% of the total agriculture teacher population in Louisiana. No attempt was made to administer the instrument to those teachers who did not attend the leadership camp.

The participants were 68.7% male (n = 108) and 31.3% female (n = 49). Participating Louisiana agricultural educators’ age ranged from 22-67 with an average age of about 41 years old. The average agricultural education teaching experience was a little more than 13 years. Teachers from each of the four FFA areas were present in the sample, with 22 (14%) from Area I, 29 from Area II (18.5%), 59 from Area III (37.6%), 42 from Area IV (26.8%), and 5 who did not indicate the area in which they teach (3.2%). According to the Louisiana FFA directory, there are 193 chapters in Louisiana with 33 (17.1%) in Area I, 41 (21.2%) in Area II, 60 (31.1%) in Area III, and 59 (30.1%) in Area IV.

The instrument utilized to collect data comprised of 18 items divided into three sections. The first section was comprised of researcher-created items utilized to determine smartphone availability, as well as Louisiana agriculture teachers’ openness to utilizing them for instruction. The second section was comprised of items modified from Coley et al. (2014) to determine self-perceived level of educational technology adoption as well as educational technologies these teachers utilize currently. The final section was utilized to determine the demographics of the teacher participants. Items related to smartphone availability and use of educational technologies was considered nominal data, therefore reliability estimates were not calculated. The reliability of the items related to openness was calculated post hoc utilizing Cronbach’s Alpha (α = .79).
A panel of three agricultural education faculty evaluated the instrument for face and content validity. Further, five active Louisiana agriculture teachers completed the instrument and provided feedback on the items. Minor changes were made to some items after the instrument was field-tested. No initial items were eliminated. Data associated with each research objective were analyzed through descriptive statistics, including frequencies, percentages, minimum value, and maximum value. Due to the ordinal nature of the data collected, the mode was determined as the most appropriate measure of central tendency to meet the needs of objectives two and three.

**Findings**

**Objective 1: Availability of smartphones for teaching and learning**

The first objective of this study sought to describe the smartphone usage policy for teachers and students in Louisiana secondary schools that offer agricultural education courses (see Table 1). In all, 143 (91.1%) personally owned a smartphone and 132 (84.1%) of the teachers reported having Wi-Fi access in their classrooms. Over half, \( n = 85 \) of the teacher participants indicated their school district policy allowed teachers to utilize smartphones for educational purposes while 51 (32.5%) reported they could not and 21 (13.4%) did not know if their district policy allowed teachers to use smartphones for learning. A total of 48 (30.6%) reported students in their district could utilize smartphones for learning, while 105 (66.9%) reported their district policy was against student smartphone use.

<table>
<thead>
<tr>
<th>Item</th>
<th>Yes</th>
<th>No</th>
<th>I don’t know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you own a smartphone?</td>
<td>143</td>
<td>14</td>
<td>0</td>
</tr>
<tr>
<td>Do you have access to “Wi-Fi” (wireless internet) in your classroom?</td>
<td>132</td>
<td>22</td>
<td>2</td>
</tr>
<tr>
<td>Does your school board policy allow teachers to use smartphones in the classroom as a teaching tool?</td>
<td>85</td>
<td>51</td>
<td>21</td>
</tr>
<tr>
<td>Does your school board policy allow students to use smartphones in the classroom for educational purposes?</td>
<td>48</td>
<td>105</td>
<td>4</td>
</tr>
</tbody>
</table>

**Objective 2: Openness to utilizing smartphone technology for teaching and learning**

The second objective was to describe Louisiana agricultural educators’ openness toward students using smartphones for learning. The greatest number of teachers indicated they were Somewhat Open \( n = 48; 29.1\% \) followed by Open \( n = 38; 23.0\% \) to the idea of allowing students to use smartphones for learning (see Table 2). Over one-fifth \( n = 34 \) of the teachers indicated they were Not at all Open to the idea of students utilizing smartphones for learning. Further, at total of 50 (30.3\% of the teachers indicated they were Open to the idea of participating in a professional development on utilizing smartphones for learning. Another 48 (29.1\%) teachers indicated they were Somewhat Open to attending a smartphone centered professional development.
Table 2

*Louisiana School-based Agricultural Educators’ Openness to Utilizing Smartphone Technology for Teaching and Learning (n = 157)*

<table>
<thead>
<tr>
<th>Item</th>
<th>Not at all Open</th>
<th>Somewhat Open</th>
<th>Open</th>
<th>Very Open</th>
<th>Entirely Open</th>
<th>Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>f</td>
<td>%</td>
<td>f</td>
<td>%</td>
<td>f</td>
<td>%</td>
</tr>
<tr>
<td>Openness to students utilizing smartphones for learning</td>
<td>34</td>
<td>20.6</td>
<td>48</td>
<td>29.1</td>
<td>38</td>
<td>23.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>15</td>
<td>9.1</td>
<td>21</td>
<td>12.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Openness to participating in professional development on smartphones for learning</td>
<td>20</td>
<td>12.1</td>
<td>48</td>
<td>29.1</td>
<td>50</td>
<td>30.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>16</td>
<td>9.7</td>
<td>23</td>
<td>13.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

*Note.* Percentages do not equal 100 due to missing responses
Objective 3: Educational technologies incorporated into instruction

The third research objective sought to describe Louisiana agricultural educators’ incorporation of educational technology into classroom instruction (see Table 3). Teachers were asked to indicate their level of access to various educational technologies. Overall, the most commonly utilized educational technologies were the teacher desktop/laptop \((n=125)\) and digital projector \((n=72)\), both of these items received modal scores of 6, indicating many teachers use these technologies on a daily basis. These teachers indicated they use test generation software and PowerPoint on a weekly basis and DVD players are used monthly. The remaining 10 educational technologies each received modal scores of zero, indicating many teachers do not have access to the technologies. However, of the teachers who do have access to these ten items, the smartboard is used daily, iPads/tablets are used weekly, and YouTube is used monthly. The teachers indicated they have access to the remaining educational technologies, but never use them.

Table 4

*Louisiana Agricultural Educators Self-Perceived Level of Educational Technology Adoption (n = 157)*

<table>
<thead>
<tr>
<th>Response</th>
<th>(f)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>I let others test new technologies before I adopt them</td>
<td>77</td>
<td>49.0</td>
</tr>
<tr>
<td>I am among the first to adopt new technologies as they become available</td>
<td>50</td>
<td>31.8</td>
</tr>
<tr>
<td>I rarely adopt new technologies</td>
<td>16</td>
<td>10.2</td>
</tr>
<tr>
<td>I create my own technology resources before anyone shows me</td>
<td>12</td>
<td>7.6</td>
</tr>
<tr>
<td>Missing</td>
<td>2</td>
<td>1.3</td>
</tr>
</tbody>
</table>
Table 3

**Louisiana School-based Agricultural Educators Use of Educational Technologies**

<table>
<thead>
<tr>
<th>Educational Technology</th>
<th>Do not have Access</th>
<th>Have access, but never use</th>
<th>Use a few times per year</th>
<th>Use a few times per semester</th>
<th>Use Monthly</th>
<th>Use Weekly</th>
<th>Use Daily</th>
<th>Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher desktop/laptop (n = 156)</td>
<td>6</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>8</td>
<td>11</td>
<td>125</td>
<td>6</td>
</tr>
<tr>
<td>Digital projector (n = 156)</td>
<td>10</td>
<td>9</td>
<td>5</td>
<td>8</td>
<td>16</td>
<td>36</td>
<td>72</td>
<td>6</td>
</tr>
<tr>
<td>Test generation software (n = 155)</td>
<td>28</td>
<td>15</td>
<td>12</td>
<td>25</td>
<td>24</td>
<td>39</td>
<td>12</td>
<td>5</td>
</tr>
<tr>
<td>PowerPoint (n = 150)</td>
<td>4</td>
<td>3</td>
<td>5</td>
<td>14</td>
<td>13</td>
<td>56</td>
<td>55</td>
<td>5</td>
</tr>
<tr>
<td>DVD player (n = 157)</td>
<td>9</td>
<td>7</td>
<td>26</td>
<td>33</td>
<td>35</td>
<td>33</td>
<td>14</td>
<td>4</td>
</tr>
<tr>
<td>YouTube (n = 157)</td>
<td>40</td>
<td>4</td>
<td>14</td>
<td>19</td>
<td>34</td>
<td>33</td>
<td>13</td>
<td>0</td>
</tr>
<tr>
<td>Smart board (n = 156)</td>
<td>75</td>
<td>10</td>
<td>5</td>
<td>3</td>
<td>6</td>
<td>17</td>
<td>40</td>
<td>0</td>
</tr>
<tr>
<td>Smartphone (n = 154)</td>
<td>46</td>
<td>30</td>
<td>11</td>
<td>14</td>
<td>16</td>
<td>12</td>
<td>25</td>
<td>0</td>
</tr>
<tr>
<td>iPad or other tablet (n = 156)</td>
<td>62</td>
<td>18</td>
<td>11</td>
<td>12</td>
<td>12</td>
<td>25</td>
<td>17</td>
<td>0</td>
</tr>
<tr>
<td>Apps (n = 154)</td>
<td>54</td>
<td>21</td>
<td>21</td>
<td>16</td>
<td>17</td>
<td>11</td>
<td>14</td>
<td>0</td>
</tr>
<tr>
<td>Document camera (elmo) (n = 156)</td>
<td>77</td>
<td>27</td>
<td>7</td>
<td>13</td>
<td>12</td>
<td>8</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td>Facebook and/or Twitter (n = 156)</td>
<td>79</td>
<td>44</td>
<td>4</td>
<td>0</td>
<td>5</td>
<td>13</td>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td>Instagram and/or Snapchat (n = 156)</td>
<td>85</td>
<td>56</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>6</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Facetime and/or Skype (video call) (n = 150)</td>
<td>78</td>
<td>54</td>
<td>10</td>
<td>7</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Student response system (clickers) (n = 156)</td>
<td>102</td>
<td>31</td>
<td>5</td>
<td>11</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>0</td>
</tr>
</tbody>
</table>

Note. 0 = do not have access, 1 = have access but never use, 2 = use a few times per year, 3 = use a few times per semester, 4 = use monthly, 5 = use weekly, and 6 = use daily.
Conclusions/Recommendations/Implications

Overall, even though smartphone ownership by Louisiana agriculture teachers mirrors the general public very few indicate daily or even weekly usage of this technology for learning. Over 90% of Americans between the ages of 18 and 49 reported they own a smartphone (Pew, 2017) and our data revealed 91% of Louisiana agriculture teachers own a smartphone. Over half of Louisiana agriculture teachers are allowed by board policy to use their smartphones in the classroom for instruction and have Wi-Fi access in their classrooms. Despite ready availability, Louisiana agriculture teachers are only somewhat open to the idea of students using smartphones in class. Results from this study indicate that approximately two-thirds of schools in Louisiana ban students from using smartphones for learning, consistent with a previous report by Common Sense Media (2010). The disconnect between availability and a willingness to use the technology within a classroom environment adds to the idea of a new digital divide between students and teachers (Thomas & O’Bannon, 2015). This finding is consistent with the idea put forth by Palak and Walls (2009) that the availability of technology does not mean teachers will embrace and incorporate it. Perhaps teachers, although open to the idea of utilizing smartphones for learning, perceive it to be high in complexity, thus outweighing the positive attributes (Rogers, 2003). Future research is warranted to determine what attributes of smartphones are perceived by Louisiana agriculture teachers as being beneficial or detrimental to the learning process (Rogers, 2003). Per Guskey (2002), teachers should engage in high quality professional development before change in classroom practice can take place. Results from previous studies have determined that agriculture teachers are often self-taught in terms of educational technologies (Kotrlik & Redmann, 2009; Kotrlik et al., 2009; Redmann et al., 2003). It is possible that these teachers may perceive utilizing the smartphone for educational purposes to be complex because they have never received training on how to incorporate them into their pedagogy.

A plethora of research insists that student perceptions of smartphone use in formal education are more positive than teacher perceptions (Kalinic, et al., 2011; Tindell & Bohlander, 2011; Thomas & O’Bannon, 2015; Berry & Westfall, 2015). That is not to say that students do not recognize the problems with using smartphones in education. Studies have indicated that students often share the same concerns teachers have about smartphones being used to cheat, disturb, or bully (Thomas & Muñoz 2016; Gao, Yan, Wei, Liang, & Mo, 2017). To date, most of the research on student perceptions towards smartphones for educational purposes is collected at the university level. For technology perceptions and policies to change, more research should be conducted in secondary education, and namely agriculture classes, to gain insight from students on the benefits of technology integration. Additional research should be focused on secondary level administrators who are charged with enforcing district policy regarding the allowance of smartphones to determine what procedures or practices would be beneficial to students and teachers in secondary education.

Despite it not being used readily within the classroom, agriculture teachers in this study indicated they are open to the idea of professional development geared towards implementing smartphone technology into classroom instruction. Kotrlik and Redmann (2009) found that 92% were self-taught in terms of where they attained technology skills. Similarly, a study of Tennessee agriculture teachers found the most common ways for teachers to learn technology were through personal trial and error, interaction with other faculty, and independent learning (Coley et al., 2015).

As with similar studies, teachers in Louisiana indicated using teacher-centered technology most often in their educational practice. The majority of teachers indicated that they used a teacher desktop/laptop, digital projectors, test generation software, and PowerPoint on a daily or weekly basis. This research is strikingly similar to previous studies in agricultural education (Kotrlik & Redmann, 2009; Coley et al., 2015; Williams et. al., 2014) and indicates that agriculture teachers’
use of technology has remained relatively unchanged in the past 10 years. Previous research on teacher usage of mobile devices indicated that most use their devices for passive learning and administrative duties rather than collaborative projects and material creation (Thomas & Muñoz, 2016). Research should be conducted to determine what first and second order barriers are inhibiting agriculture teachers from using newer technologies in districts with favorable technology policies.

Findings from this study indicate that the teachers’ perceptions of their educational technology adoption level are comparable to Roger’s (2003) description of the categories of adopters. Over 80% of teachers in this study indicated they either are among the first to adopt educational technology or let others try new technologies prior to adopting. These categories correspond with the early adopters, early majority, and late majority as described by Rogers (2003). Per the theory, these three categories of adopters should make up 81.5% of the individuals in a given system. A larger percentage of teachers perceived themselves as innovators than Roger’s (2003) theory would have predicted. Roger’s (2003) states that innovators make up 2.5% of the individuals in a system, while 7.6% of teachers in this study indicate they create new technologies before anyone shows them. Finally, just over 10% of teachers indicated they rarely adopt new technologies, indicating they could be considered laggards. Roger’s (2003) showed laggards should comprise 16% of a social system. The discrepancy between Rogers (2003) adopter categories and what we reported in this study may be attributed to non-response. Future studies should attempt to contact non-respondents to determine if they tend to be of a particular adopter category. Rogers (2003) describes laggards as isolated within their social system and they also tend to be traditional and suspicious. It could be that our lower level of self-reported laggards is attributed to laggards either not attending a leadership camp session or choosing not respond.

Results from this study show the large majority of teachers are willing to adopt educational technologies to enhance student learning. If teachers are indeed open to new technology and if they are willing to allow other teachers to implement technology before them, then Guskey’s (2002) model for teacher change would allow for greater opportunities for teachers to successfully adopt new educational technology. According to Guskey (2002), teachers must learn about the technology, then see the impact of that technology before they will consider adoption. Professional development opportunities provided by teachers who integrate technology successfully, can be an excellent opportunity to help teachers move from becoming aware of new technology to seeing the value in including the technology as part of their educational practice. For new technology to be adopted, a new professional development model must be established in Louisiana to help teachers move into new technology integration.

This study only looked at whether teachers were using smartphone technology in their programs. From this study, it is recommended that further research should be conducted to determine what basic and advanced smartphone functions agriculture teachers in Louisiana are actually using, specifically, in programs where teachers have access to technology and are allowed to use it for educational purposes, but students are not. A better understanding of what technologies are available and useful for teachers can be beneficial when developing professional development opportunities to encourage educational technology integration.

As technology increases, education will be expected to continue to integrate. If teachers in Louisiana have not increased their technology adoption in the past 10 years, how can they be expected to integrate at even higher rates? Future research and practice should be geared toward determining what technologies can be used, how to best provide professional development to teachers and how to help teachers measure the impact of those technologies in their programs.
References


The Motivational Changes Pre-Service Agricultural Education Teachers Endure while Facilitating Quality Supervised Agricultural Experiences: A Six-Week Project-Based Learning Experience

Richie Roberts1 & J. Shane Robinson2

Abstract

The Planning the Community Program in Agricultural Education course exists to provide pre-service teachers in agricultural education with knowledge about FFA and supervised agricultural experiences (SAEs). As such, pre-service teachers embarked on a six-week project-based learning experience in Spring 2016 in which they raised a pen of broilers from a one-day old chick to harvest ready (42 days). The broilers were used as the context to learn about managing data for entrepreneurial SAEs. This case study examined pre-service teachers’ motivation regarding their self-reported beliefs and perspectives for participating in the project. Three themes emerged: (a) initial self-ambition, (b) achievement stagnation, and (c) stabilized self-concept. Students began the project with high motivation and excitement. However, toward the midway point of the project, students’ motivation waned, due to monotony and challenges. Finally, during the last two weeks, pre-service teachers’ motivation stabilized, as their self-concepts and reflection abilities matured. The study holds important implications for how teacher educators in agricultural education should design and deliver future project-based learning experiences regarding students’ motivational processes. Specifically, this study indicates that, although student motivation may fluctuate at various stages, it is developed and sustained in a successive manner over time.

Keywords: motivation, project-based learning, SAE

Introduction

Agricultural education exists, as a discipline, to enable students to learn valuable life skills necessary for employment in various sectors of the agricultural industry through rich, experiential learning opportunities (Baker, Robinson, & Kolb, 2012; Rice & Kitchel, 2017). However, creating such opportunities where students are expected to apply their knowledge and skills in various contexts can be a difficult and imperative task (Arnold, Warner, & Osborne, 2006). To be deemed effective, agricultural education teachers are expected to be quality classroom instructors, advise students in the FFA program, and operate, maintain, and utilize all school-based laboratories (Roberts & Dyer, 2004) by providing rich experiences across the comprehensive agricultural education model (Baker et al., 2012).

Agricultural education teachers face a myriad of challenges regarding their professional role. Among them is a lack of student motivation for learning or experiencing agriculture (Boone & Boone, 2009). Fewer people than ever before rely on farming as their livelihood (Environmental

1 Richie Roberts is an Assistant Professor at North Carolina A&T University, frichardroberts@ncat.edu.
2 J. Shane Robinson is a Professor of Agricultural Education in the Department of Agricultural Education, Communications and Leadership and the Associate Director of the Institute for Teaching and Learning Excellence at Oklahoma State University, PIO Building, Stillwater, OK, 74078, shane.robinson@okstate.edu.
Protection Agency, 2012). As people have become further removed from the family farm (Sayers, 2011), so too has their basic knowledge about (Dale, Robinson, & Edwards, 2017; Wingenbach, McIntosh White, Degenhart, Pannkuk, & Kujawski, 2007), as well as their motivation for and appreciation of agriculture, food, fiber, and natural resources (Boone & Boone, 2009; Dyer & Breja, 2003; Stair, Warner, & Moore, 2012).

Sadly, in addition to the general public, today’s college students know very little about agriculture. Colbath and Morrish (2010) revealed that incoming freshmen students enrolled at a higher education institution in central Texas failed (54%) a basic agricultural literacy test, where 70% was deemed acceptable. Unfortunately, students majoring in agriculture do not fare much better. In a study of the entire freshmen body at Oklahoma State University, it was found that students in the College of Agricultural Sciences and Natural Resources possessed barely a passing grade (61%) on a similar 100-point test regarding their knowledge of basic agricultural concepts (Dale et al., 2017). This lack of basic knowledge has implications for pre-service agricultural education teachers as they come to the university with a dearth of experiences in agriculture. It becomes the role of teacher preparation programs and educators to provide the adequate human capital, such as knowledge and experiences, pre-service teachers need before entering the profession (Mundt, 1991; Robinson & Baker, 2013; Rice & Kitchel, 2017).

Fortunately, teacher preparation programs of agriculture exist to provide coursework and experiences that enable students to learn technical agricultural skills and improve their confidence to teach them (Leiby, Robinson, & Key, 2013). Kennel (2009) stated, “because teachers are the single most important influence on student achievement, teacher education programs need to provide learning experiences for pre-service educators to impact their confidence to teach pertinent subject matter . . . .” (p. 2). One such area of need is supervised agricultural experience (SAE) programs (Rubenstein, Thoron, & Estepp, 2014).

Rubenstein et al. (2014) stated:

Since its inception, school-based agricultural education in the United States has utilized the home project method, later known as a supervised agricultural experience program (SAE), as a way to provide students with contextual, hands-on learning experiences outside of class that complement classroom learning. (p. 72)

Although SAEs are a fundamental component of the agricultural education program (Croom, 2008; Ramsey & Edwards, 2012) and have been since Stimson’s Farm Project Method was introduced in the early 1900s (Boone, Doerfert, & Elliot, 1987), teachers spend the least amount of time teaching students about them in comparison to other aspects of their job (Robinson, Krysher, Haynes, & Edwards, 2010; Terry & Briers, 2010). Therefore, a decline in student participation in SAEs at the secondary level exists (Croom, 2008). Although the reasons for the decline are largely unknown (Bird, Martin, & Simonsen, 2013), it could be due to teachers’ lack of knowledge of and experience in SAEs (Lewis, Rayfield, & Moore, 2012).

It is recognized widely that, although agricultural education consists of a balanced and integrated three-circle model including classroom and laboratory instruction, FFA, and SAE (Croom, 2008; Phipps, Osborne, Dyer, & Ball, 1988), the SAE component appears to be the weakest among the three (Croom, 2008; Rubenstein et al., 2014; Wilson & Moore, 2007). In addition to being the weakest component, Dyer and Breja (2003) revealed that SAEs actually serve as “obstacles” to recruiting students into agricultural education programs (p. 84).
Part of the reason SAE participation has decreased over time is due to historical issues. Stimson’s vision of SAE “became in actuality a mission statement of agricultural education. Many teachers soon realized, however, that education in agriculture must encompass more than only one home project, and initiated broader SAE programs . . . .” (Dyer & Osborne, 1995, p. 6). The Vocational Act of 1963 was intended to improve the broader aspect of what constituted an SAE. However, it came with unintended consequences and “de-emphasize[d] the need for SAE programs” (Dyer & Osborne, 1995, p. 7), which had a negative impact on SAE activity in the US (Boone, Doerfert, & Elliot, 1987). The decrease in students’ SAE participation eventually had a ripple effect, resulting in teachers being less experienced in and knowledgeable about teaching SAEs (Dyer & Osborne, 1995).

To increase participation, teachers have tried to motivate and encourage students to participate in SAEs through extrinsic rewards (Bird et al., 2013). Specifically, teachers use FFA awards as the motivation for students to participate in quality SAEs (Wilson & Moore, 2007). However, the spirit of SAEs may be more intrinsic than extrinsic for students in secondary programs (Bird et al., 2013).

Motivation can be impacted by the types of experiences students have (Baker, Robinson, & Terry, 2015). Kolb (1984) recognized the need for establishing concrete learning experiences in which students reflect, draw conclusions, and then retry their new ideas for experiencing a novel situation. It is important that an expert be present to guide the novice learner through a novel learning experience (Kolb, 1984).

Teacher educators should provide the expert guidance to pre-service teachers regarding the skills and experiences they need to be successful in the classroom (Rubenstein & Thoron, 2015; Stair et al., 2012). Teachers have indicated that ensuring SAE quality and effectiveness is one of the most important and difficult tasks associated with teaching school-based agriculture (Dyer & Osborne, 1995; Ramsey & Edwards, 2012; Robinson & Haynes, 2011; Rubenstein et al., 2014). Therefore, including SAEs in teacher preparation programs is imperative (McLean & Camp, 2000). Specifically, “teacher preparation programs in agriculture [should] provide authentic, relevant instruction to preservice teachers on developing, implementing, maintaining, sustaining, evaluating, and supervising an SAE program” (Rubenstein et al., 2014, p. 72). For SAEs to be relevant, viable, and impactful for secondary students, teachers must be well equipped, as they play an integral role in the development and delivery of student SAEs (Rubenstein & Thoron, 2015). Given the importance that motivation plays in shaping quality SAEs (Bird et al., 2013), a need existed to understand how pre-service teachers experienced motivation as they engaged in experiences designed to enhance their instructional knowledge and skills to facilitate SAEs.

Theoretical Framework

Through our analytic procedures, we decided Maehr’s and Zuscho’s (2009) achievement goal theory (AGT) served as the most appropriate theoretical lens to describe how pre-service agricultural education students experienced motivation during a six-week SAE project focused on raising broilers. Although scholars have theorized the link between motivation and learning from multiple perspectives (Schunk, 2016), AGT emphasizes the importance that motivational processes play in students’ learning experiences. Motivational processes affect the way students acquire, transfer, and use new knowledge and skills (Dweck, 1986). Further, AGT scholars (Senko et al., 2013; Senko & Hulleman, 2013) conceptualize motivational processes as the goal-directed behaviors students’ exhibit over time. Goal-directed behaviors involve social cognitive processes such as motives, strivings, achievements, concerns, and action. As a consequence, Maehr and Zuscho (2009) argued that motivation should be examined in terms of students’ shifting
perspectives, beliefs, and behaviors throughout the life of learning activities.

Therefore, we discerned motivation through students’ self-reported beliefs and perspectives regarding their goal-directed behaviors. For example, we analyzed how participants articulated their choice to engage in particular activities, quality of engagement, performance, and resolve. In other words, we used this *a posteriori* theoretical lens to make sense of the motivational shifts participants experienced during their six-week broiler project. However, AGT also positioned us to consider the role that cultural and individual factors might have played in shaping the motivational processes of participants. For example, through the lens of AGT, we analyzed the influence that factors such as the culture of learning activities, individual tasks, and as well as the laboratory environment might have played in affecting students’ motivation. Therefore, AGT served as underlying theoretical scaffolding to which the study’s findings are anchored.

**Theoretical Perspective, Purpose, and Rationale**

From this study’s early conception, we nested our decisions in Koro-Ljungberg’s, Yendol-Hoppy’s, Smith’s, and Hayes’ (2009) position that qualitative researchers’ philosophical perspective and methodological choices should be aligned. Therefore, we grounded this study in the worldview of constructionism (Crotty, 1998). Constructionists consider knowledge to be “... contingent upon human practices, being constructed in and out of interaction between human beings and the world, and developed and transmitted within an essentially social context” (p. 42). Grounded in this perspective, we developed the purpose of this study, which was to describe how pre-service agricultural education teachers experienced motivation during a project-based learning assignment that used broilers as a context for teaching data management (i.e., record keeping) and SAE concepts. Consequently, we also were positioned to address Priority 4 of the National Research Agenda, which calls for “meaningful, engaged learning in all environments” (Roberts, Harder, & Brashears, 2016, p. 37). Next, we will outline the background of the study.

**Background of the Study**

*Planning the Community Program in Agricultural Education* is the third in a sequence of courses taken by agricultural education students at Oklahoma University. Per the 2016-2017 [University] Course Catalog, the *Planning the Community Program in Agricultural Education* course exists to increase students’ human capital regarding “FFA chapter advisement, planning and managing the instructional program, and identification and completion of records and reports required to be a teacher of agricultural education in Oklahoma” (p. 199). The course is designed to assist and equip students with the tools needed to conduct quality SAE programs at the secondary level (Robinson, 2016). The aim of this course is to allow students to gain a theoretical and practical understanding of the FFA and SAE components of agricultural education’s integrated three-circle model. In Spring 2016, the course’s lead instructor introduced record keeping and SAE concepts through a project-based learning approach. Through this project, 34 pre-service teachers partnered to care for approximately 200 one-day-old broilers over a six-week period. As an additional requirement for the course, students designed broiler experiments, tested interventions, collected and maintained accurate records, and rotated between student and advisory roles to gain insight into facilitating such experiences. Specifically, each student was provided “five (5) broilers to raise and collect data for the last six weeks of the semester” (Robinson, 2016, p. 5). Students were paired with a partner, so as to have 10 birds between them, to design an experiment and role-play the teacher and student during the project’s duration.

To assist pre-service teachers with making learning connections, they were required to submit weekly reflections, photos, and data collection records. Further, the pre-service teachers
were required to create and deliver a final presentation of their experience to their peers. In the
design of this project, our personal beliefs about teaching and learning influenced its
conceptualization. Therefore, to be transparent about our influences, the reflexivity section details
our position in the design, collection, and analysis of data associated with this study.

Reflexivity

It is crucial for qualitative researchers to reveal the biases and perspectives influencing
their decision-making (Patton, 2002). As a consequence, we constructed the following reflexivity
statement as a way to promote honesty and sincerity before offering an interpretation of the study’s
findings (Lincoln & Guba, 1985).

Both researchers were involved directly with the course under investigation. For example,
at the time of data collection, the lead researcher was a doctoral student in agricultural education at OSU and served as a teaching assistant for the course. The second author was a Professor at OSU and served as the course’s lead instructor. It also is important to note that both researchers are former school-based, agricultural education (SBAE) instructors in Oklahoma. Because we consider Oklahoma traditional in regard to agricultural production, we also held biases concerning the importance of using animals as a context for teaching and learning. This bias influenced our decision to use poultry (i.e., broilers) to facilitate the teaching of record keeping and SAEs for this project-based learning assignment.

Given these experiences and perspectives, we recognize our influences on the study. However, we attempted to mitigate our biases whenever possible. Consequently, the following section outlines our methodological decisions, analytic moves, and discoveries as we sought to understand this phenomenon.

Methodology

We chose to ground this study, methodologically, in Stake’s (1995) instrumental case study
approach. Due to its roots in the interpretivist paradigm (Stake, 1995), this choice allowed us to
bring our theoretical and methodological decisions into philosophical alignment (Koro-Ljungberg
et al., 2009). For example, instrumental case studies can offer rich understandings into bounded
systems (Stake, 1995). However, this qualitative approach’s strength lies in the context-rich
description of specific issues that may have transferability to similar circumstances (Creswell,
2013; Stake, 1995).

In this study, time and the unit of analysis bounded the case. For example, we limited the
project-based learning assignment to a six-week period and analyzed data for only one particular
laboratory section of the course. Our reason for bounding this case during this time period is
because the broilers are typically harvested at Oklahoma State University after 42 days (Name,
personal communication, January 17, 2016). We offer a deeper insight into participant
characteristics and selection criteria next.

Participants

Each participant (n = 14) was enrolled in Laboratory Section 001 of the Planning the
Community Program in Agricultural Education course at Oklahoma State University in Spring
2016. Our decision to mobilize data from this particular unit of analysis was threefold: (a) it was
the largest laboratory section, (b) it reflected student demographics best, and (c) the lead researcher was immersed in all of the section’s major activities throughout the duration of the project. As a consequence, we purposefully selected (Patton, 2002) seven female and seven male pre-service agricultural education teachers from this bounded system.

Data Sources and Analysis

We collected multiple sources of data to triangulate findings. For example, written reflections, student photographs, record keeping submissions, field observations, summative presentation materials, and video of participants’ final presentations all furnished sources of data. Analysis was an ongoing process as we began to engage data sources (Saldaña, 2015). To make sense of our analytic work, we used memoing techniques to mobilize findings, empirical assertions, and analytic shortcomings. Because data become fragmented in qualitative analysis, we followed Saldaña’s (2015) recommendations to continually return to the data corpus to minimize misrepresentations, thus improving the transferability of the findings.

Data were analyzed using the constant comparative method (Corbin & Strauss, 2015). Both hand coding and NVivo® qualitative analysis software were used to explore and manage the data. To initiate analysis through the constant comparative method, we used Saldaña’s (2012) coding suggestions consisting of the following techniques: (a) open, (b) axial, and (c) selective. Through two distinct rounds of open coding and multiple coders, we identified initial codes (Saldaña, 2012). Then, we scrutinized the relationships of the open codes in the axial coding phase. When analyzing these relationships, we considered the study’s context and the consequences of reducing data units into particular categories through a negotiation phase (Patton, 2002). Ultimately, the resulting product was used to develop evidentiary warrants (Corbin & Strauss, 2015). To mobilize the evidentiary warrants, we reengaged the data through selective coding (Saldaña, 2012). The use of selective coding allowed us to develop an analytic storyline that we chose to narrate through the three themes (Saldaña, 2015).

Rigor and Trustworthiness

Before offering our interpretation of the findings, it is important to discuss our strategies for building rigor and trustworthiness into this investigation. From this study’s inception, we allowed Lincoln’s and Guba’s (1985) four standards of qualitative quality – credibility, transferability, dependability, and confirmability – to drive our ethical decision-making. Strategies for upholding each standard are outlined below.

Credibility refers to the production of trustworthy findings (Lincoln & Guba, 1985). We addressed credibility through three major strategies: (a) persistent observations, (b) triangulation of data sources, and (c) peer debriefing sessions. We also stressed the importance of the study’s findings in providing meaning to other contexts, or transferability. To accomplish this, we provided a rich description of the setting and participants while also being frank about the limitations of the study. The third standard, dependability, represents the stability of the investigation. We emphasized dependability in three major ways: (a) only collecting data that connected to the study’s purpose, (b) describing clearly each researchers’ role in the study, and (c) outlining the philosophical paradigms influencing this investigation’s design. Finally, the extent to which the study’s findings could be linked to data, or confirmability, was addressed through using direct quotes from participants and comparing claims regularly against relevant data sources. Through our efforts to uphold standards for rigor and trustworthiness, we gained confidence in our interpretations of this investigation’s findings.
Findings

Through our analysis of the data, three processes emerged that describe how participants experienced motivation in the project-based learning assignment under investigation. Using Maehr’s and Zuscho’s (2009) AGT as theoretical lens, we narrated the processes through three themes: (a) initial self-ambition, (b) achievement stagnation, and (c) stabilized self-concept. The processes provide new insights into the role that motivational shifts can play in shaping learning outcomes for pre-service agricultural education teachers. Using relevant examples from the data, each theme seeks to distinguish how participants experienced these motivational processes throughout the six-week broiler project, which provided a context for teaching record keeping and SAE concepts.

Initial Self-Ambition

Through the lens of AGT, individual goals and ambitions could serve as powerful motivators (Maehr & Zuscho, 2009). In accordance, participants in the study articulated the ambitions they held regarding the broiler project were connected largely to building their professional capacity. Typically, participants expressed these sentiments in the early stages of the project. For example, Participant 11 revealed his ambition was to gain a deeper understanding of teaching the scientific method in the context of agriculture. In his first journal entry, he wrote:

I feel like there are a lot of valuable things that can be learned and taught by doing this assignment. For example, you can learn to teach the scientific method and the importance of being consistent and responsible. The scientific method is crucial in the agriculture industry.

Meanwhile, Participant 13’s early goal was to hone her pedagogical skills to keep students engaged in laboratory settings. She explained, “This type of project is one that most students will be excited and motivated to complete.” On the other hand, Participant 7 saw value in the project due to its focus on animals. He explained, “The livestock side of teaching Ag is something I’m excited for, yet nervous for at the same time.” Consequently, his ambition was to gain more knowledge about facilitating such experiences for his future students.

In the project’s introduction, participants also were optimistic about learning to facilitate record keeping for SAEs. In week one, various pre-service teachers expressed their ambitions to gain proficiency in this particular technical area through the project. For instance, Participant 4 found this element of the project “thrilling and exciting.” Several participants even submitted photos after week # 1 that depicted elements of the record keeping process (see Figure 1).
Achievement Stagnation

After several weeks of caring for the broilers, participants appeared to lose sight of their initial ambitions. Further, their motivation for the project seemed to become disconnected, narrow, and stagnant. AGT scholars (Huang, 2011; Linnenbrink-Garcia, 2012; Putwain, Larkin, & Sander, 2013) argued that stagnation occurs as individual challenges and concerns begin to overpower learners’ goals and expectations. For instance, Participant 2 did not perceive growth in her abilities; consequently, she struggled to make sense of how to engage her future students in similar projects. She explained:

I feel that I am satisfactory. I myself am a little tuned out from this project. This project to me is the same routine. I feel I can’t engage students if I myself am not engaged. This particular project isn’t something I have found passion in and until I find that spark I don’t really know how excited I will really be. I feel maybe it will be more interesting as the project goes on but right now I have no clue how to engage my students.

Other participants articulated their struggles with staying motivated were due to the demanding and monotonous tasks associated with the project. For example, Participant 10 explained, “keeping motivated can be a hard task.” Similarly, Participant 9 voiced that he experienced “little growth” during this phase of the project. Interestingly, participants’ photo submissions also appeared to lack a sense of motivational and skill development. For example, in photo submissions for week # 3 several participants submitted photos illustrating their
unwillingness to test new boundaries and work toward achieving their initial goals for the project. Instead, their submissions depicted rudimentary skills, such as weighing broilers (see Figure 2).

The second theme, *achievement stagnation*, demonstrated a substantial shift in participants’ motivational schemes. For instance, they seemed to lose sight of the importance of their early ambitions as they engaged in monotonous and tedious activities associated with the broiler project. This motivational disengagement also appeared to influence their learning outcomes, as numerous participants refrained from making important pedagogical and content knowledge connections.

**Stabilized Self-Concept**

Over the final weeks of the project, students began to encounter more complex problems. For example, in the project, many of the participants faced issues such as “sickness” (Participant 12), “disease” (Participant 6), “irregular growth patterns” (Participant 8), and the “death” of one or more of their broilers (Participant’s 7, 10, and 14). Interestingly, after confronting these difficulties, participants began to articulate more complex, integrated, and stable perspectives. In this regard, AGT conjectures that as learners persist through the trials of learning activities, their motivation often stabilizes as they begin to make meaning of how these difficulties helped them to grow and mature (Maehr & Zuscho, 2009). The maturation of one’s self-perspective, therefore, holds substantial implications for the study of motivation.

In the literature, Schunk (2016) defined *self-concept* as the self-perspectives individuals hold of themselves. As a consequence, one’s self-concept is formed by the confidence a person maintains as a result of his or her experiences (Shunk, 2016). In this study, participants’ self-concept appeared to stabilize in the later stages of the broiler project. This factor also appeared to positively influence the pre-service teachers’ motivation to gain quality professional benefits from the assignment.

For example, as the broiler project came to a conclusion, we asked the pre-service teachers to reflect deeply on their professional growth and development. To facilitate this process, we required each student to develop and deliver a final presentation (Robinson, 2016). Through this
process, participants seemed to make sense of their experience, which also appeared to help them crystallize their beliefs about the role the project had in shaping their pedagogical and technical development. We captured the final presentations and resulting discussions on video; therefore, we were able to use these moments of explanation, clarification, and co-construction of knowledge as important data points in this study.

In students’ final evaluation of their learning, they seemed to make important connections in regard to the value the broiler experience might provide as they transitioned into teaching in a real-world laboratory setting. Participant 3 explained,

Towards the end we became more comfortable with the project and began to learn what needed to be done to help out the animals and make their life easier day-by-day. For example, we had to move the feeders up and down. This is part of the learning process and will help us solve problems when we are in the real world as ag teachers.

Other participants perceived they had matured professionally through the project as well. For example, they espoused they could “provide recommendations” to future students (Participant’s 10 and 14), “plan successful laboratory experiences” (Participant’s 8 and 9), overcome “unexpected challenges” (Participant’s 2 and 5), and “manage students” in a laboratory setting (Participant’s 4 and 6) better than they could before engaging in the experience. Thus, the final theme detailed how these pre-service teachers began to move beyond the motivational stagnation experienced in the mid-stages of the broiler project. By confronting complex issues and reflecting deeply on their experiences, numerous participants’ self-concept seemed to stabilize in the project’s final stages, which encouraged positive professional growth.

Conclusions

In this study, we sought to describe how pre-service teachers in agricultural education at Oklahoma State University experienced motivation during a project-based learning assignment that used broilers as a context for teaching concepts related to data management and SAEs. Interpreting the findings through the theoretical lens of Maehr’s and Zuscho’s (2009) AGT revealed three themes: (a) initial self-ambition, (b) achievement stagnation, and (c) stabilized self-concept.

The first theme, initial self-ambition, illuminated the importance of participants’ early goals and expectations regarding the broiler assignment, which mainly seemed to reflect their desire for professional growth and development. For example, participants articulated enthusiasm to enhance their knowledge and skills about facilitating the scientific method, livestock projects, as well as record keeping for SAEs. These early ambitions appeared to drive the motivational processes experienced by participants. As a consequence, we conclude that identifying participants’ individual self-ambitions is central to understanding how motivational shifts might occur at the individual level during project-based learning assignments. Although this literature on motivation and learning supports this finding (Dweck, 1986; Maehr & Zuscho, 2009), scant evidence exists in the context of agricultural education.

In the mid-stages of the broiler project, pre-service teachers seemed to experience achievement stagnation. For instance, participants reported the challenges, demands, and monotony of certain tasks associated with the assignment caused them to lose sight of its intents and purposes. As a result, participants’ course submissions also appeared to lack a sense of pedagogical and content-specific growth. Existing evidence across disciplines suggests that challenges in learning endeavors may result in students lacking the motivation needed to attain their
educational and professional goals (Huang, 2011; Senko et al., 2013). However, findings from this investigation hold new insights for the motivation literature by providing a basis for how contextual, emotive, and visceral dimensions of learning might affect students’ motivation.

The final theme demonstrated how participants’ motivation appeared to stabilize in the latter phases of the assignment. This stabilization seemed to occur through the maturation of participants’ self-concept through reflective strategies that required participants to consider how they grew professionally during the project. The view that reflection serves as a crucial element of learning process is situated firmly in the agricultural education literature (Baker, Brown, Blackburn, & Robinson, 2014; Epler, Drape, Broyles, & Rudd, 2013; Lambert, Sorenson, & Elliot, 2014). However, the notion that reflection may be used as a technique to stabilize the self-concept of pre-service teachers has not been addressed explicitly.

Discussion, Implications, and Recommendations

Recently, the construct of motivation appears to have been operationalized as a quantitative variable in the agricultural education literature (Baker et al., 2015; Chumbley, Haynes, & Stofer, 2015; Roberts, Terry, Brown, & Ramsey, 2016). However, by approaching this study from the qualitative paradigm, this study’s findings hold important implications for agricultural education in regard to future research, theory, and practice.

First, existing research in agricultural education largely attempts to measure students’ changes in motivation using pre-determined outcomes through treatments that are both short-term and novel in design (Baker et al., 2015; Chumbley et al., 2015; Roberts et al., 2016). However, by using an emergent design that was more longitudinal in nature, this study’s findings illuminated three existing motivational processes while also providing empirical evidence of a theorized, sequential relationship among them. Additional research is needed to explore the parameters of this relationship and whether more nuanced motivational processes need to be discovered and more evocatively defined. Researchers exploring the motivation of pre-service teachers also should consider the findings to examine whether the motivational process identified might influence the design, collection of data, and resulting outcomes of their studies.

The three motivational processes also warrant future research. For example, initial self-ambitions appeared to influence the major motivational shifts experienced by participants. Consequently, future work should attempt to identify pre-service teachers’ goals and expectations more extensively as they engage in project-based learning throughout teacher preparation training. Additional research is needed to explore the stagnation participants experienced in regard to achievement. In this case, monotony and the demands associated with the project seemed to have influenced participants’ motivation negatively. To this point, we recommend that future investigations test various interventions throughout project-based learning assignments to determine whether learners’ motivation could be maintained at a more consistent level. Finally, although the agricultural education literature is rife with evidence concerning the importance of reflection (Baker et al., 2014; Epler et al., 2013; Lambert et al., 2014), more research is needed to identify the types of reflective strategies that might be most useful in assisting pre-service teachers’ self-concept to stabilize.

In this investigation, we used Maehr’s and Zuscho’s (2009) AGT as an a posteriori lens to make meaning of the study’s emergent findings. Therefore, we allowed AGT to assist in organizing our understanding of how participants experienced motivation during the broiler project. As a result, we were able to grasp and explain each motivational process more intimately. Nevertheless, we believe the study’s findings could offer a crucial expansion to AGT. For example, participants
in this study appeared to experience the motivational processes in a successive manner. Consequently, more theory-building efforts should be undertaken to generate a clearer conceptual explanation for how AGT might unfold in praxis.

In an era where less people are exposed to agriculture (Environmental Protection Agency, 2012; Dale et al., 2017; Sayers, 2011; Wingenbach et al., 2007), this course was focused on providing concrete experiences in which students could participate and reflect over time (Kolb, 1984). However, providing such experiences came with a cost. The broiler project under investigation required time, money, and human capital to be successful. In practice, therefore, university officials should deeply consider whether they are willing to dedicate the time and resources necessary to ensure that students gain a quality learning experience. We also recommend that practitioners consider whether broilers might be the most appropriate context to facilitate learning the principles of data management (i.e., record keeping) and SAEs. For example, perhaps a horticulture project could be a more cost-effective and less controversial alternative given the rise of animal advocacy legislation in recent years. Moving forward, we recommend that university officials consider the motivational processes identified in this study in the design and delivery of project-based learning assignments for pre-service teachers in agricultural education. By integrating strategies to promote consistent motivational behaviors purposefully, perhaps greater learning outcomes can be achieved.

Finally, although motivation for participating in the six-week project fluctuated over time for these pre-service teachers, it served as a valuable teaching opportunity regarding their prospective students’ SAE projects. Undoubtedly, their future secondary students will become demotivated and disenfranchised with their own SAEs at some point throughout the process. Having experienced and rebounded from their own lack of motivation might help these pre-service teachers relate better to the potential struggles of their future students when and as they occur.

References


Robinson, J. S. (2016). Planning the community program in agricultural education (AGED 3203, course syllabus). Department of Agricultural Education, Communications and Leadership, Oklahoma State University, Stillwater, OK.


Reflective Journeys of Five Women Agriculturists in Australia: A Qualitative Study

Carrie A. Stephens¹, Shelby Brawner², Amanda Dean³, Christopher T. Stripling⁴, & Danielle Sanok⁵

Abstract

Women comprise the minority in production agriculture leadership, and their leadership roles in agricultural industries are rarely explored. The purpose of this study was to explore the reflective journeys of five Australian women in production agriculture. The central research questions asked were “What lived experiences helped you obtain your leadership position and what leadership characteristics do you identify as essential in your success?” This study used a phenomenological approach, as reflecting upon the subjects’ past cultural experiences was crucial in understanding their current positions in life and leadership. Five women in agriculture from Australia served as the participants for this study, and they were selected based upon their leadership presence in Australia. Specific themes were generated which included (a) childhood experiences, (b) current family dynamics, (c) hardship, and (d) perception of leadership style. The perception of leadership style is further divided into three sub-themes: (a) self-perception of leadership, (b) leading by example, and (c) outreach efforts for women in the industry. The five women whose personal journeys were explored are primarily concerned with improving the knowledge given to them and presenting new opportunities to other women when they can. Some recommendations for future research are “What are the reflective journey stories of women agriculturists in the United States?”, “What are reflective journey stories of men engaged in agriculture industries?” and “What mentoring strategies are being utilized to recruit and retain women in agriculture industry fields?”

Keywords: women; Australia; agriculture; social learning theory; leadership

Introduction

During the past 70 years, women have become more involved in obtaining employment (U.S. Bureau of Labor Statistics, 2015b). After World War II, less than one-third of women held jobs until they quickly filled positions from the 1960s to the 1980s before it decelerated in the 1990s (U.S. Bureau of Labor Statistics, 2015b, p. 1). In 1999, women represented 60% of the labor force, which has been their highest involvement (U.S. Bureau of Labor Statistics, 2015b). According to

¹ Carrie Ann Stephens is a Professor of Agricultural Leadership in the Department of 4-H Youth Development and Agricultural Leadership, Education and Communications at The University of Tennessee, 2640 Morgan Circle, 114 McCord Hall, Knoxville, TN 37996, cfritz@utk.edu
² Shelby Brawner is a Grant Coordinator in the Department of 4-H Youth Development and Agricultural Leadership, Education and Communications at The University of Tennessee, 2621 Morgan Circle, 202 Morgan Hall, Knoxville, TN 37996, ssummare@vols.utk.edu
³ Amanda Dean is a Digital Communications Associate for the American Institutes for Research, 1000 Thomas Jefferson Street, NW, Washington, D. C., 20007, adean9@vols.utk.edu
⁴ Christopher T. Stripling is an Associate Professor of Agricultural Education in the Department of 4-H Youth Development and Agricultural Leadership, Education and Communications at The University of Tennessee, 2621 Morgan Circle, 320 Morgan Hall, Knoxville, TN 37996, cstripling@utk.edu
⁵ Danielle Sanok is an English Educator at Knoxville Catholic High School, 9245 Fox Lonas Rd NW, Knoxville, TN 37923, dsanok@vols.utk.edu

In 1962, 54.4% of mothers worked whereas in 2014, the number of working women who were married with children included 61.8% with children under three, 64.3% with children under six, 75.8% with children aged six to 17, and 70.1% with children 18 years of age (U.S. Bureau of Labor Statistics, 2015b). Women were most employed in 2014 in “financial activities (53% female), education and health services (75% female), leisure and hospitality (51% female), and other services (53% female)” (U.S. Bureau of Labor Statistics, 2015b, p. 2). Conversely, women were significantly “underrepresented in agriculture (25%), mining (13%), construction (9%), manufacturing (29%), and transportation and utilities (23%)” (U.S. Bureau of Labor Statistics, 2015b, p. 2). Although women have made great strides in the labor force, they are still absent from top leadership roles, especially those in agriculture (Kark & Eagly, 2010).

The statistics mentioned above reflect the women in the United States but there is also the same gap of women leaders in Australia. Women comprise 46.2% of the workforce in Australia but get paid 16.2% less than men (Australian Government, 2016). Ninety percent of women ages 20-24 have graduated from high school, 39.6% of women ages 25-29 have received a bachelor degree, and only 5.7% of women ages 15-74 have obtained a postgraduate degree. However, women in leadership positions in Australia, compared to men, are drastically lower. Women account for 14.2% of chair positions, 23.6% of directorships, 15.4% of CEOs, and 27.4% of key management positions (Australian Government, 2016). However, there are 25.1% of reporting agencies who have no women in leadership positions. Overall, women are underrepresented in Australia, especially in male-dominated professions.

Women who enter male-dominated professions, such as agriculture, may be perceived as inherently unsuited for such work (Akeredolu, 2009; Eagly & Carli, 2007; Doss et al., 2011). This misconception results from complex gender dynamics and established expectations within industries, such as agriculture, traditionally led by men (Akeredolu, 2009). This lack of acknowledgment may lead women to collectively withdraw from engaging with their industries and fail to seek out leadership roles. However, women are being encouraged to view leadership as the opportunity to influence others and create positive change (Longman & Madsen, 2014).

Women have a remarkable capacity to learn from relationships and connections with others (Kante & Blackwell, 2009; Wells, 1998). Often, due to lack of “education, self-confidence, or an appropriate place in society to offer their leadership capacity” (Kante & Blackwell, 2009, p. 515), women cannot offer their attributes in the workplace. Therefore, female leaders are likely to endorse the contributions of others as significant when reflecting upon their journeys into leadership. This emphasis on association with colleagues and mentors is important in realizing leadership opportunities for women often stem from human connection and relationship building (Longman & Madsen, 2014). Furthermore, mentorship can be critical for the future success of women in leadership fields (Longman & Madsen, 2014) and provide more opportunities for authentic leadership to occur.

Women’s typical leadership style may be considered more authentic than men (Eagly, Johannesen-Schmidt, & van Engen, 2003). Authentic leaders display genuine self-awareness, internalized moral perspective, balanced processing, and relational transparency (Avolio,
Walumbwa, & Weber, 2009). As women leaders seek to promote opportunity and outreach to other women, one should understand how these leaders first became inspired and how they were encouraged to seek out advancement in their chosen career path. This process requires one to reflect on one’s own journey on how the position was obtained (Kolb, 2015).

Understanding one’s own journey provides the opportunity for reflection and recognition of self-value (Bennis, 1989). This understanding of past experiences could be used to promote further potential leadership capacities of other women. However, there is limited research that is focused on women’s journeys in agriculture to help inform others of this effort. Previous literature related to women in agriculture in the Journal of Agricultural Education has been focused on university deans (Kleihauer, Stephens, Stripling, & Hart, 2013) and women in both secondary and post-secondary agricultural education (Baxter, Stephens, & Thayor-Bacon, 2011; Enns & Martin, 2015; Kelsey, 2007; Kelsey, 2006; Murphrey, Odom, McKee, & Christiansen Wilkens, 2016). Also, the American Association for Agricultural Education’s National Research Agenda Research Priority Area 3: Sufficient Scientific and Professional Workforce That Addresses the Challenges of the 21st Century poses the research question, “What strategies are effective in recruiting diverse populations into agriculture and natural resource careers?” (Roberts, Harder, & Brashears, 2016). Therefore, this article will help inform the reader about creating a diverse workforce by describing woman’s lived experiences on their journeys to reach a leadership position within her selected agriculture field.

Theoretical Framework

Krumboltz’s (1976) social learning theory of career selection served as the theoretical framework for this study. Social learning theory of career selection seeks to explain the factors influencing career decision making (Krumboltz, 1976). The social learning theory is divided into four categories: (a) genetic endowment and special abilities, (b) environmental conditions and events, (c) learning experiences, and (d) task approach skills (Krumboltz, 1976). Genetic endowment and special abilities refers to characteristics such as race, sex, physical appearance and characteristics, and abilities (Krumboltz, 1976). Environmental conditions and events refer to events or actions that are out of a person’s control, such as the number of job opportunities, natural disasters, educational system, family training and experiences, and community influences (Krumboltz, 1976). Learning experiences refer to an individual’s current behaviors which are a direct reflection of their past experiences, the consequences developed from those experiences, and observational learning (Krumboltz, 1976). Task approach skills refers to the work ethic, skill set, and values a person has developed from prior experiences (Krumboltz, 1976).

The social learning theory also asserts how “internal (personal) and external (environmental) influencers (constraints or facilitators) shape the nature and number of those options and the way in which individuals respond to them” (Krumboltz, 1976, p. 71). Additionally, the theory discusses generalizations made about the self (Krumboltz, 1976). Individuals create observations of themselves in comparison to those around them (Krumboltz, 1976) and develop “self-observation generalizations” by comparing their own performance to past performances and with others resulting in the creation of generalizations (Krumboltz, 1976, p. 74). Additionally, self-observations include the individual’s preferences of how they complete tasks or handle situations (Krumboltz, 1976).

Purpose and Central Research Questions

The purpose of this study was to explore the reflective journeys of five Australian women in production agriculture. The central research questions asked were “What lived experiences
helped you obtain your leadership position and what leadership characteristics do you identify as essential in your success?"

Methods and Procedures

In order to fully comprehend the experiences participants shared, the study was performed using the qualitative mode of inquiry (Creswell, 2013). This study sought to understand past experiences of women leaders in agriculture as well as their leadership style. The qualitative approach is justified in that it seeks to understand the phenomenon (Flick, 2014) of women’s experiences of their leadership journeys. A phenomenological approach was utilized to gain entry into the conceptual world of the women in order to understand how and what meaning they construct from their lived childhood experiences, adulthood personal and work experiences, and leadership experiences (Bogdan & Biklen, 2007). Gathering information from interviews, observations, documents, and pictures provided the researchers with a bank of data from which themes could be created, interpretations made, and a “rich, full picture of a research situation” painted (Wright, 2003, p. 8). Interviews were conducted with the participants; observations before, during, and after the interview sessions were conducted by three individuals involved with the research project and included taking detailed notes on body language, word descriptions and analysis, and behavior related to the interview and discussions opportunities (eating supper with participant, guided tours, etc.); documents (articles, accolades, etc.) related to each woman’s lived experiences were collected by the researchers; and pictures of the participants accomplishments, family photos, work experiences, and so forth. These materials were collected over a six-month period.

The sample for this study consisted of five women in agriculture from Australia. Women from Australia were selected from the Australian Women in Agriculture Organization, and the selection was based on the woman’s leadership presence in Australia. These women were considered leaders amongst their peers in their selected agriculture venue and had received recognition for their innovation in agriculture. In an effort to protect the identity of the women, there will be limited background information given about the participants and names were assigned to each participant based on the products in which they either produce or represent. The agricultural names selected were the winemaker, viticulturist, rose grower, citrus producer, and the pig farmer.

The methods employed to collect data in this study included three to four hour in-depth, audio-taped interviews, in which the primary researchers asked open-ended, non-leading questions (Creswell, 2013). The central research questions focused on having each woman explain her journey (past and present) to her current leadership role. The interviews focused on revealing the influences and experiences that helped to develop each woman into the leader she is today. This open-ended approach enabled the researchers to gain an understanding related to each woman’s unique lived experiences (Bogdan & Biklen, 2007). Additionally, the researchers were participant observers for one to five days in each woman’s environment. A participant observer interacts with the participants in the environment, so they can experience the environment like the participant (Lincoln & Guba, 1985).

The interview transcriptions were open-coded to discover the main concepts and categories (Hays & Singh, 2012). The researchers analyzed the in-depth interviews, along with the researchers’ field notes, which captured the thoughts related to the women agriculturists and their environment. These field notes were used in the data analysis to assist the researchers in recalling what had occurred during the field experience. Furthermore, data were examined using several methods, which included identifying significant statements and elements of meaning; creating
Data were analyzed and coded by two researchers independently. The researchers then discussed each individual’s coding schematic and agreed upon four themes. Those four themes are hardship, childhood experiences, current family dynamics, and perception of leadership style. After the themes were developed, three sub-themes emerged related to the perception of leadership style. Those sub-themes are self-perception of leadership, leading by example, and outreach efforts for women in the industry. After the themes and sub-themes were identified, a male, secondary researcher confirmed the emerging themes and subthemes sorted into the aforementioned categories were representative of the data.

In an effort to reduce the impact of bias on the data collected, several validation strategies were employed to document the accuracy of this phenomenological research study. Prolonged engagement in the field and the triangulation of data sources, methods, and investigators were techniques used to establish credibility (Creswell, 2013). From the researchers’ observations, a thick description of the women’s life experiences and their environment was constructed to help readers determine the transferability of the research. Dependability of the study was established through peer review by another researcher trained in qualitative analysis throughout the research process and who had not conducted the interviews. Additionally, member checks from participants related to data, analyses, interpretations, and conclusions were conducted to confirm credibility of the study.

**Subjectivity Statement**

Prior to launching the study, the researchers reflected on qualities possessed which may have impacted the relationship with women in the study. The researchers hold a strong passion for agriculture and women in the agricultural field, which may result in a more focused analysis on each woman’s journey to their current leadership position. The researchers who conducted and analyzed the data were female and possess moderate feminist beliefs. This may have influenced the interview questions asked of participants pertaining to leadership positions in agriculture, a predominantly male field. In an effort to keep a neutral viewpoint, the researchers reflected on their biases of the research topic, assumptions of the outcomes of the study, and each occasion of contact with the women agriculturists to maintain as impartial of a position as possible. In addition, the researchers also structured the research question and probing questions in such a way that did not lead or guide the women in their responses.

**Findings**

The following results are divided into four sections: (a) childhood experiences, (b) current family dynamics, (c) hardship, and (d) perception of leadership style. The perception of leadership style is further divided into three sub-themes: (a) self-perception of leadership, (b) leading by example, and (c) outreach efforts for women in the industry.

**Childhood Experiences**

The childhood experiences for these five women included their agriculture exposure, familial upbringing, and sacrifices they made for their family. While it is usual for those involved in agriculture to have been raised in farm settings, three of the five women interviewed had limited exposure of the industries they would later lead. The winemaker revealed:
I was interested in wine at quite an early age . . . But I did not grow up in a wine region, so growing up, it was not considered a normal career. It was an opportunity to do something a little bit creative and scientific and live in the country. And it is still an industry that has a positive vibe to it, I think . . . you are making something that is not too serious.

The rose grower expressed that rose growing was not her background but her dad’s exhaustive efforts to better his children’s lives with agriculture was important.

My dad was adamant to put all the kids through private schools… and to have everything that rich people have, that’s why we ended up being big into horses because that’s what rich people do . . . and but by the time I was born my mum and dad had moved up into the Eastern Hinds and bought a coffee farm and ended up buying out all the neighbors and he had a plane that used to go back to manage other farms, so I was born on a very big, extensive coffee farm . . . I went to boarding school and . . . when I came home from the holiday, they were very focused on the business and making sure it ran . . . my dad was very . . . conscious about money and making money.

The citrus producer and viticulturist both identified their upbringing as being from small towns. The citrus producer’s father worked as an agronomist in the wheat industry and she did not become exposed to the citrus industry until she began working in the citrus pack house at a young age. The viticulturist explained she was a 3rd generation viticulturist and described her family farm as a fruit block.

My family had a property for about 50 years and it was called a fruit block so it is a cockle term for a little bit of everything. I loved growing up on a fruit block and I got to drive tractors when I was 8 years old. When I was in year 9, I was talking to the school teacher and I had been plowing out in the vineyard and I would have literally been 12 or 13, so a tremendous amount of responsibility at a young age. I loved the responsibility and I loved growing things and I loved the practical hands on experience.

In contrast, the pig farmer, though raised on a sprawling farming operation, found her enthusiasm for agriculture later in life.

It was only when I was about 25 that I took any proper interest in the farm, but I had a lot of farming experience . . . I studied a non-agriculture career, but it has been great to have [agriculture experience growing up] because it makes that side of things here very easy for me.

In addition to each woman’s agriculture exposure, character traits from family members shaped their views and perceptions of the world in which they live. When analyzed, origins of the women’s behaviors became clearer. For example, the citrus producer discussed the restrictive nature of her familial raising, and she suggested her parents’ decisions still heavily influence her choices today as a working mother.

I did not have any support from my parents . . . I had actually applied to join the Navy as a physical instructor and got accepted, but I was not allowed to go. So you know, I would never do that to my child . . . having parents who restricted you [as a child] makes you a much better parent yourself.
Furthermore, the viticulturist described her upbringing as resilient and found a way to survive after losing her father.

My father died when I was very young, my mom was not able to provide the amount of support perhaps you may need at that age so I was pretty resilient, looking after myself and my brother from the age of 13. And you do not have much choice but to sink or swim. I always wanted to do my best and excel and I have just found ways that I can do that within my circumstances at the time.

**Current Family Dynamics**

Women in this study described their current family support system as crucial to their success in their current leadership positions, but each woman was actively involved in creating a career path for herself. While these women are successful in their positions of leadership, some argued many of their challenges may have been lessened if they were men in the industry. While most parents’ experience is gained from both work and their children, those whom were studied contended society and cultural beliefs charge women with responsibilities not always equally burdened by men. For example, bearing children requires time away from the office. Moreover, most women, should they choose to work after having children, are expected to maintain an equilibrium between career and motherhood to fulfill all responsibilities. In the experiences of the women interviewed, to falter in either is to be undeserving of both. In the view of the viticulturist, who was not married or had children but was involved with raising her niece stated, “It is about creating boundaries in your work and life balance so you can maintain a bit of personal time as well as wanting to change the world.” The rose grower (wife and mother of three children) detailed the startup of her rose-growing business and the difficulty she felt as a new mother in ensuring her dedication, both to career and childcare. The rose grower commented, “Between taking car seats out [to make room for roses to deliver] and putting car seats back in, we decided we needed to buy a van . . . but we had very little cash flow.” By contrast, the winemaker, who stepped into her leadership role while raising two young children and two stepchildren, fundamentally disagreed such a defined work-home balance was essential. The winemaker elaborated, “I work full-time, raise the children, and I am a wife. Each of these take time. I think the work-life balance is more like, ‘you make choices and decide you roll with the decisions that you make’ . . . work-life balance is probably just a myth.”

It was also evident with a few of the women that spousal involvement in agriculture in addition to communication with their partner was key to blending their professional and personal identities. Some of the women’s partners maintained the home-front in order for the women to be successful entrepreneurs. As the pig farmer revealed, “If you asked my husband about the farm, that is probably the hardest aspect of our marriage . . . we do not argue about personal life things; it is always something to do with work. Also, he is my support person at home while I am managing farm duties.” In addition, the rose grower discussed how her and her husband began marketing their roses as a team:

My husband…[joined] a rugby club and we signed our little boys up, we are a rugby family…that was our social life. So on the weekend we would go and watch rugby and we socialize with people that we did not know. And it was a comradery ship that was probably our godsend and it was really good for my mother and father in laws because they have a connection to a rugby club…and when we first got our roses we took our bucket of roses down to the rugby and we would sell our roses to the rugby players…it was our first little bit of marketing to our local community.
Hardship

Each woman studied discussed her personal struggles within the agricultural industry and those endured outside of it. When asked what hardships each endured some detailed turmoil within the industry related to gender stereotypes and others’ perceptions regarding their status as women in powerful positions. Each participant experienced hardship in her life, yet the rose grower’s situation was much more histrionic than the other four women. The rose grower, a political refugee to Australia and rose grower by trade, eventually was able to protect and provide for her family amid dire straits. Despite the turmoil in and around her life, she exhibited unfathomable capabilities in leadership and admirable determination to overcome her circumstances and thus created a better life for herself and for those who depended on her. To explain further, the rose grower was living in a Country that was extremely unsafe and unfortunately her and her family were given 45 days by the government to leave their farm or would risk being incarcerated. Also, people living around them who were farming were being murdered for their land. As the rose grower explained:

we depleted our fund and expanded our farming business in 1998, and then the murders started happening. The first major murder that made a big impact on our life involved four friends being abducted…my little girl was 3 days old…she was born on the 12th of April and the murders started happening on the 15th of April.”

The rose grower explained her family was trapped in their house one night before they could leave the Country and she reflected on that experience:

My little five-year old boy . . . said to me ‘mummy, are we going to die today?’ . . . we just went . . . there are people dying around us, we need to get on a plane and go . . . we cannot raise a family when you are going to lose your life just farming.

Although not as grave a situation as that of the rose grower who was forced to flee her homeland in search of safety and stability, the other subjects described struggles of their own. The citrus grower stated:

Out in the citrus industry, it is still a man’s world . . . some of your older people . . . will target us [females] because they think we are weak targets, but it is getting fewer and fewer because they know we are not weak targets because not only are we very passionate about our industry, but we also have the knowledge, and we have the skills to back it up . . . however, it is still not unusual for me to sit as the only female in a room of 200 men.

The winemaker assessed her own power play dynamics between men and women in the wine industry. She acknowledged the disparity but did not view it necessarily as a concern that required urgent oversight or rectification. The winemaker revealed:

I think most women in the wine industry are pretty comfortable being in a male dominated [field] . . . But one of the biggest hurdles for women in leadership is gaining the support of men and that women and men are equal so both can contribute to home and family life.

The viticulturist also lamented the lack of women in visible leadership roles is a hardship. She was simply unaware of how any woman could advance through an industry to which she wished to contribute. The viticulturist emphasized how few channels exist for women to promote themselves or further progress in their own industry. The viticulturist mentioned:
There have not been too many women who have been at my level as mentors for me to be able to look up to . . . You have to keep struggling to find those opportunities as a minority . . . I was looking for that next opportunity, and I really struggled to find it, and now in hindsight, I think I was probably treading water for three or four years.

Through perseverance and exhaustive outreach to discover opportunity, each woman overcame what hinders most others and became leaders in fields traditionally dominated by men. All five women achieved leadership positions within their respective industry, yet they remain the minority. As the viticulturist stated, “At the moment, we are top heavy with men. There is a thick layer of men . . . the challenge for us is to take the goodness of what we have learned but not to repeat the mistakes or any bad culture.” The viticulturist further stated her gender may have been a factor in her decision to conceal medical information when she was first getting footing in the industry. The viticulturist commented:

I nearly went blind when I was about 30. So I was juggling having medical appointments and trying to keep it quiet . . . if people think that maybe I could not physically do my job because I am a female anyway . . . it makes one feel vulnerable at times.

However, each woman stated her experience with hardship extended beyond office place sexism or professional discrimination and included disparity manifested in their personal lives. The citrus producer reflected upon an all-encompassing dark period in her life. The citrus producer revealed:

I found myself alone with three children . . . and maybe $27 in the bank. No house. No anything. Moved into a little unit, me and my children; and that is where I started my own business, when I started to drive myself forward . . . I had been down in the deep dark depths; I drug myself out. I proved to myself whatever I needed to do, I could do.

Perception of Leadership Style

When asked to describe their leadership styles, the women’s responses were diverse. Their answers, however, revealed substantively similar outlooks on leadership and the power their positions can yield in influencing other women to pursue similar work. The following results are divided into three sub-themes: (a) self-perception of leadership style, (b) leading by example, and (c) outreach to women in their industry.

**Self-perception of leadership.** When probed about their perceptions of how they lead others, the women delivered varied ideas about leadership roles and styles. However, all women agreed contributing to their own agriculture industry was the primary goal in seeking leadership roles. The winemaker stated:

I really like . . . making a positive contribution to the broader industry. Leadership is a lot about actually having the initiative to get outside and think hard about the industry, putting your hand up . . . look for inspiration . . . and it is amazing how it snowballs from there . . . I knew I was more driven by being inspired than being told . . . I really like to foster people’s own roles with clear objectives from my experience . . . and by approaching change by harnessing support from people.
The viticulturist spoke subjectively on the importance of investing in the industry she has helped build—an industry for which she passionately wishes to improve. The viticulturist mentioned:

I would like to think I give as much as I have the capacity to give. It is my industry so I have an invested interest in wanting to see it do well. I want to have a thriving industry that is sustainable and profitable and resilient going forward.

The citrus producer also believed the key to leading effectively lay in efforts put forth by true motivation and extending enlightened encouragement to others who will follow. The citrus producer stated:

My leadership is that, if you go out there and do it, you will actually . . . inspire people with your knowledge and your passion, and they will want to come along for the ride . . . You cannot drag them along; you have got to inspire them with that.

**Leading by example.** While acknowledging various other factors shaped their leadership style, all five women mentioned holding positions seldom held by other women through community leadership and the broader agricultural industry. This visibility, as expressed by the women, would provide other women a basic template to emulate and embellish for themselves; thus, the reason each woman was involved in community leadership. The viticulturist believed in leading by example, as a true leader inspires rather than instructs. The viticulturist commented:

[I encourage women in the agricultural industry] by being in the industry myself . . . just seeing someone you can relate to doing something is a great way of encouraging someone . . . I remember sitting there and going, ‘Wow, I did not know you could do all this.’ If you can, lead from behind rather than from in front [by] encouraging those around you . . . the opportunity for us to be the change we want people to see, to build a positive culture going forward and to make sure we are known for being generous, inclusive, and a conversational industry.

Similarly, the citrus producer implored women interested in non-traditional roles to make choices reflecting their strengths and to take action in these roles. The citrus producer stated, in place of the unproductivity commonly found with being a mere figurehead,

I have proved to them I do not just sit in a back room. I am actually out there . . . I have never just sat and said ‘This is what the industry needs to do.’ I have actually been out there doing it.

Echoing her sentiment of the significance of visibility and reinforcement within agricultural fields is the winemaker and her belief that:

Leadership in the industry has been about taking the challenge and being prepared to do a little bit more ... embrace other women when they are at the table and ... see them in the same positive light ... we encourage and embrace the idea of more women going into the industry, and [we offer any] support we can.

**Outreach efforts for women in the industry.** All five women interviewed championed the significance of extensive outreach efforts to other women within their respective industries. The
rose grower stated, “I am just really big on that—mentoring and helping other people. I have got to that sort of stage in my life where I want to help people.”

Underlining the importance of open and honest communication industry-wide, the citrus producer detailed how to engage with others about agriculture in general. She also advocated more leadership positions for women within the field. The citrus producer revealed:

[I promote] how to tell your story, how to have the right conversations at the right time … [that is] the only way we are going to get people to appreciate agriculture and realize that, pardon my [bad manners], it is not just shoveling [expletive].

The viticulturist viewed her outreach role to women within the industry to be straightforward. She mentioned simply providing resources and encouragement to other women will lead to increased involvement across a range of agricultural industries. The viticulturist mentioned:

What I am trying to do now in the industry is make sure that people have access to all the contacts and knowledge, so that they can contribute sooner, and they are being challenged in their roles…I am now thinking what can I do to support, especially other women who actually get their foot in the door and encourage them to put their hands up for opportunity…each time I seek out a new opportunity, it makes it easier for others to do the same, and that lifts the bar across the whole industry.

Conclusions

The participants represented a broad range of industries within Australian agriculture, and the findings from this study emphasize the women—including and especially that of their leadership development—ultimately are generated by lived experiences (Kante & Blackwell, 2009; Wells, 1998). In addition to their human experiences, one’s genetic endowment, environmental conditions and events, and learning experiences influence the nature of career decision making (Krumboltz, 1976). An individual’s parents’ values, hobbies, skills, careers, and wealth impact the individual’s life choices (Krumboltz, 1976). By examining women’s individual learning experiences and environmental conditions, the personal and professional environments each has constructed for herself then may be understood and valid conclusions may be drawn (Bennis, 1989; Krumboltz, 1976).

The citrus producer did not have the support she needed from her parents during her upbringing, so she chose to shape her career path differently. Moreover, the winemaker, citrus producer, and rose grower were not raised around their current employed agriculture industry. The pig farmer and viticulturist were raised around their agriculture industries, although the pig farmer did not take interest in her field until later in life. Therefore, the environment in which one is raised can influence and shape one’s career journey, and depending on the environment, the career can be rooted in a person’s upbringing or despite the person’s upbringing. Overall, one’s childhood dynamics appear to have shaped and guided their chosen career pathway.

In addition, current family dynamics play an essential role in an individual’s career and lifestyle choices (Krumboltz, 1976). Women face choices of not working or only accepting part-time employment because of her duties as a wife and mother (Krumboltz, 1976). However, having the responsibility of family and full-time employment can be challenging for women (Eagly & Carli, 2007). The rose grower faced challenges with her young children and maintaining her new rose business, but she prevailed through those trying times. Spousal relationships may alter the
traditional roles to help maintain the familial duties and career aspirations but the pig farmer’s husband provided her with the assistance she needed at home in order be a successful leader in her industry. Therefore, one can conclude that careers can impact how a family operates but those roles do not have to determine whether success is achieved.

This study found leadership was generally promoted as a trait to be carefully cultivated, but women leaders may meet additional resistance (Doss et al., 2011). As expressed by the viticulturist, “If you are a female in the industry, you may have to work twice as hard to be thought of as half as good.” The influence of others was also noted in this study. While the women reached a general consensus that their parents and upbringing contributed to their character-building during childhood and early development, they mostly agreed, as they matured, they turned more to their individual industry for inspiration and guidance. Female mentors in production agriculture remain a rarity, but that has provided motivation for each woman in this study to become an example for her daughters and other women who lack professional or personal inspiration (Longman & Madsen, 2014).

In relation to Krumboltz (1976) social learning theory category of environmental conditions and events, all five women of this study detailed stories of themselves in times of stress and hardship. The study also found the strain of such circumstances created a pressure each woman used as a learning experience to build herself up by driving herself forward (Krumboltz, 1976). In spite of the rose grower’s horrifying experiences, she preached, “You just keep going.” In addition, the five women who participated in this study believed mentoring was key to increasing and maintaining the number of women in agriculture. As stated by the viticulturist, “I am now thinking what I can do to support, especially other women who actually get their foot in the door and encourage them to put their hands up for opportunity.”

Each of these women recognized the importance of task approach skills such as self-development and the value of support from others necessary to achieve their leadership goals and contribute more to the organization in which they serve (Kark & Eagly, 2010; Krumboltz, 1976). Similar to Longman and Madsen (2014), the women were eager to share their knowledge and to present others with similar opportunities for success. Each emphasized that one cannot take people along but can only inspire and encourage. These five women also have faced personal struggles both within the industries they lead and achieving balance in their families. They simply wish to engage with the industries to which they have dedicated themselves and to inspire others—especially women—to contribute to the agriculture industry. Moreover, these five women aspire to inspire other women to become involved in the agricultural industry.

Though spanning an entire continent and representing vastly different industries of agriculture, this study shows the five women agree to advance the image of women in agriculture in Australia. The agricultural industry itself seems to drive each woman, once established within her field to be passionate, authentic leaders (Avolio et al., 2009). As a leader in her industry the rose grower said, “I want to better myself [in this position by] mentoring and helping people. We can help people not make the mistakes we made to get here.” Each woman in this study also has her own view of leading others from being a positive contributor to the industry, searching for inspiration, encouragement to others, passion about the industry, leading by example, and providing motivation to others. Furthermore, these women have learned their own leadership tactics through personal experiences and their time spent in the agricultural industry (Krumboltz, 1976).

Similarly, subjects who had experienced sexism within their own industry now busy themselves with reforming their field from within. Despite previous research by Doss et al. (2011) which stated that women who enter male-dominated professions may be perceived as inherently
unsuited for such work, these women are changing current perceptions by actively involving themselves in businesses in which they have earned the right to operate and utilizing their leadership skills to do so. Simply acknowledging that women are affecting change, top-down, further promotes gender equity by combating the archaic attitude that women are not natural leaders and unfit for such status (Eagly & Carli, 2007). Women in this study faced some stereotype related to their gender, and they have used those experiences as a learning opportunity to better themselves as an individual and leader for their family and the field of agriculture (Krumboltz, 1976).

Speaking to the responsibility these women feel as minority leaders, the citrus producer detailed, “It is up to us women who have managed to step outside our comfort zone to motivate.” The five women whose personal journeys were explored are primarily concerned with improving the knowledge given to them and presenting new opportunities to other women when they can. In conclusion, each of the woman are promoting their industry and engaging with other women to help advance leadership roles for women in agriculture industries.

**Implications and Recommendations for Future Research**

Individuals working with women may take this information into consideration when training women for leadership roles. Individuals such as employers, educators, and mentors to women may utilize this article as a guide to help advance the diversity in agriculture industry careers. In addition, this article provides details that may assist an employer in understanding some of the underlining stresses of women in leadership roles. Additionally, those working in any field, especially a male-dominate field, could use this information to better understand the women’s personal and professional struggles. Similarly, understanding different individual perspectives can only improve the strength of an organization and develop better professionals: male or female. Also, the hope is that other women are inspired to attain leadership roles in agriculture after reading these five women’s stories and encourage more gender equity in the field of agriculture. Likewise, the hope is to increase the number of women who enter into agriculture industries and advance the body of literature related to women in agriculture fields. However, after considering the results of this study and its implications, some recommendations can be made for women in agriculture attaining leadership. Future research should include:

1. What are reflective journey stories of men engaged in agriculture industries in Australia?
2. What are the reflective journey stories of women agriculturists in the United States?
3. What are reflective journey stories of men engaged in agriculture industries in the United States?
4. What mentoring strategies are being effectively utilized to recruit and retain women in agriculture industry fields?

**References**


Beginning SBAE Teachers’ Metal Fabrication Knowledge Needs: Implications for Teacher Preparation

Marshall Swafford1 & Paden Hagler2

Abstract

While agricultural mechanics, which includes metal fabrication, continues to be popular among school-based agricultural education (SBAE) students (Hubert & Leising, 2000), the number of required courses in agricultural mechanics for teaching certification in agricultural education is relatively low (Blackburn, Robinson, & Field, 2015). Despite the minimal required coursework, Saucier and McKim (2010) argued that all SBAE teachers who instruct agricultural mechanics should be technically competent. To ensure preservice teachers are technically prepared to enter the profession, this study, guided by the model for teacher preparation (Whittington, 2005), sought to determine the essential metal fabrication knowledge and skills which beginning SBAE teachers should possess prior to beginning a career in agricultural education. Results from this study identified eight essential knowledge and skill areas categorized into four categories, metal fabrication equipment, metal fabrication production, student assessment, and laboratory management. Preservice teacher programs should be evaluated to determine if they are effectively preparing teachers in the curriculum area of metal fabrication. Teacher educators and professional development staff should plan professional education programs for in-service teachers in this agricultural mechanics area.

Keywords: agricultural mechanics, metal fabrication, teacher needs

Introduction

The importance of agricultural mechanics to school-based agricultural education (SBAE) programs has been documented (Burris, Robinson, & Terry, 2005) and continues to be popular among secondary agriculture students (Hubert & Leising, 2000; Oklahoma Department of Career and Technology Education (ODCTE), 2012). Approximately 59% of the United States’ eleven thousand SBAE instructors teach agricultural mechanics (National FFA Organization, 2010). In Missouri, courses related to agricultural mechanics had the highest enrollment among SBAE courses (Burris et al., 2005). Likewise, in Texas, nearly 28,000 students were enrolled in agricultural mechanics-based courses at 925 secondary schools (Hubert & Leising, 2000). In 2012, the ODCTE reported approximately 5,000 secondary agriculture students were enrolled in courses related to agricultural mechanics. Most recently in New Mexico, approximately 15% of secondary agricultural education students were enrolled in agricultural mechanics-based courses (E. Lopez, personal communication, September 14, 2017).

1 Marshall Swafford is an Assistant Professor of Agricultural Education in the Department of Family and Consumer Sciences & Agriculture at Eastern New Mexico University, 1500 South Avenue K, Station 11, Portales, NM 88130, marshall.swafford@enmu.edu.
2 Paden Hagler is an undergraduate Agricultural Education student in the Department of Family and Consumer Sciences & Agriculture at Eastern New Mexico University, 1500 South Avenue K, Station 11, Portales, NM 88130, paden.hagler@enmu.edu.
When not a standalone program, metal fabrication is an area which is included in agricultural mechanics curriculum. Metal fabrication can be defined as “the building of metal structures by cutting, bending, and assembling processes”, and includes welding, casing, machining, and metal finishing (Yakubu, 2014). A competent metal fabrication teacher must possess manipulative skills along with theoretical knowledge (Yakubu, 2014). Instruction in metal fabrication requires technical and administrative procedures, tools, equipment, laboratory arrangement, consumable materials, and quality assurance (Yakubu, 2014). To ensure SBAE teachers are technically competent, teacher preparation programs should engage preservice teachers in agricultural mechanics courses to prepare them to teach specific skills necessary for future employment (Blackburn et al., 2015).

Although agricultural mechanics has been integrated with or closely related to agricultural education for several years (Thoron, Myers, & Barrick, 2016) numerous agriculture teacher preparation programs require preservice teachers to complete relatively few credit hours of agricultural mechanics courses for graduation (Blackburn et al., 2015). As noted by Burris et al. (2005), a majority of teacher preparation programs required fewer than 12 hours in agricultural mechanics. Hubert and Leising (2000) reported the average number of credit hours in agricultural mechanics for preservice teachers to complete certification in agricultural education was 6.7, with most universities reporting three credit hours was the minimum requirement.

The American Association for Agricultural Education (AAAE) endorsed standards for SBAE teacher preparation programs (AAAE, 2017) which include knowledge requirements of program graduates. Standard 2: Technical Content Knowledge indicates preservice teachers should exhibit knowledge of agricultural equipment found in facilities along with demonstrating awareness and ability to use technology in the agricultural industry (AAAE, 2017). Burris et al. (2005) recommended restructuring teacher education programs to better prepare preservice teachers in agricultural mechanics but, increasing credit hour requirements may not be an option (Blackburn et al., 2015). In 2001, Connors and Mundt reported the median number of credit hours to complete a degree in agricultural education was 128, with 45 hours devoted to technical agriculture. More recently, under pressure from state legislators, universities have decreased the number of credit hours required for graduation (Weldon, 2013), further complicating the issue for teacher educators as they prepare preservice teachers.

While well prepared SBAE teachers can aid secondary agricultural education students in developing practical, hands-on skills (McKim & Saucier, 2011), researchers have concluded recent agricultural education graduates were deficient in aspects of agricultural mechanics instruction (Dyer & Andreassen, 1999). Burris et al. (2005) reported that even though preservice teachers were receiving instruction in metal fabrication, the level of skill development was inconsistent with the allocation of resources devoted to this area of agricultural mechanics. In 1990, Johnson, Schumacher, and Stewart found agricultural education teachers in Missouri had earned, on average, over 17 college credit hours in agricultural mechanics education but, by 2009, that number had decreased to 11 credit hours (Saucier, Terry, & Schumacher, 2009). In Oklahoma, preservice teachers were only required to complete five credit hours in agricultural mechanics coursework, which can result in poor or failing scores in the agricultural mechanics sections on agricultural education certification exams (Leiby, Robinson, & Key, 2013; Leiby, Robinson, Key, & Leising, 2011).

Educators are typically considered beginning teachers until they have completed three years in the profession (Myers, Dyer, & Washburn, 2005). Although a variety of measures and data collection procedures have been employed, clearly identifying in-service needs of beginning teachers is difficult (Birkenholz & Harbstreit, 1987; Joerger, 2002; Myers et al., 2005). Differences
in program priorities has been purported as a possible cause in identifying beginning teacher needs (Birkenholz & Harbstreit, 1987; Myers et al., 2005). Although not specific to beginning teachers, Saucier, McKim, and Tummons (2012) identified 23 essential agricultural mechanics skills needed by SBAE teachers. Included in this comprehensive list, were basic metal fabrication skills.

**Conceptual Framework**

A modified version of Whittington’s (2005) model for teacher preparation in agricultural education served as the conceptual framework for this study. This framework is grounded in the philosophical tenets of agricultural education including experiential learning (Kolb, 1984), problem-based teaching (Lancelot, 1944), social cognition (Bandura, 1986), and reflective practice (Schön, 1983). Coursework in agricultural education teacher education programs are aligned with the Council for the Accreditation of Educator Preparation (CAEP) standards, Interstate New Teacher Assessment and Support Consortium (INTASC) principles, Praxis criteria for licensure, and AAAE Standards to guide preservice teacher preparation, including knowledge and skills needed for entry into the teaching profession.

As noted by Whittington (2005), the characteristics of experiential learning including hands-on, contextual, problem-solving, and project-based serve as one of the “philosophical foundations of agricultural education teacher preparation” (p.92). Without proper preservice preparation in metal fabrication, “it is unlikely that beginning teachers will be able to use the agricultural mechanics laboratory as a mode of experiential learning and a tool to provide rigorous and relevant instruction” (Saucier et al., 2012, p. 138) to their students. Because of the relatively few hours of agricultural mechanics coursework required for certification, it is important to establish the most appropriate and necessary metal fabrication knowledge and skills needed by beginning teachers. Thus, it is important to accurately identify the essential metal fabrication knowledge and skill areas needed by beginning SBAE teachers.

![Figure 1. Modified model for teacher preparation in agricultural education. Adapted from Whittington (2005, p. 94).](image)

**Note.** Years in College: Fr=Freshman year, So=Sophomore year, Jr= Junior year, Sr= Senior year
Purpose and Objective

The 2017-2020 Standards for School-Based Agricultural Education Teacher Preparation Programs (AAAE, 2017) indicated students completing an agricultural education teacher preparation program and who will be licensed to teach should demonstrate awareness of contemporary technology and its use in agriculture and be able to teach students how to use technology present in the modern agricultural industry. Therefore, the purpose of this study was to identify the metal fabrication knowledge needed by beginning SBAE teachers. The specific objective of this study was to:

1. Identify the perceived metal fabrication knowledge and skills needed by beginning school-based agricultural education teachers.

Methods

The Delphi method was used to determine the perceived metal fabrication knowledge and skills areas needed by beginning SBAE teachers as determined by identified experts. The Delphi method is a process by which a panel of experts is convened to provide informed judgment toward consensus on a specific topic (Delp, Thesen, Motiwalla, & Seshadri, 1977). The purpose of a Delphi panel is to collect responses from a group of experts and combine the responses into a useful statement (Stitt-Gohdes & Crews, 2004). In agricultural education, Martin and Frick (1998) noted that this method is effective when planning curriculum. Delphi studies reduce the negative impacts of the bandwagon effect of majority opinion, persuasiveness of opinionated individuals, the vulnerability of group dynamics to group manipulation, and the unwillingness of individuals to abandon publicly stated opinions (Isaac & Michael, 1987).

Delphi studies employ a series of questionnaires to collect data from the expert panel (Isaac & Michael, 1987). Prior to data collection, experts are identified and selected due to their knowledge in the subject matter being explored. For this study, purposeful sampling was used to select members for the panel of experts. Purposeful sampling can be defined as “a qualitative sampling procedure which researchers intentionally select individuals and sites to learn or understand the central phenomenon” (p. 359). Dalkey (1969) noted, for a Delphi instrument to be reliable (.70 or greater), a panel of experts must consist of 11 or more members. However, a panel size of 13 is needed for an instrument to be reliable with a correlation coefficient of .90 (Dalkey, Rourke, Lewis, & Snyder, 1972). To ensure the reliability of this instrument, 24 panelists were selected and solicited to serve on the panel for this study.

The participants for this study included those college and university faculty members who taught metal fabrication courses as part of an agricultural education department or program. Teacher educators were selected as the experts in this study based upon their knowledge of the methods used to teach metal fabrication along with the technology currently located in preservice teacher programs and their alignment with the curriculum taught at the secondary level. To ensure a representative sample across the AAAE membership, eight faculty members were selected from each region (North Central, Southern, & Western). All panelists were deemed proficient with the entry level metal fabrication knowledge required of beginning SBAE teachers. Of the 24 faculty invited, 16 accepted and returned the initial instrument. Thirteen completed the second and third round questionnaires.

This Delphi study employed three rounds and was initiated through an email detailing the process and anticipated timeline. The entire study was conducted electronically, using a web-based data collection service, as the panelists were located throughout the United States. Each round was
closed after 21 days, and data collection was closed after 63 days. IBM SPSS Statistics Version 22 was used to create frequency tables. Upon collecting data from round one, variables were recoded to combine Strongly Agree, and Very Strongly Agree to examine the percentage of overall agreement among the panelists. Consensus was defined a priori as two-thirds strong agreement or very strong agreement on a seven-point Likert-type scale. Validity of the content analysis was conducted by experts including a teacher educator, two secondary SBAE teachers, and an agricultural systems management faculty member.

The first round consisted of one open-ended question that asked the panel members to list the metal fabrication knowledge and skill areas that a beginning SBAE teacher should possess prior to starting a career in secondary agricultural education. Upon closing data collection for round one, the research team identified an initial list of 68 statements. Similar concepts were combined and resulted in 44 knowledge and skill areas. These areas were then used to develop the second questionnaire and can be found in Table 1.

In round two, the consolidated needs identified in round one were provided alongside a Likert-type scale and the panelists were prompted to indicate their level of agreement or disagreement to each identified need. The Likert-type scale was constructed with seven-points ranging from 1 (Very Strongly Disagree) to 7 (Very Strongly Agree). The panel was also asked to revisit the complete list of consolidated needs from round one and provide additional needs that were missing from the list. The same data analysis process used in round one was repeated to analyze the additional suggestions. Consensus was defined a priori as items that achieved two-thirds consensus of Strongly Agree, or Very Strongly Agree.

The 19 items which met the two-thirds threshold from round two were retained for round three to finalize consensus among the panelists. Results from round three revealed eight items received two-thirds consensus, while eleven areas were dropped. Based upon the panel’s level of agreement with the areas in round three, the researchers determined to cease data collection and no future rounds were conducted.

Results

In round one, 16 panelists (66% response rate) identified 68 statements of metal fabrication knowledge and skills a beginning teacher should possess prior to teaching SBAE. Similar or duplicated statements were combined or eliminated while compound statements were separated (Shinn, Wingenbach, Briers, Lindner, and Baker, 2009). The statements were validated by the research team, grouped into 44 knowledge and skill areas, and were used to develop the round two questionnaire. The knowledge and skill areas from round one can be found in Table 1.
Table 1

Results of Round 1 Metal Fabrication Knowledge and Skills Needed by Beginning SBAE Teachers

<table>
<thead>
<tr>
<th>Metal Fabrication Knowledge and Skill Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parts/components of metal fabrication equipment including, PAC, SMAW, GMAW, GTAW, FCAW, &amp; Oxy-Fuel</td>
</tr>
<tr>
<td>Evaluation rubrics</td>
</tr>
<tr>
<td>Distinguishing weld joints</td>
</tr>
<tr>
<td>Electricity principles</td>
</tr>
<tr>
<td>Ordering materials</td>
</tr>
<tr>
<td>Designing projects</td>
</tr>
<tr>
<td>CAD/CAM software</td>
</tr>
<tr>
<td>First Aid</td>
</tr>
<tr>
<td>Cold metal work</td>
</tr>
<tr>
<td>Power and hand tools used in metal fabrication</td>
</tr>
</tbody>
</table>

The data from round one were re-distributed to the panel to seek consensus in round two. Twenty-five areas were removed from the list. The response rate for this round was 54% (n=13). The knowledge and skills in round two reaching two-thirds consensus can be found in Table 2.

Table 2

Results of Round 2 Metal Fabrication Knowledge and Skills Needed by Beginning SBAE Teachers

<table>
<thead>
<tr>
<th>Metal Fabrication Knowledge Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parts/components of metal fabrication equipment including, SMAW, GMAW, &amp; Oxy-fuel</td>
</tr>
<tr>
<td>Distinguishing weld joints</td>
</tr>
<tr>
<td>First Aid</td>
</tr>
<tr>
<td>Performance assessments</td>
</tr>
<tr>
<td>Fabrication techniques</td>
</tr>
</tbody>
</table>

A 54% response rate (n=13) was achieve for round three. The areas from round two, meeting the two-thirds consensus threshold, were re-distributed to the panelists in round three. The areas including Laboratory Management, Safety, First Aid, Maintaining Equipment, and Ordering Materials, were combined into one knowledge area for round three. The new area was labeled as Laboratory Management – to include safety, first aid, maintaining equipment, and ordering materials. Data collection ceased after round three and the resulting eight areas were consolidated.
into four categories, metal fabrication equipment, metal fabrication production, teaching, and management. Table 3 provides a visual representation of the final list of categories including the knowledge and skill areas.

Table 3

<table>
<thead>
<tr>
<th>Categories and Areas of Metal Fabrication Knowledge and Skills Needed by Beginning SBAE Teachers</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Metal Fabrication Knowledge &amp; Skill Categories</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Metal Fabrication Equipment</strong></td>
</tr>
<tr>
<td>1. Identify parts/components of welding and cutting equipment including:</td>
</tr>
<tr>
<td>SMAW, GMAW, Oxy-Fuel</td>
</tr>
<tr>
<td>2. Understand the operating procedures of welding and cutting equipment including:</td>
</tr>
<tr>
<td>SMAW, GMAW, Oxy-Fuel</td>
</tr>
<tr>
<td>3. Understand the proper use of power and hand tools used in metal fabrication</td>
</tr>
<tr>
<td><strong>Metal Fabrication Production</strong></td>
</tr>
<tr>
<td>4. Distinguish weld joints</td>
</tr>
<tr>
<td><strong>Table 3 Continued</strong></td>
</tr>
<tr>
<td>5. Welding positions</td>
</tr>
<tr>
<td>6. Create project bill of materials</td>
</tr>
<tr>
<td><strong>Student Assessment</strong></td>
</tr>
<tr>
<td>7. Create authentic performance assessments</td>
</tr>
<tr>
<td><strong>Laboratory Management</strong></td>
</tr>
<tr>
<td>8. Implement laboratory management plans to include:</td>
</tr>
<tr>
<td>Safety</td>
</tr>
<tr>
<td>First-aid</td>
</tr>
<tr>
<td>Ordering materials</td>
</tr>
<tr>
<td>Equipment maintenance</td>
</tr>
</tbody>
</table>

**Conclusions/Implications/Recommendations**

A panel of experts identified eight essential metal fabrication knowledge and skill areas that beginning agricultural education teachers should possess prior to starting a career as an SBAE teacher. These knowledge skill areas ranged from metal fabrication equipment and production to student assessment and laboratory management.

After analyzing the responses from this study four main questions arose: Are preservice teacher preparation programs providing preservice teachers with the opportunities to increase and improve their metal fabrication knowledge and skills to successfully gain employment upon graduation? If the answer is yes, what strategies have teacher educators implemented to mitigate the reduction in laboratory time resulting from the decrease in credit hour requirements? If the question is no, what are the compounding issues existing in teacher education programs which prevent adequate preparation of preservice teachers? Furthermore, what professional development
opportunities exist for in-service teachers to enhance and improve their knowledge and skills in metal fabrication techniques and instruction?

As this study only took into consideration the needs of beginning SBAE teachers from the perspectives of faculty involved in teacher education, are the knowledge and skills identified by these experts relevant to the needs of secondary students who enter the workforce upon graduation? Are the graduates of SBAE programs prepared for a modern metal fabrication workforce emphasizing STEM concepts and advanced technology-related skills? How should industry-based advisory groups be implemented to aid teacher preparation programs to help modernize metal fabrication instruction to ensure employability skills of high school graduates?

Based upon the results of this study, several actions are recommended. Teacher preparation programs should use this list of knowledge and skill areas as a guide to determine if preservice teachers are being adequately educated in metal fabrication. Teacher educators should continuously monitor metal fabrication knowledge and skill needs of in-service teachers and use the resulting data to provide educational opportunities to improve teaching and learning in this area. Researchers should assess the metal fabrication technology currently located in preservice SBAE programs and ensure it aligns with the curriculum taught at the secondary level.

References


Saucier, P. R., Terry, Jr., R., & Schumacher, L. G. (2009). Laboratory management in–service needs of Missouri agricultural educators. Paper presented at the *Southern Region Conference of the American Association for Agricultural Education*, Atlanta, GA.


STEM Education at the Nexus of the 3-Circle Model

Marshall Swafford

Abstract

The United States economy is requiring employees to have knowledge and skills in science, technology, engineering, and mathematics (STEM). Researchers have identified agriculture, food, and natural resources (AFNR) education as a context in which STEM concepts can be formally taught and highlighted. Additionally, researchers have identified where, within the 3-circle model of agricultural education, students can develop STEM-related career skills. However, a conceptual model illustrating an integrated approach to STEM-AFNR education does not exist. The purpose of this research study was to identify where STEM technical content and employability skills can be explicitly taught, highlighted, and developed, within the current model of agricultural education. Research findings suggest STEM technical content can be explicitly taught and highlighted in curriculum when grounded in the Agriculture, Food and Natural Resources (AFNR) Career Cluster Content Standards. Furthermore, STEM technical content and employability skills are embedded in Supervised Agricultural Experience programs and National FFA Career Development Events. Using the findings as a guide, a conceptual model of STEM-AFNR is suggested along with recommendations for practice and future research.

Keywords: Agricultural education, STEM education, model of agricultural education

Introduction

Currently, 64% of companies have vacancies for STEM positions due to a lack of qualified applicants (Dobbs, Madgavkar, Barton, Labaye, Manika, Lund, & Madhav, 2012). By 2020, the United States economy is expected to require 123 million highly skilled workers, yet at current qualification levels, only 50 million workers will be available to fill the jobs (Gordon, 2009). However, the current model of school-based agricultural education (SBAE) provides a context where students may be exposed to and engaged in activities which support the development of competencies and skills required to fill future jobs. The current SBAE model is comprised of three interconnected components and include classroom/laboratory instruction, Supervised Agricultural Experience (SAE) programs, and leadership development through participation in the FFA. The classroom/laboratory component provides students opportunities to create content-specific knowledge pertaining to agriculture and natural resources through traditional instruction and inquiry-based methods (Phipps, Osborne, Dyer, & Ball, 2008). The SAE component engages students in settings where they apply knowledge and skills learned in the classroom to real-life situations (Phipps et al.). Participation in National FFA Organization sponsored activities provides an intra-curricular setting where students can participate in programs and activities through which communication, leadership, critical thinking, and teamwork skills are developed (Bunshaft, Boyington, Curtis-Fisk, Edwards, Gerstein, & Jacobson, 2015; Phipps et al.).

According to Bunshaft et al. (2015), employers are seeking candidates with more than just discipline-specific competencies or technical skills. Employability skills including communication, teamwork, leadership, along with critical thinking, problem solving, and
managerial abilities are priorities for hiring managers. Bunshaft et al. suggested experiential learning activities provide opportunities for future employees to develop and apply their skills, increasing the likelihood of obtaining employment after graduation. Although difficult to identify a universal definition of employability skills, most accepted definitions include 1) a set of general skills needed to perform well and remain employed throughout one’s career, 2) generic skills which cut across all industries, business types, and job levels and; 3) are divided into three skill sets – academic skills, personal qualities, and higher-order thinking skills (Bunshaft et al., 2015). Unsurprisingly, mathematics and science are common academic skills required by employers (Bunshaft et al., 2015; Jang, 2016). Within the context of AFNR, Scherer, McKim, Wang, DiBenedetto, and Robinson (2017) identified STEM learning as a need for success within professional careers. However, candidates who possess non-technical skills, in addition to technical competence, are highly sought by 21st century organizations. Written and oral communication, project management, and interpersonal skills are frequently cited as lacking in STEM graduates (Hung-Lian, Lee, & Koh, 2000; Radermacher & Walia, 2013). As technology has advanced, computers have increasingly replaced humans in performing routine tasks (National Research Council, 2011). Thus, workers are required to have the cognitive and social skills needed to solve non-routine problems (Jang, 2016). The National Research Council (2011) identified five 21st century skills needed by prospective STEM employees: adaptability, complex communication skills, non-routine problem-solving skills, self-management/development, and systems thinking. Using workplace characteristics information maintained by the United States Department of Labor, Jang (2016) identified five similar competencies employers sought in STEM candidates, 1) problem-solving skills, 2) social communication skills, 3) technology and engineering skills, 4) system skills, and 5) time, resource, and knowledge management skills. Career and technical education organizations have attempted to identify employability skills needed in STEM careers. Advance CTE: State Leaders Connecting Learning to Work (2008) identified 10 competencies required of future STEM employees and include areas ranging from academic and technical knowledge and skills to problem-solving, critical thinking, and leadership.

Engaging students in active educational programs focused on fostering STEM competencies is vital for students’ future employment prospects (Bunshaft et al., 2015; Crawley, Malmqvist, Östlund, & Brodeur, 2007; Jang, 2016). Ferrini-Mundy (2013) was more specific and noted, more hands-on, authentic STEM activities should be provided at the secondary level. Agricultural education has been considered a viable platform for teaching STEM concepts (Smith, Rayfield, & McKim, 2015). In a case study of three Florida high schools, Stubbs and Myers (2015) found students were exposed to a variety of STEM disciplines and careers through interdisciplinary curricula. STEM integration in agricultural education has been researched, however primarily as a vehicle to teach math and science (Boone, Gartin, Boone, & Hughes, 2006; Brister & Swortzel, 2009; Clark, 2013; Conroy, Dailey, & Shelley-Tolbert, 2000; Haynes, Robinson, Edwards, & Key, 2012; Johnson, 1996; Myers & Thompson, 2006; Myers & Washburn, 2008; Parr, Edwards & Leising, 2006, 2009; Ricketts, Duncan, & Peake, 2006; Scales, Terry, & Torres, 2009; Shinn et al., 2003; Stripling & Roberts, 2012; Thompson & Balschweid, 1999; Thompson & Balschweid, 2000; Thoron & Myers, 2012a, 2012b; Warnick, Thompson, & Gummer, 2004). Additionally, Heinert and Barrick (2015) established a framework which aligned agricultural education and STEM disciplinary core ideas with the Agriculture, Food and Natural Resources (AFNR) Career Cluster Content Standards (The Council, 2015a), and the Next Generation Science Standards (NGSS, 2013). Specifically, regarding future employment, agricultural education has been identified as a foundation for providing career development (Baker, Robinson, & Kolb, 2012; Roberts & Ball, 2009). Furthermore, agricultural education teachers are charged with developing knowledge and skills in their students by creating experiences from which connections can be made to future careers (Arnold, Warner, & Osborne, 2006).
Bunshaft et al. (2015) suggested STEM employability skills may be best developed through engaging students in career-focused experiential learning as, “Experiential learning is a practical way for individuals to internalize Employability Skills within the context of a career” (p. 20). Henderson (2008) echoed this notion when it was observed that STEM education has experienced a shift from teacher-centered to student-centered. The Supervised Agricultural Experience (SAE) program found within the contemporary model of agricultural education is an effective medium through which students can further develop the STEM competencies (Smith & Rayfield, 2016) needed for employment in the 21st century. While involved in an SAE, students are able to explore multiple careers and occupations, develop and apply industry-specific and occupational skills, and learn professional workplace behavior (National FFA Organization, 2017). SAE involvement enables students to make management decisions, demonstrate scientific knowledge through research-based SAEs, and plan projects (National FFA Organization, 2017), which have been identified as competencies needed for contemporary STEM careers (Jang, 2016). Regarding technical knowledge, Wooten, Rayfield, and Moore (2013) identified 21 STEM concepts to which students may be exposed or experience while involved in junior livestock projects.

Career Development Events (CDEs), sponsored by the National FFA Organization, have been identified as a successful experiential learning model to engage students in STEM fields (Bunshaft et al., 2015). These events focus on career exploration, development, and preparation. Career Development Events seek to challenge participants to develop skills in critical thinking, decision-making, teamwork, and communication (National FFA Organization, 2017). Lundry, Ramsey, Edwards, and Robinson (2015) found participation in CDEs provided participants knowledge of agricultural careers, and the potential for career preparation. These researchers also identified 24 workplace skills, in addition to content or technical science and mathematics skills, desired by employers seeking qualified candidates for careers in the 21st century.

Conceptual Framework

Experiential learning has served as a foundation for agricultural education (Moore & Krueger, 2005). Within the context of agricultural education, Knobloch (2003) identified four principles of experiential learning including, learning through real-life context, learning by doing, learning through projects, and learning through problem-solving. These tenets align with standards which guide authentic learning and provide a “sound psychological framework for learning” (Retallick & Martin, 2008, p. 29). Baker et al. (2012) attempted to clarify the connection between experiential learning and agricultural education. These researchers concluded experiential learning should “(a) encompass each of the three components of the agricultural education model, (b) require purposeful and planned support from the agricultural education instructor, (c) lead to the development of important meta-cognitive skills, and (d) include curriculum planning and assessment” (p.6).

Dewey (1938) believed there was an inherent connection between education and personal experience and that the impact hinged on the experience quality and its connection to later experiences (Retallick & Martin, 2008). Dewey further described the continuity of experience where “every experience both takes up something from those which have gone before and modifies in some way the quality of those which come after” (p. 35). The project method, as described by Kilpatrick (1918), is purposeful and has utility for learning. Stimson (1915) expanded upon the premise of utility for learning when he explained students were better able to retain abstract concepts when they had the opportunity to apply those concepts in concrete experiences.

Kolb (1984) described experiential learning as a method to examine and strengthen the relationships between education, work, and personal development. The “combination of grasping
experience and transforming it” (Kolb, 1984, p. 41) creates knowledge. Kolb (2015) further conceptualized learning as process, which is continuous and grounded experience; and the process of learning requires the resolution of conflicts between opposed modes of adaption to the world. Using these as a foundation, Kolb (2015) based his experiential learning cycle on three additional characteristics:

1. Learning is a holistic process of adaption to the world
2. Learning involves transactions between the person and the environment
3. Learning is the process of creating knowledge (as cited in Smith, 2015).

As a result, Kolb conceptualized the process of the experiential learning cycle. The model includes two sets of dialectically opposed approaches to learning: Active Experimentation (AE) and Reflective Observation (RO) in relation to the perception of information, and Concrete Experience (CE) and Abstract Conceptualism (AC) in relation to information processing. Kolb and Kolb (2013) further defined each mode of learning. Active Experimentation (AE) is “learning by doing”, Concrete Experience (CE) is “learning by feeling”, Reflective Observation (RO) is “learning by watching”, and Abstract Conceptualization (AC) is “learning by thinking” (Kolb & Kolb, 2005, p. 10).

When integrated with the agricultural education model, the model of experiential learning theory (ELT) illustrates the total and comprehensive learning experience of agricultural education (Baker et al., 2012). While McLean and Camp (2000) indicated the SAE component of the model has been traditionally known as the experiential element of the model, Baker et al. (2012) explored the concept that all three components of the model “fit nicely into the experiential learning cycle” (p. 6). These researchers further explained, within the context of the experiential learning cycle, the classroom/laboratory component of the agricultural education model was related to the abstract, while the FFA is more concrete and reflective.

When the agricultural education model is combined with the experiential learning model, a more comprehensive illustration is provided as “Agricultural education has a great advantage in that the entire program is so easily experiential” (Baker et al., 2012, p.6). While these researchers indicated the direct connection between classroom instruction and SAEs is insignificant, this activity allows students to identify an area of interest from which to build a project that can be used to create a synergy enabling both components to inform the other. Most importantly, the interconnectedness of the model aids in the development of meta-learning (Baker et al., 2012) which refers to applying learned information to implement a plan by which problems are solved. The resulting meta-skills can then be used to support classroom instruction and FFA components, as well (Baker et al., 2012). The conceptualized model of contemporary agricultural education illustrated by Baker et al. (2012) guiding this study is identified in Figure 1.
Scherer et al. (2017) indicated a need for establishing a framework for connecting AFNR and STEM learning to lay the foundation from which “research can evaluate, revise, and extend” (p. 506). Furthermore, Scherer, et al. identified a lack of coordination between STEM and AFNR education literature thus, impeding the advancement of both. However, clearly articulating the relationship between STEM and AFNR may assist AFNR education to address student career preparedness in STEM fields. Therefore, the purpose of this study, through systematic analysis of existing documents, was to articulate the interconnectedness of STEM and AFNR education in order to inform research and innovations in practice. To achieve this purpose, the following research questions guided this study:

1. Where do STEM content competencies exist in the Agriculture, Food and Natural Resources (AFNR) Career Cluster Content Standards (The Council, 2015a)?
2. Are STEM career readiness competencies present in National FFA CDEs?
3. Are STEM content competencies embedded in SAEs?

Methods

STEM content competencies included in the classroom and laboratory instruction component of the agricultural education model were identified by analyzing the standards found in the Agriculture, Food and Natural Resources (AFNR) Career Cluster Example Crosswalks (The Council, 2015b). The researcher, along with two additional teacher education faculty, determined the existence of STEM content competencies, by systematically reviewing each content standard, along with the associated performance indicators, and sample measurements. Each standard was assessed for STEM competencies guided by the Common Core Mathematics Standards (NGA Center/CCSSO, 2010) and the Next Generation Science Standards (NGSS, 2013). STEM technical content competencies in each standard were identified using directions outlined in the Agriculture, Food and Natural Resources (AFNR) Career Cluster Example Crosswalks, which noted, “for a crosswalk to be established, the content of the cross-walked standard must be explicitly taught in order to attain the related Performance Indicator in the AFNR Content Standards given the stated sample measurements” (p. 1). Inter-rater reliability (Ary, Jacobs, Razavieh, & Sorensen, 2006) was established for all document analyses by comparing individual competencies and reconciling differences through consensus.
To determine the STEM career readiness competencies existing in National FFA CDEs, a document analysis was conducted of the affiliated crosswalk standards found in each CDE handbook. The *STEM Career Cluster: Cluster Knowledge and Skill Statements* (Advance CTE, 2008) served as the framework for this analysis. AFNR Career Cluster Content Standards are identified in a matrix within each CDE handbook. Within the matrix, performance measurement levels, event activities addressing measurements, and related academic standards are identified. The research team assessed each AFNR standard and any affiliated cross-walked standard to determine what STEM career statement was present. To maintain the integrity of the analysis, no attempts were made to identify additional *STEM Career Cluster: Cluster Knowledge and Skill Statements* present in the CDEs.

STEM technical knowledge existing in SAEs was assessed using the affiliated science standards (NGSS, 2013) crosswalked within the *Agriculture, Food and Natural Resources (AFNR) Career Cluster Content Standards* (The Council, 2015a) as established by Heinert and Barrick (2015). STEM technical content competencies in SAEs were identified through document analysis of National FFA proficiency award applications and *A Framework for Agricultural STEM Education: Aligning Ag-STEM Disciplinary Core Ideas with the Agriculture, Food and Natural Resource Standards and the Next Generation Science Standards* (Heinert & Barrick, 2015). For this portion of the study, SAEs were categorized as Animal Systems, Biotechnology Systems, Environmental Service Systems, Food Products and Processing Systems, Natural Resource Systems, Plant Science Systems, and Power, Structural and Technical Systems. As a component of each National FFA Proficiency Award application, the FFA member completing the application must identify which system pathway their SAE most closely aligns. Within the pathway, each applicant must identify five skills, competencies, and/or knowledge affiliated with an AFNR performance indicator and discuss how the performance indicator contributed to the success of their SAE and resulting proficiency award. Using the framework established by Heinert and Barrick, the research team identified the disciplinary core idea affiliated with each AFNR performance indicator FFA members can reference when discussing its contribution to their SAE. Once the Disciplinary Core Ideas were identified for each SAE pathway, the research team utilized the framework to identify with which, if any, Next Generation Science Standard was affiliated.

**Findings**

The focus of Objective 1 was to identify STEM content competencies currently embedded in the *Agriculture, Food and Natural Resources (AFNR) Career Cluster Content Standards* (The Council, 2015a). Displayed in Table 1, are the eight content pathways, and STEM content areas explicitly taught within each pathway. At least one STEM content area competency is taught in all pathways, with content representing all areas of STEM present in the Environmental Service Systems Pathway.
Table 1

*Technical STEM Content Explicitly Taught in AFNR Career Cluster Pathways*

<table>
<thead>
<tr>
<th>AFNR Cluster Pathway</th>
<th>Explicitly Taught STEM Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agribusiness Systems</td>
<td>Math</td>
</tr>
<tr>
<td>Animal Systems</td>
<td>Science, Engineering, Math</td>
</tr>
<tr>
<td>Biotechnology Systems</td>
<td>Science, Engineering</td>
</tr>
<tr>
<td>Environmental Service Systems</td>
<td>Science, Technology, Engineering, Math</td>
</tr>
<tr>
<td>Food Products and Processing Systems</td>
<td>Engineering</td>
</tr>
<tr>
<td>Natural Resource Systems</td>
<td>Science, Math</td>
</tr>
<tr>
<td>Plant Systems</td>
<td>Science, Math</td>
</tr>
<tr>
<td>Power, Structural and Technical Systems</td>
<td>Science, Engineering</td>
</tr>
</tbody>
</table>

Objective 2 sought to identify STEM career readiness competencies present in National FFA CDEs. The *STEM Career Cluster: Cluster Knowledge and Skill Statements* (Advance CTE, 2008) are, when applicable, cross-walked in the matrix within each handbook as they relate to AFNR Career Cluster Content Standards performance measurement levels. Per CDE, STEM career readiness competencies existed at a mean frequency of 1.94 ($SD = 1.51$). Agricultural Communications, Agricultural Sales, Farm and Business Management, Food Science and Technology, and the Marketing Plan CDEs did not include STEM career readiness cross-walked standards. The Environmental and Natural Resources CDE included five STEM career readiness cross-walked standards. A visual representation of these findings can be found in Table 2.
Table 2

Existence of STEM Career Cluster: Cluster Knowledge and Skill Statements in National FFA Career Development Events

<table>
<thead>
<tr>
<th>National FFA Career Development Events</th>
<th>STEM Career Cluster Knowledge &amp; Skill Statements</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SCC01</td>
</tr>
<tr>
<td>Ag Mechanics</td>
<td>x</td>
</tr>
<tr>
<td>Agronomy</td>
<td>x</td>
</tr>
<tr>
<td>Dairy Cattle</td>
<td>x</td>
</tr>
<tr>
<td>Environmental &amp; Natural Resources</td>
<td>x</td>
</tr>
<tr>
<td>Floriculture</td>
<td>x</td>
</tr>
<tr>
<td>Forestry</td>
<td>x</td>
</tr>
<tr>
<td>Horse Evaluation</td>
<td>x</td>
</tr>
<tr>
<td>Livestock</td>
<td>x</td>
</tr>
<tr>
<td>Meats Evaluation</td>
<td>x</td>
</tr>
<tr>
<td>Milk Quality</td>
<td>x</td>
</tr>
<tr>
<td>Nursery Landscape</td>
<td>x</td>
</tr>
<tr>
<td>Poultry</td>
<td>x</td>
</tr>
<tr>
<td>Vet. Science</td>
<td>x</td>
</tr>
</tbody>
</table>

Note. SCC01 = Academic Foundations; SCC02 = Communications; SCC03 = Problem-Solving and Critical Thinking; SCC04 = Information Technology Applications; SCC05 = [Organizational] Systems; SCC06 = Safety, Health, and Environmental; SCC07 = Leadership and Teamwork; SCC08 = Ethics and Legal Responsibilities; SCC09 = Employability and Career Development; SCC10 = Technical Skills (Advance CTE, 2008).

Objective 3 was to identify STEM technical content competencies in SAEs. Establishing STEM competencies embedded in SAEs was accomplished by identifying Next Generation Science Standards (NGSS, 2013) cross-walked with Agriculture, Food and Natural Resources (AFNR) Career Cluster Content Standards (The Council, 2015a) Performance Indicators used by FFA members when describing their SAEs within National FFA Proficiency Award applications. Using the Agriculture, Food and Natural Resources (AFNR) Career Cluster Content Standards (The Council, 2015a) as a guide, SAEs were categorized as Animal Systems, Biotechnology Systems, Environmental Service Systems, Food Products and Processing Systems, Natural Resource Systems, Plant Science Systems, and Power, Structural and Technical Systems. As identified by Heinert and Barrick (2015), the Agriculture, Food and Natural Resources (AFNR) Career Cluster Content Standards (The Council, 2015a) include systems pathways with inherent STEM concepts, which include performance indicators associated with disciplinary core ideas. Heinert and Barrick identified multiple performance indicators which affiliate with multiple disciplinary core ideas. Table 3 summarizes the number of performance indicators and disciplinary core ideas found within each system pathway (Heinert & Barrick, 2015).
Heinert and Barrick (2015) identified 63 of the 143 AFNR disciplinary core ideas were associated with Next Generation Science Standards (NGSS, 2013). Forty (28%) disciplinary core ideas were associated with life science, 14 (10%) with physical science, eight (6%) with earth and space science, and six (4%) with engineering, technology, and applications of science. It should be noted, six ANFR disciplinary core ideas were associated with more than one Next Generation Science Standard (NGSS, 2013) performance expectation. Table 4 outlines the specific AFNR disciplinary core ideas, as identified by Heinert and Barrick, proficiency award applicants may include in their applications and the affiliated Next Generation Science Standards (NGSS, 2013) performance expectation.

Table 4

<p>| AFNR Disciplinary Core Ideas Associated with Next Generation Science Standard Performance Expectations (NGSS, 2013) |</p>
<table>
<thead>
<tr>
<th>.AFNR Pathway/Disciplinary Core Idea</th>
<th>NGSS Performance Expectation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Animal Systems</td>
<td></td>
</tr>
<tr>
<td>Anatomy and physiology of animals</td>
<td>LS</td>
</tr>
<tr>
<td>Animal Nutrition</td>
<td>LS</td>
</tr>
<tr>
<td>Genetics</td>
<td>LS</td>
</tr>
<tr>
<td>Management practices for livestock and animals</td>
<td>LS</td>
</tr>
<tr>
<td>Animal behavior and management systems</td>
<td>LS</td>
</tr>
<tr>
<td>Animal production systems</td>
<td>ETS</td>
</tr>
<tr>
<td>Power, Structural and Technical Systems</td>
<td></td>
</tr>
</tbody>
</table>
Global significance of animal agriculture  LS, ESS, ETS
Innovations and applied technologies within animal systems  PS
Veterinary technology  PS
Taxonomy and classification  LS
Energy and its transformation in animal systems  LS
Domestication and evolution of species and breeds  LS
Biodiversity and humans  LS
Data analysis and probability  LS

Biotechnology Systems
Genetics  LS
Chemical reactions  PS
Ethical and cultural issues in biotechnology  LS, ETS
Biofuels  PS
Macromolecules  LS
World food systems  LS
World population  LS

Environmental Service Systems
Wildlife management  LS
Ecosystem  LS
Humans and the environment  LS, ETS
Land use management at different levels  ESS
Ecology: earth’s systems and cycles  LS
Sustainability of human systems  LS
Global environmental phenomenon & trends  ESS
Innovations & applied technologies within environmental service systems  PS, LS
Environmental technologies  PS
Climate change  ESS
Data analysis, quantitative reasoning and calculation  LS

Table 4 (continued)

*AFNR Disciplinary Core Ideas Associated with Next Generation Science Standard Performance Expectations (NGSS, 2013)*

<table>
<thead>
<tr>
<th>AFNR Pathway/Disciplinary Core Idea</th>
<th>NGSS Performance Expectation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food Products and Processing Systems</td>
<td></td>
</tr>
<tr>
<td>Chemistry of food</td>
<td>LS</td>
</tr>
</tbody>
</table>
### Table 4 (continued)


<table>
<thead>
<tr>
<th>AFNR Pathway/Disciplinary Core Idea</th>
<th>NGSS Performance Expectation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power, Structural and Technical Systems</td>
<td></td>
</tr>
<tr>
<td>Sources of power</td>
<td>PS</td>
</tr>
<tr>
<td>Innovations and applied technologies within power, structural and technical systems</td>
<td>PS</td>
</tr>
</tbody>
</table>

Food security                  ETS  
Sustainable food production across the globe    LS  
Genetically modified foods and biotechnology  LS  

Natural Resource Systems  
Biodiversity                  LS  
Natural resource management       ESS  
Wildlife habitat               LS  
Use of natural resources        ESS  
Sustainability                 ETS  
Interaction of humans and natural resources  LS, ESS  
Ecosystem and energy transfer   LS  
Forestry and timber systems     LS  
Energy                        PS  
Cycles of matter               LS  
Innovations and applied technologies within natural resource systems  PS, ESS  
Climate change                 ESS  
Economics of resource utilization  ESS  
Data analysis, quantitative reasoning and calculation  LS  

Plant Science Systems  
Anatomy and physiology of plants  LS  
Genetics                       LS  
Plant reproduction             LS  
Environmental effects on plants  LS  
Growth and development of organisms  LS  
Biodiversity                   LS  
Innovations and applied technologies within plant systems  PS  
Hormones                       LS  
Energy conversion              PS  

**Journal of Agricultural Education** 307  
**Volume 59, Issue 1, 2018**
Conclusions

Supported by the findings of this study, AFNR and STEM are complex systems of knowledge and skills with overlapping ideas, concepts and abilities (Scherer et al., 2017). The Agriculture, Food and Natural Resources (AFNR) Career Cluster Content Standards (The Council, 2015a) are replete with STEM content and competencies. While technical STEM content is present in all pathways, it should be clearly noted, the identification of STEM knowledge and skills were limited to content that can be explicitly taught within curriculum grounded in the standards. Except for Agribusiness Systems, competencies within at least two STEM content areas can be explicitly taught within the remaining pathway standards. The most common areas, falling under STEM, in the standards are science and math. Engineering and technology are present, but to a lesser degree. The Environmental Service Systems Pathway serves as a broad foundation to develop curriculum to explicitly teach technical content in all areas falling under the STEM framework. Nevertheless, agricultural education serves as an effective context in which to teach and reinforce STEM technical content.

It is well known and documented, experiential learning activities engage students in authentic scenarios which support deeper and more complete content knowledge acquisition and application (Smith, 2015). Furthermore, experiential learning methods can be used to teach employability skills more effectively (Bunshaft et al., 2015). The findings from this study support the position of Wooten et al. (2013) who concluded STEM concepts exist in SAEs. Not only is STEM technical knowledge present in SAEs but, STEM-based employability. As the SAE program is inherently experiential, engaged participation in SAEs provides an effective medium to support STEM content knowledge acquisition and skill development in secondary AFNR students.

Bunshaft et al. (2015) indicated the National FFA Organization’s CDE program is an excellent career focused experiential learning model for developing STEM-based employability skills. The findings further support the conclusions of Bunshaft et al. and Lundry et al. (2015) that participation in CDEs exposes students to workplace competencies needed in the 21st century. The inclusion of team activities within the current CDE model provides, yet, another medium to engage students in scenarios which support effective workplace employability competencies. It should be further noted, while CDEs may not implicitly develop STEM content and competency knowledge, they do create an environment where participants are required to apply STEM content knowledge.

The findings from this study suggest STEM and AFNR education are not separate, standalone concepts. By its very nature, a comprehensive education in agriculture, food, and natural resources exposes students to and engages them in learning environments which support the development of content knowledge and skills required by contemporary and future STEM-based agriculture careers. Therefore, based upon the findings from this study, a modification to the current model of Agricultural Education (Phipps & Osborne, 1988) to include STEM education is proposed. The proposed model is illustrated in Figure 2.
Discussion

As the agricultural education profession promotes its place in the education fabric of the United States, as well as the global economy, the active enhancement of STEM education is imperative. It is clear, to be a successful member of today’s professional workforce, STEM knowledge and workplace employability skills are required. STEM education is naturally inherent to the standards by which agricultural education curriculum is developed and implemented. As the agricultural education profession self-evaluates, the concept of STEM education should be viewed as an integral component and not a concept viewed as separate, with the potential to be infused. Through examination of the vast STEM-AFNR paradigm, the agricultural education profession shoulders the responsibility to support future teachers and students by conducting methodologically sound research to explore the most effective methods by which the future workforce may be prepared.

The proposed model herein was not conceptualized for perpetuity. Rather, it is to be used as a foundation to support future research with the expectation that agricultural education scholars will continue to produce findings supporting STEM-AFNR education. It is my desire that the quality research produced by scholars will inform the profession in a manner which supports the conceptualization of a more comprehensive model to guide the academic preparation of future generations of STEM-AFNR students and professionals.

Recommendations for Practice

Based upon the findings and conclusions of this study, several recommendations are proposed. As the profession continues to solidify its place in education, teacher preparation faculty are encouraged to support the concept of the interconnected nature of STEM-AFNR principles. These professionals are encouraged to continue to incorporate effective methods to teach and highlight STEM concepts within the context of agricultural education.

As CDEs and SAEs are key components and sub-components within the agricultural education model, SBAE teachers are encouraged to continue implementing those elements into
comprehensive agricultural education programs. Teacher educators should continue to support well-rounded SBAE programs by incorporating effective instructional strategies regarding implementation of SAEs and additional FFA activities in preservice teacher education programs. STEM career readiness skills are present in National FFA CDEs. However, while not all STEM career standards are specifically noted in the CDE Handbook content standards matrices, the CDEs do require the skills necessary for future employment. It is further suggested to more deeply assess the STEM career readiness competencies and technical content existing within the specific CDEs.

Agricultural education provides an effective context in which to teach and enhance STEM concepts. Therefore, SBAE teachers along with college and university AFNR faculty should continue to promote the effective context agricultural education provides to teach STEM technical knowledge and career readiness skills to the general public and non-AFNR teachers, faculty, and education administrators.

**Recommendations for Research**

Future research studies should assess the efficacy for teaching STEM concepts in agriculture by incorporating the science, technology, engineering, and math standards cross-walked in the existing *Agriculture, Food and Natural Resources (AFNR) Career Cluster Content Standards* (The Council, 2015a). Implementing the cross-walked standards may provide insight into specific needs for which inservice teachers require additional support. To support this, future research should be conducted to determine the specific content topics which are not only explicitly taught, but those topics which can be highlighted within the existing *Agriculture, Food and Natural Resources (AFNR) Career Cluster Content Standards* (The Council, 2015a).

As agricultural education can be viewed as a context for teaching abstract STEM concepts (Myers & Dyer, 2004), little research exists documenting the best methods to deliver this content (Stone, 2011). However, Smith (2015) indicated grounding agricultural education in experiential learning theory along with differentiated instruction through cognitive sequencing, meeting the challenge to teach STEM concepts more effectively in agricultural education may be realized. Education researchers should continue to investigate effective teaching methods, both formal and informal, by which STEM concepts can be explicitly taught and highlighted. Findings from this research are recommended for implementation to better prepare preservice teachers to effectively employ those strategies within AFNR curriculum.

**References**


Myers, B. E., & Thompson, G. W. (2006). Integrating academics into agriculture programs: A delphi study to determine perceptions of the national agriscience teacher ambassador


The Council for Agricultural Education. (2015a). *Agriculture, food and natural resources (AFNR) career cluster content standards*. Indianapolis, IN: The Council for Agricultural Education.

The Council for Agricultural Education. (2015b). *Agriculture, food and natural resources (AFNR) career cluster example crosswalks*. Indianapolis, IN: The Council for Agricultural Education.


