

AGRICULTURAL EDUCATORS' ADOPTION OF INQUIRY-BASED LEARNING:  
THE EFFECTS OF BELIEFS ABOUT EDUCATION, SELF, AND CONTEXT

A Record of Study

by

KALYNN DAWN BALDOCK

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Chair of Committee,	Theresa Pesl Murphrey
Co-Chair of Committee,	John Rayfield
Committee Members,	Gary Briers
	Steve Frazee
Head of Department,	Scott Shafer

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## ABSTRACT

Agricultural education is responsible for preparing future generations to continually advance agriculture in a rapidly changing and growing world. How can agricultural education best prepare students to be innovative problem-solvers who can keep up with these changes? One way educators can engage students is to create learning experiences that allow students to uncover material through their own questioning and experimentation using inquiry-based learning (IBL).

The purpose of this study was to (a) determine how agricultural educators' characteristics affect the adoption of IBL; (b) determine how agricultural educators' beliefs about education, self, and context are related; and (c) determine how agricultural educators' beliefs about education, self, and context affect their adoption of IBL.

Agricultural educators' adoption of IBL was significantly affected by degree obtained and the agricultural pathway taught. A positive relationship was demonstrated between both IBL adoption and the orientation to teach substantive and procedural knowledge, with the higher correlation between procedural knowledge and the adoption of IBL.

Additionally, orientation to teach substantive and procedural knowledge was positively correlated with agricultural educators' self-efficacy to organize IBL activities. A positive relationship also existed between agricultural educators' perceived ability to implement IBL and the perceived abilities of their students to complete IBL activities. Of the variance in the adoption of IBL among agricultural educators, 26.5 percent could be attributed to the structural equation model of this study.

In conclusion, the adoption of IBL by agricultural educators is something that needs further research. However, this study indicates that beliefs about education, self, and context do affect the adoption of IBL by agricultural educators. Those agricultural educators with a higher self-efficacy in regard to creating IBL lessons and an orientation toward teaching procedural knowledge are more likely to adopt it in their classrooms. Programming should be developed that impacts these beliefs to encourage adoption of IBL.

## DEDICATION

This dissertation is dedicated to my family, without whom none of this would have been possible. To my husband for always understanding when I was overwhelmed by the amount of work I had to complete and for all the things that went unfinished while I was completing my dissertation. To my children for understanding when I could not be there because I had work to do and when I was distracted by the worries of what I needed to get completed. Hopefully, by being a part of me completing this dissertation, my children will have learned they can do anything they set their minds to if they work hard enough for it. To my parents for teaching me the value of hard work and dedication. To my mother- and father-in-law for always being supportive and editing first drafts of many assignments.

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## NOMENCLATURE

AIL	Adoption of inquiry-based learning
IBL	Inquiry-based learning
NAAE	National Association of Agricultural Educators
NKO	Nature of Knowledge
OTP	Orientation to teach procedural knowledge
OTS	Orientation to teach substantive knowledge
PCH	Perceived contextual hindrances
PSA	Perceived student abilities
SEF	Self-efficacy

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## CHAPTER I

### INTRODUCTION

Agricultural education is responsible for preparing future generations to continually advance agriculture in a rapidly changing and growing world (National Research Council, 2009). How can agricultural education best prepare students to be innovative problem-solvers who can keep up with these changes? Christensen, Garvin, and Sweet (1991), in their book *Education for Judgement*, explained that “to teach is to engage students in learning” (p. xiii). One way educators can engage students is to create learning experiences that allow students to uncover material through their own questioning and experimentation. Inquiry-based learning (IBL) is a teaching method that not only motivates students to learn but also helps them develop skills necessary to be successful throughout their lives (Dewey, 1910). This study examined the belief systems of agricultural educators about agricultural education, self, and context in regard to their adoption of IBL.

Philosophers and educators are continually trying to improve teaching methods. In recent history, educational reform has inspired the movement of teaching methods from teacher-driven to student-driven to meet the demands of a diverse learning population (Deboer, 2002; McCombs & Whisler, 1997). Student-driven teaching methods are based on constructivist theories positing that education should move away from traditional methods of only transmitting knowledge to methods allowing students to create their own understanding through interactions with both prior knowledge and

experiences and new experiences (Richardson, 1997). Further, educational policy organizations in the United States are encouraging schools to utilize activities that empower students to learn by engaging their thought and inquiry processes as used by scientists (American Association for the Advancement of Science, 1993; Mullis, Martin, Ruddock, O'Sullivan, & Preuschoff, 2009; National Research Council, 2011).

Constructivism is rooted in Piaget's Theory of Cognitive Development and Vygotsky's Sociocultural Theory, which indicate students' knowledge schemes are modified through activities, problem solving, and discussion (Driver, Asoko, Leach, Mortimer, & Scott, 1994; Schunk, 2004). In science classrooms, students use constructivism to interpret experiences that lead to discovery of the meaning and development of understanding (Palmer, 2005). According to Schunk (2004), the goal of constructivism is to provide students with an environment that motivates them to learn. Teaching strategies based on constructivism provide students with experiences, which empower them to develop their own knowledge schemes. Constructivist instructional methods include discovery learning, IBL, and peer-assisted learning (Schunk, 2004).

Inquiry-based learning (IBL) is a student-centered teaching approach most widely used in science. However, research has shown the benefits of IBL across domains such as agriculture, English, history, and science (Levy, Thomas, Drago, & Rex, 2013; Thoron & Myers, 2012). IBL allows for connections to be made across disciplines due to the fact that many problems require science, mathematics, reading, writing, and social studies concepts to investigate (Carin & Bass, 2001). With IBL, the teacher acts as a facilitator for the learners' thinking while the student takes

responsibility for their own learning (Donner & Bickley, 1993). The National Research Council (NRC, 2000) considers IBL to be the optimal teaching method for providing students with the opportunity to apply their knowledge to real-world applications. Students participate in activities which allow them to engage in scientifically oriented questions, give priority to evidence in responding to questions, formulate explanations from evidence, connect explanations to scientific knowledge, and communicate their justification for their explanations (NRC, 2000).

IBL is not new to agricultural education, as it has been utilized through project-based learning, problem-solving, and experiential learning for decades (Baker, Robinson, & Kolb, 2012; Dyer & Osborne, 1996; Moore, 1988; Phipps, Osborne, Dyer, & Ball, 2008). The National Research Council's Committee on Agricultural Education in Secondary Schools recommended more science be included in agricultural education (NRC, 1988). In response, some states, such as New Mexico, are already connecting their agricultural courses to Next Generation Science Standards (NGSS) (New Mexico Agricultural Education & FFA Association, n.d.). Meals and Washburn (2015) found that using agricultural contexts through outdoor education programs met the NGSS for the state. Next Generation Science Standards are conducive to IBL (Achieve, Inc., 2018). Integrating career and technical education into competency-based pathways is also being encouraged by education reform organizations (Achieve, Inc., 2015). Career and technical education courses, including agricultural science, provide students the opportunity to apply concepts learned in core classes, such as science, to real world situations within their realm of interest (Achieve, Inc., 2015).

Peasley and Henderson (1992) found that agricultural educators were either strongly supportive or strongly against science credit in agricultural education courses due to recruitment and retention concerns. Recruitment and retention of agricultural students is one of the biggest problems facing agricultural programs (Myers, Breja, & Dyer, 2004). One solution to the recruitment and retention problem was to adapt curriculum to include more science and technology (Myers et al., 2004). Utilizing IBL to teach science concepts through agriculture can improve students' attitudes toward their agricultural education classes (Thoron & Burleson, 2014), thereby aiding in retention.

Furthermore, as agricultural courses incorporate science concepts into their curriculum, it will become increasingly important to understand the factors that affect agricultural educators' adoption of IBL. Being unfamiliar with the factors involved with inquiry and IBL is one of the main reasons teachers do not incorporate IBL as a common practice in their classrooms but is not the only determining factor for IBL adoption (Loucks-Horsley, Hewson, Love, & Stiles, 1998; Voet & De Wever, 2017; Yilmaz, 2008). According to Voet and De Wever (2018), five activities to familiarize teachers with IBL exist: (a) immersion, (b) explicit-reflective instruction, (c) development of lesson plans, (d) reflection, and (e) extended support.

Teachers' beliefs and assumptions guide their actions within their classrooms (Kagan, 1992; Pajares, 1992; Woolfolk Hoy, Davis, & Pape, 2006). The beliefs a teacher holds about education mold their decision-making process and outcomes (Pajares, 1992). When teachers receive professional development that does not take

these beliefs into account, the impact of that development is argued to be minimal (Lotter, Rushton, & Singer, 2013). Capps, Crawford, and Constatas (2012) completed a review of current IBL professional development and discovered few studies assessing teachers' beliefs. Understanding teachers' beliefs about IBL in the agricultural classroom will allow for the development of professional development addressing these beliefs, thereby aiding in the adoption of IBL. An exploration into this area of study will establish support for current and future agricultural educators to successfully implement IBL in their classrooms.

### **Statement of the Problem**

Priority area four of the National Research Agenda for the American Association for Agricultural Education states, "Enhanced understanding of learning and teaching environments could result in the development of present-day best practices and research-based pedagogies and technologies that not only meet the goal of agricultural education but also society's greatest challenges" (Roberts, Harder, & Brashears, 2016, p. 39). Agricultural education courses offer the opportunity for enhanced science learning (Chaisson & Burnett, 2001; Ricketts, Duncan, & Peake, 2006; Theriot & Kotrlik, 2009). IBL has the ability to further increase students' research skills, scientific thinking, and reasoning abilities (Batdi, Semerci, & Aslan, 2018; Gormally, Brickman, Hallar, & Armstrong, 2009). The use of IBL opportunities within the agricultural classroom creates a learning environment that requires further research. IBL has many positive effects when implemented in the agricultural classroom, including students' motivation to take the course which can aid in the recruitment and retention of agricultural students,

as supported by the literature. However, the actual adoption of IBL in the agricultural classroom has not been widely researched. Examination of the current literature demonstrates need for further research to be conducted to determine the hindrances to adopting inquiry-based learning in the agricultural classroom. One hindrance to IBL is teachers' need for support and mentorship when implementing IBL (Liu, Lee, & Linn, 2010). For successful inquiry to occur in the classroom, teachers must see the value of inquiry, encourage others to utilize inquiry, and possess the skills necessary to help others understand inquiry as a way of gaining understanding (Welch, Klopfer, Aikenhead, & Robinson, 1981). Gaining a better understanding of the variables that can impact agricultural educators' adoption of IBL can improve professional development and pre-service teacher courses to include the support to overcome these variables and develop the necessary skills for the adoption of inquiry.

Guiding questions for the study were:

1. How do agricultural educators' beliefs about education affect their adoption of IBL?
2. How does agricultural educators' self-efficacy effect their adoption of IBL?
3. How do agricultural educators' beliefs about context affect their adoption of IBL?

### **Purpose and Objectives**

The purpose of this study was to examine the belief system of agriculture educators about agricultural education, self, and context in regard to their adoption of IBL. The objectives for the study were to

1. Determine how agricultural educators' characteristics, such as teaching degree and pathway taught, influence their adoption of IBL.

2. Determine how agricultural educators' beliefs about agricultural education, the self, and context of agricultural education are related to one another.
3. Determine how agricultural educators' beliefs about agricultural education, the self, and context of agricultural education influence their adoption of IBL.

### **Significance of Study**

This study carries significance for agricultural educators who are members of the National Association of Agricultural Educators (NAAE), as well as agricultural educators across the United States. The NAAE develops and provides professional development for agricultural educators annually at the national conference and at regional conferences throughout the year. Many of the professional development opportunities presented at these conferences involve IBL, such as the National Agriscience Teacher Ambassadors program. This study will provide information on how to improve IBL professional development that will help raise the likelihood of agricultural educators adopting this strategy for their classrooms.

Previous research has shown that one of the main reasons teachers do not adopt IBL is due to a lack of understanding of and familiarity with this teaching method (Loucks-Horsley et al., 1998; Voet & De Wever, 2017; Yilmaz, 2008). To provide teachers with a deeper understanding of and familiarity with IBL, it is important to provide professional development focused on aiding teachers in the adoption of IBL. This study provides information on the barriers to the adoption of IBL in agricultural classrooms to aid in the creation of professional development addressing the needs of agricultural educators. Agricultural educators across the country can use this

information to develop a better understanding of their own barriers to the adoption of IBL. This will allow teacher educators to develop pre-service education opportunities for the adoption of IBL in the agricultural classroom, as well as creating IBL professional development opportunities for current agricultural educators.

### **Theoretical Base**

Voet and De Wever (2018) developed a framework of beliefs concerning the adoption of IBL in regard to history teachers. Their framework posits that teachers' beliefs about education, self, and context impact their adoption of IBL in the classroom. Within this framework, teacher belief systems are further categorized into five categories: (a) conceptions of the nature of knowledge, (b) orientation towards teaching, (c) self-efficacy, (d) contextual hindrances, and (e) perceived student abilities. Voet and DeWever (2018) posited that their framework could be utilized in other domains in addition to history. Understanding how these belief systems affect teachers' adoption of IBL will aid in the development of pre-service teacher training, as well as teacher professional development. This framework was adapted to be utilized as the theoretical basis for this study about agricultural educators' adoption of IBL.

### **Delimitations**

The data from this study were limited to the randomly selected members of the National Association of Agricultural Educators (NAAE). These data were collected from November 2018, through January 2019.

## **Assumptions of Study**

The following assumptions were made for the purpose of this study: (a) participants answered the survey honestly and thoughtfully, and (b) the sample is representative of National Association of Agricultural Educator members.

## **Definitions of Terms**

Following is a list of terms as defined pertaining to this study.

- **Adoption of IBL:** The extent to which teachers implement IBL into agricultural lessons.
- **Agricultural Education:** Represents the profession of teaching students about agriculture and the various Agriculture, Food, and Natural Resource (AFNR) pathways.
- **Agricultural Educator:** Someone who teaches agricultural classes at the secondary and post-secondary level.
- **Conceptions of the Nature of Knowledge:** Epistemological beliefs which form the conception about how knowledge is constructed and evaluated (Hofer, 2001).
- **Experiential Learning:** This method provides students with concrete experiences and the opportunity to participate in reflective observation. These observations lead to abstract conceptualization and active experimentation (Baker et al., 2012).
- **Inquiry:** “A multifaceted activity that involves making observations; posing questions; examining books and other sources of information to see what is already known; planning investigations; reviewing what is already known in light of experimental evidence; using tools to gather, analyze, and interpret data; proposing

answers, explanations, and predictions; and communicating the results” (NRC, 1996, p. 23).

- Inquiry-based Learning (IBL): This teaching method is rooted in the philosophy of John Dewey. Inquiry-based learning activities begin with a question that is then investigated in order to develop new knowledge as discoveries are made and reflection of the findings occur (Stavery, 2015).
- National Association of Agricultural Educators: A federation of state agricultural educators’ associations. “Members are involved in school-based agricultural education at any level, from middle school through postsecondary, and state and national agricultural education leaders (NAAE, n.d.)”
- Orientation Toward Teaching: The goals and purpose which guide teachers’ approaches to classroom instruction (Grossman, 1990; Magnusson, Krajcik, & Borko, 2001).
- Perceived Contextual Hindrances: Obstacles within a complex classroom which might hinder a teacher from providing the instruction they desire based on their ideas about teaching and learning (Fang, 1996).
- Perceived Student Ability: The teacher’s perception of students’ ability to accomplish a task (Van Hover & Yeager, 2003).
- Problem-based Learning: Learner-centered approach allowing the learner to conduct research and apply knowledge and skills to determine a solution to the problem (Walker, Leary, Hmelo-Silver, & Ertmer, 2015).

- Project-based Learning: Blumenfeld et al. (1991) describe project-based learning as a way to teach students through investigations. These investigations involve two components: a question or problem and artifacts developed into a final product addressing the question or problem.
- Self-Efficacy: A teacher's judgement of their abilities to accomplish a set goal (Tschannen-Moran & Hoy, 2001).

## CHAPTER II

### REVIEW OF LITERATURE

Inquiry-based learning is not something new to the educational setting or to agricultural education. Science educators were some of the first to utilize IBL as it is the basis of scientific discoveries. This chapter will explore IBL and its use in classrooms across different domains, including agriculture, and some of the benefits and issues that arise when utilizing IBL.

#### **Inquiry-Based Learning (IBL)**

Inquiry-based learning (IBL) is a form of constructivist learning (Schunk, 2004). The basic principles of constructivism are that learners construct their own knowledge schemes, new information is evaluated based on how it relates to the learner's prior knowledge, and sometimes these knowledge schemes are reconstructed or the learner's understanding of the concept is changed due to the new information. One constructivist approach is IBL, an approach that allows students to solve problems or questions without giving them background knowledge prior to the activity (Good & Brophy, 2003). Constructivism is rooted in Piaget's Theory of Cognitive Development and Vygotsky's Sociocultural Theory, which indicate students' knowledge schemes are modified through activities, problem solving, and discussion (Driver et al., 1994; Schunk, 2004).

According to these two theories, students learn through interacting with the world around them and peers (Sparks-Langer et al., 2004). The Theory of Cognitive

Development created by Piaget suggested children's cognitive development develops through four distinct phases, with individuals progressing through the stages at different rates. Also, these individuals organize the knowledge they receive into schemes. Individuals then learn by adapting these schemes to information gained from new experiences. As an individual has more experiences, their schemes are modified to make sense of the new observations until cognitive equilibrium is reached. Cognitive equilibrium is reached when the schemes are completely adapted to the new experiences (Phipps et al., 2008).

Unlike Piaget, Vygotsky believed cognitive development was a result of interactions with others and that learning comes before development. The zone of proximal development is the fundamental concept of Vygotsky's Sociocultural Theory. When students are presented with problems or questions they cannot solve alone but can answer with the help of a peer or adult with more knowledge, those students are in the zone of proximal development. Vygotsky's theory also incorporates scaffolding: assisting students at the beginning of learning and systematically stepping away to allow the student to be completely responsible for their own learning (Phipps et al., 2008).

Beginning in the 1950s, the United States began to see a push to reform the teaching of science. In the 1960s, three approaches for this goal were developed: Science-A Process Approach (SAPA), Science Curriculum Improvement Study (SCIS), and the Elementary Science Study (ESS). Each of these approaches had a different focus: SAPA focused on processes, SCIS on concepts, and ESS on learning through investigation. Later, the National Science Foundation (NSF) funded programs that

continued to push for reform to make science an action that students would actively participate in to learn. In the 1980s, a movement supported by these programs began to create national standards for science. The resulting National Science Education Standards emphasized the need for students to participate in inquiry-based activities (Carin & Bass, 2001).

IBL can be traced back to the educational philosophy of John Dewey (1910). Dewey (1916) described IBL by noting experience is nothing without reflecting on the relationships that experience has with prior knowledge. Prince and Felder (2006) described inductive teaching as teachers providing data, observations, or real-world problems to students who then solve them by deriving and using general concepts or knowledge as necessary to understand their findings. IBL is also a form of inductive teaching that utilizes data, observations, and real-world problems to teach. Anderson (2002) acknowledged three markedly distinct uses of inquiry in the literature: scientific inquiry, inquiry learning, and inquiry teaching. Scientific inquiry is the process scientists utilize to unearth new discoveries and make connections between established concepts and novel ideas. Inquiry learning is often known as the basis of all learning and is the actual process used by students to learn. IBL, a more defined and specific process, begins with a question followed by an investigation leading to the acquisition of new knowledge through the reflection and discussion of the findings (Stavery, 2015). While no exact definition was found for inquiry teaching, it is considered a desired teaching method for science. Inquiry teaching is simply the actual teaching method of

utilizing IBL in the classroom. An IBL opportunity has been described by the National Research Council's (1996) standards as:

A multifaceted activity that involves making observations; posing questions; examining books and other sources of information to see what is already known; planning investigations; reviewing what is already known in light of experimental evidence; using tools to gather, analyze, and interpret data; proposing answers, explanations, and predictions; and communicating the results. Inquiry requires identification of assumptions, use of critical and logical thinking, and consideration of alternative explanations. (p. 23)

According to Pedaste et al. (2015), inquiry-based activities go through five general phases: orientation, conceptualization, investigation, conclusion, discussion and reflection. The inquiry process begins with orientation then flows through the phases with discussion and reflection occurring throughout each of the other phases. The National Research Council (NRC) (2000) also divides inquiry into five phases; however, they describe the five phases as engagement in scientifically oriented questions, priority to evidence in responding to questions, formulation of explanations from evidence, connection of explanations to scientific knowledge, and communication and justification of results (NRC, 2000). The five phases described by NRC (2000) fit into the inquiry process described by Pedaste et al. (2015) but are more easily utilized to create inquiry-based curriculum due to the aids and materials the NRC has created for teachers.

Welch et al. (1981) determined inquiry in the classroom involves a multitude of different methodologies including lectures, experiments, student-initiated inquiry,

discussions and debates. In classrooms where inquiry is being utilized, the instructor is simply a facilitator of the learning process who models for students how to think through problems, find errors, and discover answers (Welch et al., 1981). As a role model, the instructor creates an environment which encourages students to ask questions and become risk takers in their own learning. This environment implements “a time for doing...time for reflection...time for feeling...and time for assessment” (p. 35). Thus, instructors are the most important factor in implementing inquiry in the classroom. For successful inquiry to occur in the classroom, instructors must see the value of inquiry, encourage others to utilize inquiry, and possess the skills necessary to help other understand inquiry as way of gaining understanding (Welch et al., 1981).

Successful IBL should be student centered (Blumenfeld et al., 1991; Roth & Bowen, 1995), involve real world, authentic questions or problems (Brown, Collins, & Duguid, 1989; Crawford, 2000; Krajcik et al., 1998; Marks, 2000; Roth & Bowen, 1995), collaborative (Brown et al., 1989; Marks, 2000; Roth & Bowen, 1995; Singer, Marx, Krajcik, & Chambers, 2000), reflective (Toulmin, 1982), produce products or artifacts to defend argument (Blumenfeld et al., 1991; Krajcik et al., 1998; Roth & Bowen, 1995; Singer, Marx, Krajcik, & Chambers, 2000), and allow for the discussion of failures and misconceptions (Brown et al., 1989). First, for the problem to be real-world or authentic to the student, it must be something they value or find interesting, and there cannot be predetermined correct responses (Sparks-Langer et al., 2004). To support the need for a focus on data, Carin and Bass (2001) suggested students need to be connected to science, technology, and society (STS). A method used to develop STS-

connected students is the Search, Solve, Create, Share, and Act model created by Pizzini, Bell, and Shepardson (1988). This model allows students to learn, practice, and refine problem-solving skills. With this model, the students cycle through this inquiry process until they solve the problem instead strictly following a linear, rigid process.

Many of the recent Common Core Standards stress critical-thinking, problem-solving, and analytical skills, which are the components of IBL (National Governors Association, n.d.). IBL has been found to be effective across multiple domains, including agriculture, English, history, mathematics, physics, and science (Jeskova et al., 2016; Levy et al., 2013; Thoron & Myers, 2012). Levy et al. (2013) found IBL allowed science students to engage in conversations with their teachers about the validity of the chosen data collection method, while in history classrooms it bolstered students' ability to analyze information. Levy et al. also determined that IBL in English classrooms allowed students to witness different ethical positions (2013). Thoron and Myers (2012) found IBL in the agriscience classroom improved students' scientific reasoning abilities. Finally, Teig, Scherer, and Nilsen (2018) discovered a positive relationship between students' achievements in science classes and IBL.

#### *Benefits of IBL*

Benefits of IBL have been documented in the literature. Minner, Levy, and Century (2009) synthesized results of 138 studies about IBL and found it had a positive effect on the learning of content, retention of content, and conceptual understanding of students. Additionally, teachers who received training in IBL reported that, although both teachers and students struggled when implementing such instruction into the

agriculture classroom, the students eventually gained confidence with the method and learned more from IBL than other methods (Blythe, DiBenedetto, & Myers, 2015). Further, teachers who persevered had more engaged classrooms and were more comfortable with IBL (Blythe et al., 2015). Akpulluku and Gunay (2015) conducted a case study about students' perceptions of IBL, unveiling that students enjoy IBL and understand the importance of learning by doing. Additionally, post-secondary business students were more involved in learning and had increased knowledge when faculty used IBL (Zafra-Gomez, Roman-Martinez, & Gomez-Miranda, 2015). Agricultural classes naturally lend themselves to IBL. However, there is limited research about why agricultural educators are not using this method.

IBL has been found to enhance student learning across science disciplines and mathematics, as well across grade levels in public schools and universities (Sawada et al., 2002). Students' understanding of science content can be aided through IBL by allowing them to confront their own gaps in knowledge (Hiebert et al., 1996). Often, these knowledge gaps are realized through failures in students' inquiry activities (Schank, 1999). IBL facilitates this knowledge gain process by requiring knowledge acquisition, uncovering new scientific principles while refining existing knowledge of scientific principles, and by requiring students to reorganize their scientific knowledge and create connections (Edelson, Gordin, & Pea, 1999). In summary, teachers can present information to students, but students must construct knowledge on their own (Sparks-Langer et al., 2004).

IBL helps students develop and improve their research skills, scientific thinking, and reasoning abilities (Batdi et al., 2018; Gormally et al., 2009). In 1998, Mao, Chang, and Barufaldi discovered an increase in students' test performance and comprehension of earth science concepts when IBL was utilized, but there was not a significant difference in students' factual knowledge compared to traditional teaching. Later, inquiry-based activities in agriscience classrooms were found to increase middle school students' science comprehension (Skelton, Blackburn, Stair, Levy, & Dormody, 2018). Not only do middle and high school students exposed to IBL exhibit higher scores and more growth, these students also demonstrate higher long-term retention of the material than students in traditional classrooms (Blanchard et al., 2010). More knowledge is committed to students' long-term memory through IBL activities: more connections are formed as students gain new experiences (Sparks-Langer et al., 2004).

Utilizing a standards-based inquiry curriculum improves standardized achievement test scores for underserved urban students, while also reducing the gap in achievement between African-American boys and girls (Geier et al., 2008). Further, students exposed to IBL have been found to exhibit increased integrated science abilities, as well the ability to outperform students in traditional learning environments on standardized test questions (Liu et al., 2010). Tretter and Jones (2003) discovered there was not a significant difference in standardized test scores for IBL classrooms but noted increased participation, higher overall grades, and more uniform achievement when IBL was utilized. Shymansky, Kyle, and Alport (1983) discovered students using more inquiry than traditional science curricula had improved skills development, a more

positive attitude, and higher achievement. Weinstein, Boulanger, and Walberg (1982) had previously discovered that innovative teaching methods such as inquiry resulted in high student achievement.

A meta-analysis conducted by Batdi et al. (2018) revealed IBL increases students' eagerness to learn, creating a positive attitude and increased interest in the subject matter. Further, Batdi et al. (2018) also completed a meta-analysis which indicated that the use of IBL increases students' desire to work in groups and participate in discussions. Gibson and Chase (2002) reported that students are more motivated to work hard in science classes when opportunities to ask questions and design experiments to find answers are present, suggesting that students will work harder in classes where IBL activities are utilized. Gormally et al. (2009) found students in inquiry-based laboratories had increased self-confidence in their science knowledge and skills, however students in a traditional laboratory demonstrated a larger growth in their self-confidence. The fact that students in a traditional laboratory demonstrated a greater growth in self-confidence might be attributed to the fact that inquiry-based learning is more difficult for students, possibly diminishing their confidence levels due to the amount of struggling that occurs (Krajcik et al. 1998; Achilles & Hoover, 1996; Edelson et al., 1999). Finally, IBL aids students in the ability to plan and complete goal-oriented tasks (Dieker & Hines, 2014).

### *Challenges of IBL*

Kuhn, Black, Keselman, and Kaplan (2000) questioned whether students in elementary and middle school had the cognitive abilities necessary for IBL. Their

findings suggested inquiry-based activities are not appropriate for this age group because students do not possess the skills necessary to perform these activities. The authors do not discourage the use of IBL, but rather recommend making sure the necessary steps are taken to develop students' cognitive skills to deal with multivariate situations. Further, Edelson et al. (1999) discussed five challenges to students participating in IBL. These include motivation to participate, understanding how to investigate, adequate background knowledge, ability to organize complex activities, and the learning environment's constraints.

Another challenge of IBL is the various roles that instructors must adopt for success. Crawford (2000) listed ten roles adopted by a successful inquiry-based instructor: motivator, diagnostician, guide, innovator, experimenter, researcher, modeler, mentor, collaborator, and learner. As a motivator, the teacher encourages students to take ownership in their own learning. When acting as a diagnostician, the teacher has students reflect on their learning to gain a better understanding. At times, students require direction, and the teacher must assume the role of a guide. Implementing inquiry-based activities requires a teacher to be an innovator in creating new lessons. During the adoption of inquiry-based activities, the teacher must become an experimenter with new ways of teaching and assessing students. Reflecting after teaching inquiry-based activities will require the teacher to be a researcher, solving issues that arose during implementation. For the students to successfully and willingly display attitudes and characteristics of a scientist, the teacher must model the way scientists operate. Occasionally, it will be necessary to help students and for teachers to

serve as a mentor. At other times, the teacher will act in a more traditional role as a collaborator, sharing their knowledge with the students. The last role Crawford describes is a learner: the teacher has an open mind and is willing to learn new concepts.

### *Teachers' Role in IBL*

When teaching inquiry, the teacher must be able to balance providing information to students to reach the lesson's desired goals with allowing students to pursue their own answers through their inquiry activities (Carin & Bass, 2001). Teachers can gauge their success in utilizing IBL based on their ability to guide students through the seven parts of IBL: (a) students are thinking about the natural world; (b) students are allowed to explore systems of objects and organisms on their own; (c) the teacher asks simple questions to guide students' investigations; (d) students gather relevant information and data to answer their question; (e) time is given for students to hear how others interpret the data and information; (f) students defend their understanding of the phenomena being studied; and (g) students are given an opportunity to reflect on their own and peers' understanding to begin making connections with evidence and prior knowledge (Carin & Bass, 2001).

### *IBL in Agricultural Education*

The philosophy of agricultural education is to teach students by allowing them to have direct encounters with the phenomena being taught: learning by doing. Instruction in agricultural education focuses on problems and questions affecting the agricultural industry (Phipps et al., 2008). Since the focus of agricultural education is on questions and problems, it easily lends itself to the incorporation of IBL.

In recent years, there has been a push for agricultural classes to incorporate more science into their curriculum to aid with standardized testing. Shelley-Tolbert, Conroy, and Dailey (2000) investigated the need for integrating science into agricultural classrooms, examining perceptions of agricultural educators and others involved in agriculture about shifting the agricultural curriculum toward more science and this change's effects on teacher education programs. Those interviewed expected an increase in enrollment of higher-achieving students, which could lead to agriculture reaching a wider audience. Some respondents felt science should be integrated, but only marginally to prevent discouraging those students who need vocational skills from enrolling (Shelley-Tolbert et al., 2000). Overall, Shelley-Tolbert et al.'s (2000) findings suggest not only do teachers perceive a need to integrate science into agriculture, but undergraduate students, graduate students, staff, and those in the agriculture workforce also believe there is a need. Myers, Thoron, and Thompson (2009) examined the perceptions of participants in the National Agriscience Teacher Ambassador Academy (NATAA) regarding the integration of science into agriculture courses. The majority of teachers felt integrating science increased problem-solving ability and students were better able to understand agriculture concepts. Teachers in this study also believed integrating science will lead to more high-achieving students enrolling in agriculture courses and an overall increase in agriculture course enrollment (Myers et al., 2009). Thompson and Warnick (2007) reported that not only did agricultural educators believe that science integration would improve students' science scores on state standardized tests, but the majority of science teachers interviewed also agreed.

As the need for improved science scores on standardized tests has continued to grow, the National Research Council recommended the implementation of more inquiry-based instruction (NRC, 1996; NRC, 2000; NRC, 2011). Next Generation Science Standards, which are being adopted by several states, strive to bolster students' critical thinking, problem solving, and grasp of scientific principles which can be aided through IBL (Achieve, Inc., 2018). Skelton et al. (2018) concluded that inquiry-based teaching methods in agricultural units of instruction were beneficial to secondary students' science skill and comprehension.

Agricultural educators have been utilizing components of IBL for decades through project-based learning, problem-solving, and experiential learning (Baker et al., 2012; Dyer & Osborne, 1996; Moore, 1988; Phipps et al., 2008). Project-based learning has been a part of agricultural education since it began. Blumenfeld et al. (1991) describe project-based learning as a way to teach students through investigations. These investigations involve two components: a question or problem and artifacts developed into a final product addressing the question or problem. Smith and Rayfield's (2016) examination of project-based learning in agricultural science unveiled the shift of project-based learning from being utilized in the agricultural classroom to apply concepts taught in the classroom to being utilized to allow students to learn new concepts while acquiring new knowledge. The newer method of using project-based learning to teach new concepts and knowledge is a facet of IBL where students explore to discover the information.

Secondly, the problem-solving method of teaching highlights the central theme of educating students through solving a problem (Olowa, 2009). Parr and Edwards (2004) synthesized research on inquiry-based and problem-solving methods in both science and agricultural education discovering significant agreement between the two pedagogical strategies. In agricultural classrooms, utilizing a problem-solving approach increases student's scores on achievement tests when compared to a subject matter approach (Dyer & Osborne, 1996). Teaching agricultural science utilizing the problem-solving method has been recommended as one of the most effective methods for the agricultural classroom (Phipps & Osborne, 1988). With the problem-solving method, students can either come up with a problem on their own or they are given one by their teacher (Olowa, 2009), much like IBL students who find the solution to a problem through their own experiences. Often with IBL, the question students are answering is a problem that needs to be solved. The primary difference between IBL and the problem-based method is the role the instructor plays. In IBL, the instructor acts as a facilitator of learning and provides students with information when needed. However, with the problem-based method, the teacher supports the process but does not provide any information: this is the responsibility of the student (Walker et al., 2015).

Lastly, experiential learning has also been a part of agricultural education from its inception. This method provides students with concrete experiences and the opportunity to participate in reflective observation. These observations lead to abstract conceptualization and active experimentation (Baker et al., 2012). Experiential learning can involve inquiry when all phases of experiential learning are implemented according

to the processes illustrated by Kolb's model, however these phases and processes are often not followed in the agricultural classroom (Arnold, Warner, & Osborne, 2006; Cheek, Arrington, Carter, & Randell, 1994). For example, students may be provided all the information needed for the experience and do not need to actively inquire during the experience. While project-based learning, problem-solving, and experiential learning can each include inquiry, these methods are not always implemented in a manner utilizing IBL. IBL is not new to agricultural education. However, it may not always be used with the intent of allowing students to learn completely through inquiry.

In recent years, researchers have begun investigating the benefits of IBL opportunities in agricultural classrooms. Some agricultural educators already incorporate IBL into their classrooms on a regular basis. Washburn and Myers (2010) studied agricultural educators in the state of Florida and found that teachers implemented teacher-oriented inquiry three times per week and student-oriented inquiry at least once per month. IBL opportunities are those activities allowing students to pose questions, make observations, and formulate explanations for their findings (NRC, 2000). Witt, Ulmer, Burriss, Brashears, and Burley (2014) found students spent more time engaged in agricultural lessons when IBL was utilized. Thoron and Myers (2012) discovered IBL in the agriscience classroom increased students' scientific reasoning. Thoron and Myers (2011) had previously concluded that inquiry-based instruction improved students' content knowledge when utilized in the agriscience classroom. Additionally, students had a more favorable opinion of agriscience and positive responses regarding the importance of agriculture when taught through IBL activities (Thoron & Burleson,

2014). Further, researchers have found that IBL improves students' attitudes both toward agriculture in their daily lives and their agriscience classes (Thoron & Burleson, 2014).

Multiple studies have been conducted to examine teachers' perceptions and attitudes about inquiry-based instruction (Blythe et al., 2015; DiBiase & McDonald, 2015). Voet and De Wever (2018) found history teachers' adoption of IBL was significantly impacted by their self-efficacy related to organizing IBL activities and the perceived hindrances of implementing these activities. Further, Thoron, Myers, and Abrams (2011) found, with proper training, agricultural teachers to have positive attitudes towards utilizing inquiry-based instruction.

#### *Known Barriers to IBL Adoption*

Barriers to the adoption of IBL are not a new concept. Research has found various impediments to teacher adoption of IBL in content areas other than agriculture. Some of these include lack of time, lack of experience with IBL, and lack of inquiry-based professional development (Pozuelos, Gonzalez, & de Leon, 2010). Dorier and Garcia (2013) identified five key areas in which support was needed for the large-scale implementation of IBL in science and mathematics: national policies, didactical resources, national assessments, pre-service teacher training, and professional development. Likewise, Gutierrez (2015) discovered the successful implementation of IBL was often hindered by a lack of support, training, and available materials for IBL. Blythe et al. (2015) also discovered teachers' perceptions of the amount of time required to implement IBL was often a barrier. Furthermore, class size, accountability, curricular

restraints, and support from administration are also recorded as barriers for adopting IBL (DiBiase & McDonald, 2015). In 2006, Gejda and LaRocco reported that sixty-eight percent of teachers believed time was the biggest barrier to adopting IBL.

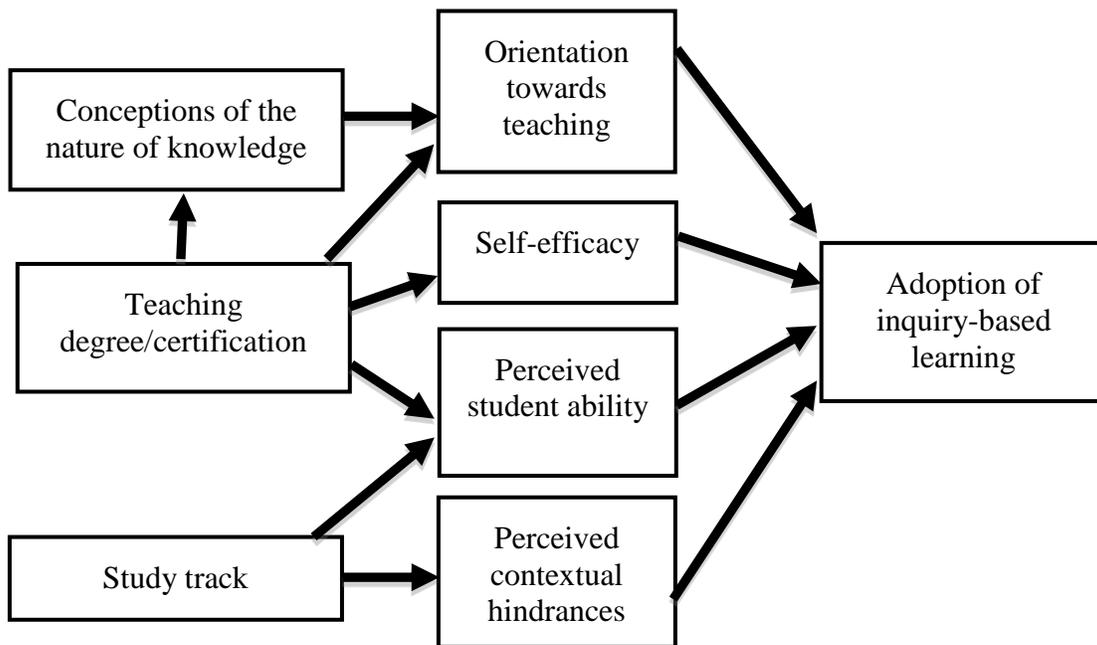
There are many factors that can influence adoption of IBL. Voet and De Wever (2018) found the adoption of IBL in the history classroom was affected by teachers' beliefs about education, self-efficacy, and the context. Reiff's (2002) results suggested teachers do not utilize IBL due to their own beliefs about IBL. Understanding the barriers associated with the adoption of IBL will help in the development of professional development to support teachers in their journey to the adoption of IBL. Further, Blythe et al. (2015) discovered often one of the biggest challenges to IBL adoption is the process of personal change.

Another barrier to the adoption of IBL is self-efficacy. Many teachers do not have the confidence to implement IBL in their first year, however those that implemented IBL in the first year and continued to utilize it gained more confidence during year two and three of IBL (Blythe et al., 2015; Thoron et al., 2011). As teachers' self-efficacy with IBL increases, they are more comfortable using it in their classroom and reported it to require less effort in a class period than other teaching methods (Blythe et al., 2015).

### **Conceptual/Theoretical Framework**

The framework for this study was based on the work of Voet and De Wever (2018) in regard to teacher adoption of IBL. Voet and De Wever (2018) developed a theoretical model (Figure 1), which suggests history teachers' adoption of IBL is

dependent on their beliefs about education, self-efficacy, and the context in which they teach. This model can be used to investigate the adoption of IBL in other domains, such as agriculture. This study seeks to utilize this framework to determine how agricultural educators' beliefs about education, self-efficacy, and context affect the adoption of IBL.



*Figure 1.* Theoretical framework to investigate adoption of IBL in agriculture. Adapted from “Teachers’ Adoption of Inquiry-Based Learning Activities: The Importance of Beliefs about Education, the Self, and the Context,” by M. Voet and B. De Wever, 2018, *Journal of Teacher Education*, p. 4.

Schoenfeld (1983) suggested that a person’s behavior is dependent on their beliefs about the task, oneself, and the environment. A person’s beliefs were further broken into the dimensions of education, self, and context by Op ‘t Eynde, De Corte, and Verschaffel (2002). According to Fang (1996), it has been suggested that teachers have

certain beliefs about the subject they teach, their students, and their responsibilities as teachers which influence their teaching practices. Further, it has been implied that teachers' beliefs act as a screen used to help make decisions about their teaching methods (Fang, 1996; Shavelson, 1983; Shavelson & Stern, 1981). Pajares (1992) argues that teachers' beliefs are an important area for future research for improving teaching methods. Voet and DeWever (2018) suggested the teacher belief systems be further divided into five categories (a) conceptions of the nature of knowledge; (b) orientation towards teaching; (c) self-efficacy; (d) contextual hindrances; (e) perceived student abilities.

### **Beliefs about Education**

Epistemological beliefs are important to academic experiences because they influence the reasoning and judgment of both students and educators (Hofer, 2001). Depending on the domain being taught epistemological beliefs often differ but are influenced by domain-general beliefs (Muis, Bendixen, and Haerle, 2006). Husbands (2011) suggested that instructors who placed a higher priority on procedural knowledge would be more likely to engage their students in reasoning activities. Nespor (1985) conducted a two-year Teachers' Belief Study, reporting that teachers' beliefs shape the objectives and goals teachers set for the classroom. Gess-Newsome and Lederman (1999) discovered from a review of literature that science teachers can be categorized into nine categories based on their educational beliefs. The educators generally put more effort into developing instructional activities that most closely matched their beliefs. One of the nine categories was identified as inquiry, meaning that educators in this category

would be more likely to develop lessons that involved learning science through inquiry (Gess-Newsome & Lederman, 1999). Van Driel, Bulte, and Verloop (2007) discovered that chemistry teachers' beliefs could be grouped into two categories: subject matter oriented and learner-centered. Therefore, these beliefs guide educators in developing their classroom activities, even agricultural educators. Mary Budd Rowe, an influential and innovative figure in inquiry learning, wrote:

Attitudes, beliefs, and feelings teachers have about what science is and what it should accomplish will influence their ways of carrying out instruction. If the meaning they attach to inquiry and problem solving in science implies finding the right answers, then they will focus on teaching and testing for the facts. They will be less interested in making inferences and constructing explanations based on data, because it is not part of their vision or personal experience of science. If, however, they hold an alternative, more comprehensive vision of science, they will encourage discussions, dialog among students and comparisons of competing explanations... In the less traditional view, experiments are a way of asking questions of nature, and science is a special form of making stories about how the world works. (Carin & Bass, 2001, p. 17)

Beliefs held by educators influence their teaching approaches. Rice and Kitchel (2018) discovered agricultural educators believe the purpose of agricultural education is for career and college preparation, agricultural literacy, and practical life skills. The beliefs agricultural educators held about agricultural education shaped the focus of their courses and the skills taught to their students (Rice and Kitchel, 2018). Not surprisingly,

Rice and Kitchel (2018) also found agricultural educators believed agricultural education should be taught using hands-on and real-world experiences.

Even when teachers' beliefs follow a more constructivist, student-centered approach, this is not always reflected in the classroom (Kaymakamoglu, 2018). However, teachers' beliefs have been linked to student achievement (Good, 1987) and to their use of scientific inquiry (Moar & Taylor, 1995). Luft (2001) discovered professional development aided in changing new teachers' beliefs from teacher-centered to more student-centered constructivist beliefs and the caused similar changes in the practices of experienced teachers. More specifically, agricultural educators' beliefs about the purpose of agricultural education and their students' abilities affects the instructional strategies utilized. Understanding how these beliefs affect their adoption of IBL can lead to the development of professional development for beginning agricultural educators to shape their beliefs about IBL in the agricultural classroom.

### **Beliefs about Self**

It has been postulated that self-efficacy is a determining factor in the activities and environment created by a person (Lent, Brown, & Hackett, 1994). Self-efficacy is indicative of career and academic choices and performance indicators (Hackett & Lent, 1992; Multon, Brown, & Lent, 1991; Sadri & Robertson, 1993). Even though self-efficacy involves a person's self-conceived belief about their capabilities, only moderate relationships have been found with actual capabilities (Betz & Hackett, 1981; Lent, Brown, & Larken, 1986). However, Bandura's social cognitive theory postulates a

strong sense of self-efficacy is necessary to effectively complete difficult or challenging tasks (Bandura, 1991).

Teacher self-efficacy is the teachers' belief in their capability to reach certain goals (Tschannen-Moran & Hoy, 2001). Student achievement (Ashton & Webb, 1986; Gulistan, Hussain, & Mushtaq, 2017; Ross, 1992; Shahzad & Naureen, 2017), motivation (Lazarides, Bucholz, & Rubach, 2018; Midgley, Feldlaufer, & Eccles, 1989; Pan, 2014), and self-efficacy (Anderson, Greene, & Loewen, 1988) can be directly related to teacher self-efficacy. A teacher's orientation toward teaching has also been linked to their own level of self-efficacy (Anderson et al., 1988). Teachers' beliefs about their self-efficacy in teaching students is positively linked to their perception of students' abilities (Ashton & Webb, 1986). Therefore, a teacher with a stronger belief of self-efficacy is more likely to believe that all their students can learn the material. High self-efficacy teachers demonstrate improved classroom management and classroom awareness, monitor student work, and encourage students more than their low self-efficacy peers (Ashton & Webb, 1986). Teachers with higher self-efficacy have a more positive attitude toward utilizing inquiry in their classrooms (Silm, Tiitsaar, Pedaste, Zacharia, & Papaevripidou, 2017). Further, teachers with high self-efficacy have been found to be more resilient when lessons do not go as planned (Ashton & Webb, 1986). These findings support Bandura's (1977) hypothesis that self-efficacy can determine the amount of effort and resilience a person demonstrates during obstacles. Therefore, teacher self-efficacy may be one of the multiple challenges affecting IBL adoption and implementation in agricultural classrooms.

## **Beliefs about the Context**

Often the classroom environment influences the decisions a teacher makes in regard to their instructional practices. Regardless of the beliefs a teacher has about education, sometimes there are contextual factors that affect their instructional practices (Ashton, 1990; Duffy & Anderson, 1984; Fang, 1996).

### *Beliefs about Hindrances*

Incorporating inquiry-based instruction into the agricultural classroom brings with it many challenges for both teachers and learners (Edelson et al., 1999; Luft & Roehrig, 2007; Quigley, Marshall, Deaton, & Cook, 2011), as implementing IBL learning does not happen without teachers developing their own beliefs about hindrances. When implementing IBL into the agricultural classroom, teachers adapt their current content to the new methodology (Blythe et al., 2015). However, agricultural teachers reported that IBL opportunities took longer to plan and prepare than traditional teaching methodologies (Blythe et al., 2015). Dorier and Garcia (2013) found teachers' self-perceived role in the classroom and the training they received could be a hindrance to implementing IBL in the mathematics classroom. DiBaise and McDonald (2015) found that science teachers believed class size, accountability, curricular demands, and support from their administration were the biggest hindrances to implementing IBL. Furthermore, Edelson et al. (1999) found five common hindrances to IBL: motivation, accessibility, background knowledge, practical constraints, and organizing and managing open-ended inquiry. Gaining a more thorough understanding of how teachers' beliefs

about hindrances affect their adoption of IBL in the agricultural classroom will allow for the creation of professional development and pre-service trainings to offer educators.

### *Perceived Student Ability*

Teachers' perceptions of students' abilities have been found to be one of the major barriers to IBL activities (Van Hover & Yeager, 2003). Voet and DeWever's (2016) instrument to study teachers' adoption of IBL includes a perceived student ability scale. The perceived student ability scale measures teacher's perceptions about their students' abilities to carry out the activities involved in IBL (Voet & De Wever, 2016). Perceived student abilities are a part of the conceptual framework used for the current study due to teacher responses about student capabilities (Voet & De Wever, 2016). Teachers often hold certain beliefs about their students which influence the teaching methods that are utilized in the classroom (Fang, 1996), affecting their instructional practices and expectations of the students (Good & Brophy, 2003; Woolfolk, 2004).

### **Summary of Review of Literature**

IBL has been utilized in science education for many years. In recent years, the use of IBL has become more popular in other domains including math and history. The benefits of IBL have been well researched and documented, including increasing students reasoning abilities. Agricultural education strives to improve students' abilities to problem-solve, thereby making IBL a very useful teaching strategy.

Implementing IBL in the classroom can be affected by many different things. Teachers' beliefs about education, self, and context often affect the teaching strategies they utilize in their classrooms. Teachers will develop lessons for their classrooms that

are closely aligned to their beliefs about education. Self-efficacy in teaching the material or utilizing certain strategies also has a role in the type of instruction developed by teachers. Further, once teachers have developed and planned lessons for their classrooms, what is actually implemented is affected by contextual hindrances. Understanding how these beliefs affect teacher adoption of IBL will help in the development of professional development and pre-service teacher programs that will aid in the adoption of IBL.

## CHAPTER III

### METHODS

A description of the research procedure is presented in this chapter. The following topics are addressed: (a) Research Design, (b) Population, (c) Sample, (d) Instrument Development, (e) Data Collection, and (f) Data Analysis.

#### **Purpose and Objectives**

The purpose of this study was to examine the belief system of agriculture educators about agricultural education, self, and context in regard to their adoption of IBL. The objectives for the study were to

1. Determine how agricultural educators' characteristics, such as teaching degree and pathway taught, influence their adoption of IBL.
2. Determine how agricultural educators' beliefs about agricultural education, the self, and context of agricultural education are related to one another.
3. Determine how agricultural educators' beliefs about agricultural education, the self, and context of agricultural education influence their adoption of IBL.

#### **Research Design**

The design for this study was non-experimental survey research. It was descriptive and correlational.

#### **Population**

The target population of this study was agricultural educators who are active members of the National Association of Agricultural Educators (N=7800). The National

Association of Agricultural Educators (NAAE) is composed of members from six regions across the United States. Members of NAAE are involved in agricultural education at many levels, from middle school through postsecondary, and some serve as state and national agricultural education leaders. The purpose of this organization is to “advocate for agricultural education, provide professional development and work to recruit and retain agricultural educators” (National Association of Agricultural Educators, n.d.).

### **Sample**

Based on the research of Krejcie and Morgan (1970), it was determined a desired sample size of 367 teachers would be appropriate for this study. A sample of 600 was selected by staff members of NAAE and represented members of all six of NAAE’s regions which includes 7,800 total members. An initial recruitment email (Appendix B) containing a link to a Qualtrics-based survey was sent to 600 members, with 110 usable responses received. As this number was lower than the target sample size, an additional 1,200 association members were selected by NAAE staff and sent the same recruitment email in order to generate the 367 responses needed. Of the 1,800 recruitment emails sent, 127 emails were undeliverable. Therefore, a total of 1,673 recruitment emails were successfully sent out. The final number of useable respondents was 410.

### **Instrument Development**

Determining the dimensions of belief systems of agricultural educators that explain their adoption of IBL required the development of an instrument. A review of literature led to the discovery of an instrument developed by Voet and De Wever (2018)

that was used to capture history teachers' beliefs about education, self, and context, and how it affected their adoption of IBL. Internal consistencies of this instrument were reported as Cronbach's  $\alpha$ : Nature of knowledge = .71, Substantive knowledge = .73, Procedural knowledge = .80, Self-efficacy = .78, Perceived student ability = .72, Perceived contextual hindrances = .83, Adoption of IBL = .69 (Voet & De Wever, 2018). Voet gave permission to adapt this instrument to agricultural educators' beliefs systems about education, self, and context.

The adapted instrument addressed the framework items as follows: conceptions of nature of knowledge (4 items), substantive knowledge (3 items), procedural knowledge (3 items), self-efficacy (4 items), perceived student ability (3 items), perceived contextual hindrances (4 items), and adoption of IBL (4 items). Each of these items employed a six-point Likert scale. The nature of knowledge, perceived student abilities (reverse-coded), and perceived contextual hindrances had Likert scale ratings of "1 - completely disagree" to "6- completely agree." Substantive and procedural knowledge had Likert scale ratings of "1 - very unimportant" to "6 - very important." Self-efficacy items had Likert scale ratings of "1 - completely unable" to "6 - completely able." Finally, the adoption of IBL had Likert scale ratings of "1 - never" to "6 - very often."

A pilot study was conducted to determine the readability and perceived appropriateness of the adapted instrument. The instrument was distributed to 25 Texas Tech University pre-service agricultural educators and 51 New Mexico State University pre-service agricultural educators via email with a Qualtrics survey link. These pre-

service teachers were asked to complete the survey and email the researcher with questions or for clarification of items on the instrument. Forty-eight of the 76 pre-service teachers contacted responded, with a total of 35 completing the survey. Only one email was received which asked how they needed to respond if they had not taught any students yet. Based on the lack of questions/concerns about the instrument and the completion rate, it was determined the instrument had good readability.

Internal consistencies of this instrument were reported from the pilot study as Cronbach's  $\alpha$ : Nature of knowledge = .50, Substantive knowledge = .53, Procedural knowledge = .77, Self-efficacy = .81, Perceived student ability = .74, Perceived contextual hindrances = .67, Adoption of IBL = .96. Kline (1999) indicates that Cronbach's  $\alpha$  below .70 are acceptable will dealing with psychological constructs. Nunnally (1978) even suggest values as low as .50 are acceptable in the beginning of research, therefore it was determined that the adapted instrument was reliable.

#### *Data Collection*

Data were collected from members of the NAAE, which included both secondary and post-secondary agricultural educators. A link to the questionnaire, hosted by Qualtrics, was distributed via email to participants between November 1, 2018, and January 31, 2019. A five-contact e-mail strategy, as suggested by Dillman, Smyth, and Christian (2014) was utilized. Early morning has been identified by Dillman et al. (2014) as the best time to distribute emails; therefore, emails were sent in the early morning. The participants' routines were also considered when selecting days for distribution, since no day of the week has been determined to elicit a significantly greater response

rate (Dillman et al., 2014; Shinn, Baker & Briers, 2007). Therefore, surveys were sent out at 6:00 am MST on various days of the week. Individuals who completed the survey but did not respond to questions imperative to the study were removed. Non-response errors were handled according to the method recommended by Lindner, Murphy, and Briers (2001). Early respondents were compared to late respondents, defined as those which responded to the survey after the third or fourth reminder. Nature of knowledge (NKO), orientation toward teaching-substantial (OTS) and orientation toward teaching-procedural (OTP), self-efficacy, perceived student ability, perceived conceptual hindrances (PCH), and adoption of IBL were compared based on early or late response using an independent t-test, no significant differences were found (Table 1).

Table 1. *Comparison of Early and Late Respondents Regarding Nature of Knowledge, Orientation to Teaching-Substantive, Orientation to Teaching-Procedural, Self-Efficacy, Perceived Student Ability, and Adoption of IBL; Responding Members of NAAE, Fall 2018*

Variable	Early Respondents (N=290)		Late Respondents (N=120)		<i>t</i>	<i>Sig.</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
Nature of Knowledge	5.19	.49	5.16	.60	.59	.56
Orientation to Teaching- Substantive	4.51	.65	4.62	.51	-1.78	.08
Orientation to Teaching- Procedural	5.01	.68	4.95	.67	.87	.38
Self-Efficacy	4.70	.72	4.63	.70	.90	.37
Perceived Student Ability	2.99	1.09	2.91	.96	.50	.69
Perceived Contextual Hindrances	3.95	1.06	4.08	.98	-1.15	.25
Adoption of IBL	3.97	.90	3.83	.85	1.44	.15

#### *Instrument Validation*

The quality of the questionnaire was determined through factor analysis and subsequent measures of internal consistency of the resulting scales. To accomplish this, the data were subjected to an exploratory factor analysis (EFA) and confirmatory factor analysis (CFA).

Exploratory factor analysis was carried out utilizing SPSS 24 with maximum-likelihood estimation and rotation through oblique Promax as recommended by Costello and Osborne (2005) and Fields (2013). The Kaiser-Meyer-Olkin test indicated that the sample was adequate for conducting an EFA (KMO = .87). Fields (2013) indicates the KMO values closer to one indicate compact pattern of correlations; therefore, a factor analysis should yield reliable factors. Barlett's test confirmed the relationship of the items being investigated ( $\chi^2 = 4041.27$ ,  $df = 300$ ,  $p < .001$ ). Fields (2013) cautions that the Barlett test is likely to be significant due to the large sample size of factor analysis; however, it should be checked in the unlikely event that it is non-significant. The number of factors to be retained was determined by comparing Kaiser's eigenvalues greater than one and Cattell's Scree test as recommended by Courtney (2013). The eigenvalues pointed to a six-factor structure, which was confirmed by the Cattell's Scree test.

Confirmatory factor analysis was conducted using SPSS AMOS 24 to determine if the data had a good fit index. According to Hu and Bentler (1999), the criteria for a good fit are CFI and TLI  $\geq .95$ , and RMSEA  $\leq .06$ . The results indicated a good fit (comparative fit index [CFI] = .96; Tucker-Lewis index [TLI] = .95; root mean square error of approximation [RMSEA] = .040). The CFA confirmed the six-factor structure instead of the seven-factor structure utilized by Voet and DeWever (2018) with history teachers. CFA also suggested a six-factor structure combining perceived contextual hindrances and perceived student abilities. For the purposes of this study, it was decided to keep the seven factors of the original instrument for comparison purposes.

For each scale, the data were used to calculate Cronbach's  $\alpha$ . Table 2 presents the internal consistency of the scales for the original Voet and DeWever (2018) data and for the data for this study. The data from this study yielded a Cronbach's  $\alpha$  for nature of knowledge items of .63 which could be considered low; however, Kline (1999) suggests lower numbers can be accepted if the items are not dealing with abilities but are instead psychological constructs. Further, Nunnally (1978) even suggested when first beginning research, numbers as low as .5 are acceptable. The survey instrument was deemed acceptable as the numbers were also closely related to the original instrument.

Table 2. *Internal Consistency of the Scales Measured by the Instrument to Investigate Agricultural Educators' Beliefs on the Adoption of IBL, Responding Members of NAAE, Fall 2018*

Scale	Items	Cronbach's $\alpha$	
		Voet & DeWever (2018)	Current Study
Nature of knowledge	4	.71	.63
Orientation to teaching substantive	3	.73	.71
Orientation to teaching procedural	3	.80	.76
Self-efficacy	4	.78	.85
Perceived student ability	3	.72	.77
Perceived contextual hindrances	4	.83	.85
Adoption of inquiry-based learning	4	.69	.85

*Note.* Values of .7 to .8 generally acceptable, however for psychological constructs lower values are acceptable.

## **Analyses Leading to Structural Equation Model**

The Likert scales were used to examine how teachers' beliefs influence the adoption of IBL. Pearson's product moment correlations were used to derive coefficients to describe the relationship between the adoption of IBL, nature of knowledge, orientation to teach substantive knowledge, orientation to teach procedural knowledge, self-efficacy, perceived student ability, and perceived contextual hindrances. Further, based on the entire sample ( $n = 410$ ), SPSS AMOS 24 was used to estimate a structural equation model (SEM). Structural equation modeling consists of (a) model identification, (b) model estimation, and (c) model evaluation. Discovering if the number of distinct elements is exceeded by the number of estimated parameters within the model is model identification (Ullman, 2013). The number of distinct elements is calculated by using  $p[p + 1]/2$ , with  $p$  representing the measured variables. Structural equation models account for the observed variable and the latent variable (unobserved variables); however, there are still structural errors. Structural errors are the variance in the variable that is not explained by the predictor variables (Bowen & Guo, 2012). Missing values were handled using full-information maximum likelihood, which Bowen and Guo (2012) recommend.

Twenty-five measured variables were represented in the model (i.e., four items for nature of knowledge, three items for orientation towards teaching substantive knowledge, three items for orientation towards teaching procedural knowledge, four items for self-efficacy, three items for perceived student ability, four items for perceived contextual hindrances, and four items for adoption of inquiry-based knowledge) with

325 distinct elements. The model contained 44 distinct sample moments, 28 distinct parameters for estimation creating 16 degrees of freedom which met the requirements for SEM (Bowen & Guo, 2012; Ullman, 2013). Following the cutoff criteria by Hu and Bentler (1999), the results of the analysis indicate a good fit: CFI = .97. The root mean square error of approximation indicated a reasonable fit (RMSEA = .07, CI [.04, .09]).

Each objective was evaluated with the above data analysis method in order to better understand the adoption of IBL by agricultural educators. Learning how characteristics affect IBL adoption, how agricultural educators' beliefs about education, self, and context are related, and determining if these beliefs can predict the adoption of IBL will lead to opportunities for further research.

## CHAPTER IV

### RESULTS

The results of the study are presented in this chapter. The chapter begins by stating the purpose of the study and then proceeds to share the descriptive findings, goals and approaches of the respondents to agricultural education, followed by results associated with each of the research objectives.

#### **Purpose and Objectives**

The purpose of this study was to examine the belief system of agriculture educators about agricultural education, self, and context in regard to their adoption of IBL. The objectives for the study were to

1. Determine how agricultural educators' characteristics, such as teaching degree and pathway taught, influence their adoption of IBL.
2. Determine how agricultural educators' beliefs about agricultural education, the self, and context of agricultural education are related to one another.
3. Determine how agricultural educators' beliefs about agricultural education, the self, and context of agricultural education influence their adoption of IBL.

#### **Profile of Respondents**

Respondents for this study were secondary and post-secondary agricultural educators who were members of NAAE. A majority of respondents taught at the secondary level, as only 6.8 percent of the responses were from agricultural educators at the post-secondary level. Those teaching at secondary schools were also subdivided into

those who taught grades 9-12 and those who taught grades lower than ninth. Table 3 represents the description of this sample.

Table 3. *Grade Levels Taught, Responding Members of NAAE, Fall 2018*

Grade	Frequency	Percent
Below 9	130	31.7
9-12	251	61.2
Post-Secondary	28	6.8

*Note.*  $N = 409$ . One respondent did not submit a response.

All six regions of NAAE were represented, and a description of the sample by region is shared in Table 4. NAAE region one represents the states of Alaska, Arizona, California, Hawaii, Idaho, Montana, Nevada, Oregon, Utah, Washington, and Wyoming. Region two consists of Arkansas, Colorado, Kansas, Louisiana, New Mexico, Oklahoma, and Texas. Region three includes Iowa, Minnesota, Nebraska, North Dakota, South Dakota, and Wisconsin. Region four is comprised of Illinois, Indiana, Kentucky, Michigan, Missouri, and Ohio. Region five represents Alabama, Florida, Georgia, Mississippi, North Carolina, Puerto Rico, South Carolina, Tennessee, and the Virgin Islands. Finally, region six includes the remaining states of Connecticut, Delaware, Maine, Massachusetts, Maryland, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, Virginia, and West Virginia. Based on the

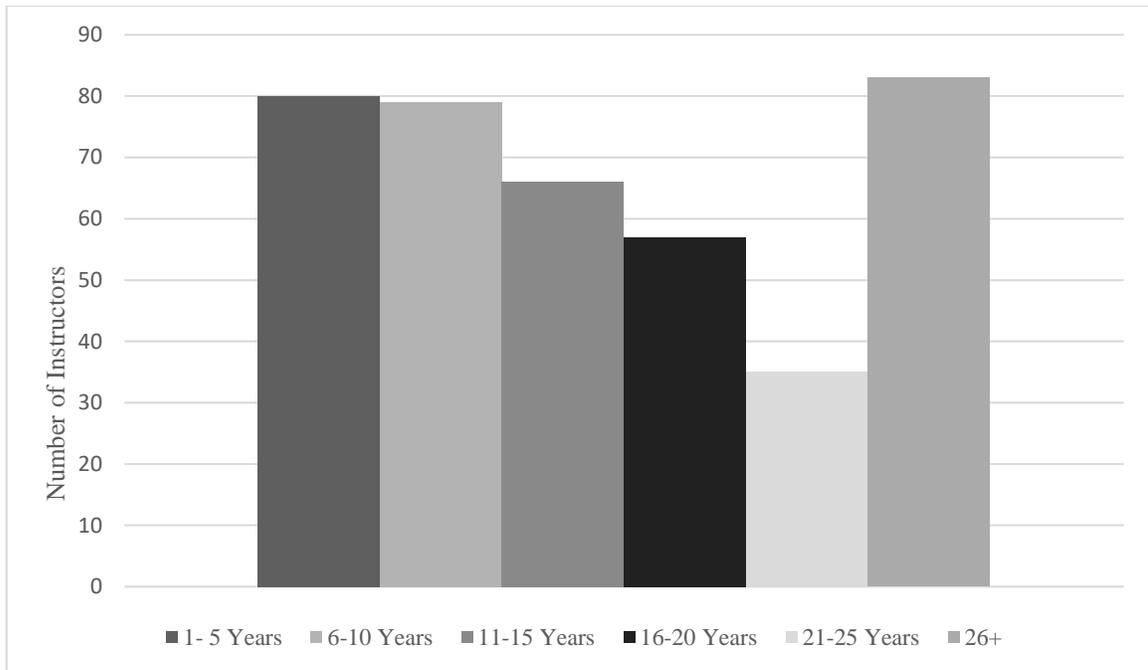
presence of responses from each region, agricultural educators from across the United States were represented in this study.

Table 4. *Frequencies by NAAE Region, Responding Members, Fall 2018*

NAAE Region	<i>f</i>	Percent
1	96	23.4
2	80	19.5
3	60	14.6
4	58	14.1
5	83	20.2
6	33	8.0

Agricultural educators with bachelor’s, master’s, and doctorate degrees were represented. A majority of respondents had a master’s degree (55.4 %), with 40.7% possessing a bachelor’s degree and only 3.7% possessing a doctorate.

Figure 2 demonstrates the diversity of respondents in regard to the number of years they have been teaching agriculture. The range was from one to 43 years of teaching experience.



*Figure 2. Years teaching agriculture, responding members of NAAE, Fall 2018.*

### **Goals of Agricultural Educators**

Respondents were asked to rank four learning outcomes for their students from most to least important to determine the goals agricultural educators find most important for their students. Table 5 presents the study’s findings regarding teachers’ goals for their agricultural education students. For this section of the survey,  $N = 362$  due to missing data from 48 of the respondents. For a plurality of agricultural educators in this study, the primary goal in their agricultural classrooms was for all students to be able to demonstrate a balanced development of knowledge and skills and the ability to identify, analyze and critique information sources. Agriculture students’ ability to tackle new content (i.e., answering a research question based on an analysis of information sources), drawing on facts from agricultural lessons was ranked second by a plurality. Developing

a technical skill which can be utilized in the agricultural workforce was most often ranked as third, while knowing history and facts about FFA and agricultural industries and being able to relate changes within the industry to common events in history was overwhelmingly ranked fourth.

Table 5. *Rankings of Four Goals Related to Teaching Agriculture, Responding Members of NAAE, Fall 2018*

Description of goal	Number of instructors ranking			
	1	2	3	4
Students are able to demonstrate a balanced development of knowledge and skills, and are able to identify, analyze, and criticize information from sources.	189	105	62	6
Students are able to tackle new content which means answering a research question based on an analysis of information sources, drawing on facts from agricultural lessons.	70	124	110	58
Students develop a technical skill which can be used in the agricultural workforce.	84	105	131	42
Student knows the history and facts about FFA and agricultural industries and is able to relate changes within the industry to common events in history.	19	28	59	256

*Note.*  $N = 362$ . Ranking was not provided by 48 respondents.

Agricultural educators were asked to identify what approach they found most effective, taking time and student abilities into consideration. Table 6 contains the findings for agricultural educators' identification of the approach they believe is most important to teaching effectively. There were 403 responses for this item, with seven respondents not answering. Agricultural educators were asked to choose the statement which most closely represented their belief about teaching effectively, taking available time and student ability into account. A majority of instructors (68.7%) believed that teaching effectively required giving students ample time and opportunities to observe, discover, and ask questions about important facts, concepts, and skills. Students have to apply, experiment with, and compare what they observe with facts and concepts to achieve understanding. Twenty-two percent of surveyed instructors also believed that, in order to teach effectively, it is necessary to provide sufficient support for learning by effectively alternating between an analysis of information sources and plenary sessions, reciprocal teaching, and feedback. Finally, 9.2% believed the most logical and effective approach was to explain the most important facts, concepts, and skills in a clear and structured way and to ensure that underlying relationships are clear.

Table 6. *Agricultural Educators' Selections for Approaches to Teaching Effectively, Responding Members of NAAE, Fall 2018*

Statement About Teaching Effectively	<i>f</i>	Relative %
It is necessary to give students time and opportunities to observe, discover, and ask questions about important facts, concepts, and skills. Students have to apply, experiment with, and compare them to achieve understanding.	277	68.7
It is important to provide sufficient support for the learning of facts, concepts, and skills, by effectively alternating between an analysis of information sources and plenary sessions, reciprocal teaching, and feedback.	89	22.1
The most logical and effective approach is to explain the most important facts, concepts, and skills in a clear and structured way and to ensure that underlying relationships are clear.	37	9.2

*Note.* *N* = 403. Seven respondents did not answer this item.

### **Research Question One: Influence of Agricultural Educators Characteristics on IBL Adoption**

The first objective of this study was to determine if agricultural educators' characteristics such as grades taught, degree obtained, agricultural pathway taught, and NAAE region had an effect on their adoption of IBL. Results for the influence of agricultural educators' characteristics on IBL adoption can be found in Table 7. There was not a significant effect of grade level taught on agricultural educators' adoption of

IBL ( $F(2, 406) = 2.52, p = .08$ ). There was a statistically significant difference in regards to the adoption of IBL when considering degree, as shown by obtained Welch's  $F(2, 42) = 6.8, p < .01$ . The Welch's F statistic was utilized due to the lack of homogeneity of variance as determined by the significance of the Levene's test  $p = .04$ . The agricultural pathway taught also had a significant effect on the adoption of IBL with Welch's  $F(3, 61) = 9.41, p < .001$ . Due to a lack of homogeneity of variance  $p = .001$ , the Welch's F statistic was utilized. The NAAE region the agricultural educator taught in did not have an effect on their adoption of IBL ( $F = .44, p = .83$ ).

Table 7. *Comparison of Agricultural Educators' Characteristics' Effects on the Adoption of IBL, Responding Members of NAAE, Fall 2018*

Variable	Respondents (N=409)			
	<i>M</i>	<i>SD</i>	<i>F</i>	<i>Sig.</i>
Grade Level Taught	3.93	.88	2.52	.08
Degree Obtained	3.93	.88	6.8	.003
Pathway Taught	3.92	.88	9.4	>.001
NAAE Region	3.93	.88	.44	.83

### **Research Question Two: Relationship of Agricultural Educators' Beliefs about Education, Self, and Context**

Pearson's product-moment correlations were calculated to describe the relationships between the adoption of IBL (AIL), nature of knowledge (NKO),

orientation to teach substantive knowledge (OTS), orientation to teach procedural knowledge (OTP), self-efficacy (SEF), perceived student abilities (PSA), and perceived contextual hindrances (PCH) of NAAE agricultural educators. Means of the scales are presented in Table 8.

Table 8. *Means and Standard Deviations of the Variables Describing Agricultural Educators' Perceptions of Teaching-Learning Variables, Responding Members of NAAE, Fall 2018*

Scale	<i>M</i>	<i>SD</i>
Nature of knowledge (NKO)	5.18	.52
Orientation towards teaching substantive knowledge (OTS)	4.54	.61
Orientation towards teaching procedural knowledge (OTP)	4.99	.68
Self-efficacy (SEF)	4.67	.72
Perceived student ability (PSA)	2.97	1.05
Perceived contextual hindrances (PCH)	3.99	1.04
Adoption of inquiry-based learning (AIL)	3.92	.88

*Note.* All scales are 6-point scales.

Correlation results are presented in Table 9 and described below. Both positive and negative relationships were found between agricultural educators' adoption of IBL and the remaining factors in this study, listed by order of strength.

Table 9. *Pearson Product-Moment Correlations (r) Addressing Agricultural Educators' Adoption of IBL, Responding Members of NAAE, Fall 2018*

	AIL	SEF	NKO	OTS	OTP	PSA	PCH	Grades Taught	Degree Received
AIL	--	.47**	.13*	.17**	.41**	.05	-.16**	.06	.09
SEF		--	.24**	.32**	.49**	.20**	-.25**	.14**	.18**
NKO			--	.26**	.36**	.07	-.01	-.06	.08
OTS				--	.44**	.03	-.03	.05	-.02
OTP					--	.05	-.12*	.11*	.07
PSA						--	-.64**	-.03	-.02
PCH							--	.05	.00
Grades Taught								--	.31**
Degree Received									--

\* $p < .05$ , \*\*  $p < .001$

A medium positive relationship (Cohen, 1988) was found between agricultural educators' adoption of IBL and their self-efficacy ( $r = .47$ , 95% CI [.38, .55],  $p < .001$ ) and orientation towards teaching procedural knowledge ( $r = .41$ , 95% CI [.30, .49],  $p < .001$ ). A small positive relationship (Cohen, 1988) was found between agricultural educators' adoption of IBL and nature of knowledge ( $r = .13$ , 95% CI [.02, .23],  $p = .01$ ) and orientation to teach substantive knowledge ( $r = .17$ , 95% CI [.06, .27],  $p < .001$ ).

There was a small negative relationship (Cohen, 1988) between agricultural educators' adoption of IBL and perceived contextual hindrances ( $r = -.16$ , 95% CI [-.26, -.06],  $p = .001$ ).

Instructors' self-efficacy also was indicated to have positive and negative relationships with other factors. First, a medium positive relationship (Cohen, 1988) was found between agricultural educators' self-efficacy and their orientation to teach substantive knowledge ( $r = .32$ , 95% CI [.21, .42],  $p < .001$ ) and procedural knowledge ( $r = .49$ , 95% CI [.39, .58],  $p < .001$ ). A small positive relationship (Cohen, 1988) existed between agricultural educators' self-efficacy and their beliefs about the nature of knowledge ( $r = .24$ , 95% CI [.13, .34],  $p < .001$ ), grades taught ( $r = .14$ , 95% CI [.04, .23],  $p = .01$ ), degree received ( $r = .18$ , 95% CI [.09, .28],  $p < .001$ ), and perceived student abilities ( $r = .20$ , 95% CI [.11, .30],  $p < .001$ ). Conversely, there was a small negative relationship (Cohen, 1988) between agricultural educators' self-efficacy and their perceived contextual hindrances ( $r = -.26$ , 95% CI [-.35, -.16],  $p < .001$ ).

Agricultural educators' conceptions about the nature of knowledge was discovered to have both positive and negative relationships with the other factors studied. There was a medium positive (Cohen, 1988) relationship between agricultural educators' conceptions of the nature of knowledge and their orientation to teach procedural knowledge ( $r = .36$ , 95% CI [.28, .44],  $p < .001$ ). A small positive relationship (Cohen, 1988) was discovered between agricultural educators' conceptions of the nature of knowledge and their orientation to teach substantive knowledge ( $r = .26$ , 95% CI [.18, .35],  $p < .001$ ). A medium positive relationship (Cohen, 1988) also existed

between agricultural educators' orientation towards teaching substantive knowledge and their orientation towards teaching procedural knowledge ( $r = .44$ , 95% CI [.32, .55],  $p < .001$ ). A small negative relationship (Cohen, 1988) was discovered between agricultural educators' orientation towards teaching procedural knowledge and their perceived contextual hindrances ( $r = -.12$ , 95% CI [-.21, -.02],  $p = .02$ ).

The perceived student abilities agricultural educators reported appear to be negatively related to their perceived contextual hindrances. A medium, negative relationship (Cohen, 1988) existed between agricultural educators' perceived student abilities and their perceived contextual hindrances ( $r = -.64$ , 95% CI [-.70, -.58],  $p < .001$ ).

### **Research Question Three: Influence of Agricultural Educators' Beliefs on IBL**

#### **Adoption**

Findings for the correlations among the scales further encouraged the use of the conceptual model of Voet and DeWever (2018). Voet and DeWever's (2018) model was utilized for creation of the structural equation model (SEM) for this study, and the SEM is presented in Figure 3. The absolute fit of the model was statistically significant ( $\chi^2 = 31.28$ ,  $df = 11$ ,  $p = .001$ ), which means this data did not have absolute fit for the model. Therefore, researchers utilized the relative fit of the model which was acceptable (Hu & Bentler, 1999). The fit indices (CFI = .97; RMSEA = .07) indicated the final model met the criteria for model evaluation (Blunch, 2013; Hooper, Coughlan, & Mullen, 2008; Hu & Bentler, 1999).

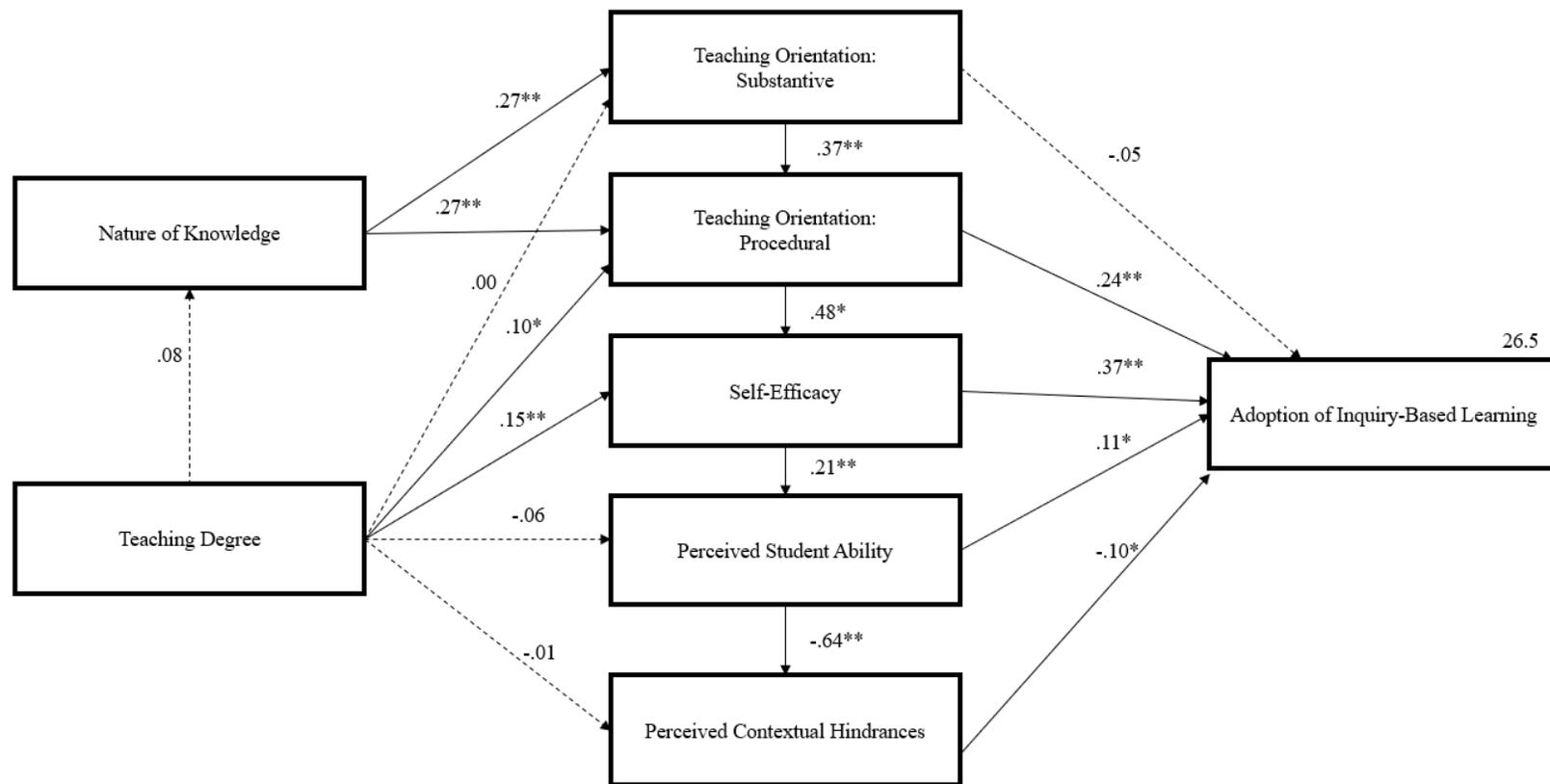


Figure 3. Structural Equation Model (SEM) representing the influence of agricultural educators' beliefs on the adoption of IBL, responding members of NAAE, Fall 2018.

Note: Dashed lines indicate non-significant effects.

\* $p < .05$ ; \*\*  $p < .001$

Together, the six predictors (nature of knowledge (NKO), orientation to teach substantive knowledge (OTS), procedural knowledge (OTP), self-efficacy (SEF), perceived student ability, (PSA) and perceived contextual hindrances (PCH)) accounted for 26.5 percent of the variance in the adoption of IBL. Orientation to teaching procedural knowledge and self-efficacy had significant effects on agricultural educators' adoption of IBL. Teachers' self-efficacy in regard to utilizing IBL was most influential in this model and had a positive effect on their adoption of IBL ( $\beta = .37, p < .001$ ). The importance of procedural knowledge goals of agricultural educators (learning about the foundations and reasoning) also had a positive effect on agricultural educators' adoption of IBL ( $\beta = .24, p < .001$ ). Orientation to teach substantive knowledge, perceived student ability, and perceived contextual hindrances had no significant effects on agricultural educators' adoption of IBL. Perceived student ability ( $\beta = -.09, p = .06$ ) and perceived contextual hindrances ( $\beta = -.09, p = .06$ ) were negatively related to agricultural educators' adoption of IBL; however, it was not statistically significant.

Agricultural educators' value of substantive and procedural knowledge was significantly influenced by their ideas about the nature of knowledge (respectively,  $\beta = .27, p < .001$  and  $\beta = .37, p < .001$ ). The level of education an agricultural educator has obtained had significant effects on their self-efficacy ( $\beta = .15, p < .001$ ) and their orientation towards teaching procedural knowledge ( $\beta = .10, p = .02$ ). Education level of the agricultural educators had no effect on their orientation to teaching substantive knowledge, perceived student abilities, or perceived contextual hindrances. Further, agricultural educators' self-efficacy had significant effects on their perceived student

abilities ( $\beta = .22, p < .001$ ). Teachers' perceived student abilities was negatively related to their perceived contextual hindrances ( $\beta = -.64, p < .001$ ).

### **Summary**

The findings of this study demonstrated how the majority of NAAE agricultural educators surveyed believe the number one goal of teaching agriculture is to provide students with a balanced education including both knowledge and skills that allow the students to problem solve. Further, agricultural educators see the value in giving students the opportunity to observe, discover, and ask questions on their own. However, currently NAAE agricultural educators are only providing these opportunities to their students sporadically.

The structural equation model created through this research was able to predict 26.5 percent of the variance in NAAE agricultural educators' adoption of IBL. The strongest predictors of the variance in adoption were agricultural educators' beliefs about their self-efficacy, procedural knowledge, student abilities, and contextual hindrances. When analyzed together, these findings lead to some important implications for practicing agricultural educators as well as agricultural education researchers.

## CHAPTER V

### CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

This final chapter reports conclusions based on the findings of this study. From these conclusions, I offer implications for future research involving IBL and agricultural education. Further, I provide recommendations for practice based on the findings from this study about the adoption of IBL by agricultural educators and additional research.

Increasing the use of inquiry-based learning (IBL) is encouraged by educational reform organizations due to the increase in retention of content and conceptual learning that occurs when IBL is utilized. IBL has been present in science classrooms for many years, since inquiry is how scientists make discoveries. The benefits of using IBL in other domains has been researched and documented. For example, agriculture curriculum is often science-based, making it an ideal opportunity to implement IBL. Identifying factors that affect agricultural educators' adoption of IBL will allow for the creation of professional development to support IBL implementation.

#### **Purpose and Objectives**

The purpose of this study was to examine the belief system of agriculture educators about agricultural education, self, and context in regard to their adoption of IBL. The objectives for the study were to

1. Determine how agricultural educators' characteristics, such as teaching degree and pathway taught, influence their adoption of IBL.

2. Determine how agricultural educators' beliefs about agricultural education, the self, and context of agricultural education are related to one another.
3. Determine how agricultural educators' beliefs about agricultural education, the self, and context of agricultural education influence their adoption of IBL.

### **Conclusions**

Analysis of the results identified the following conclusions for the profession of agricultural educators.

#### *Goals and Approaches of Agricultural Educators*

The results from this study indicate that agricultural educators' goals are for their students to be able to acquire the knowledge and skills that are necessary to identify, analyze, and criticize information. Further, agricultural educators believe it is not as important for agricultural students to know the history and facts about agriculture, but rather possess the abilities to find needed information from sources to aid in answering questions or solving problems in regard to agriculture. These results are in agreement with the findings of Voet and DeWever (2018) in regard to the goals of history teachers.

A majority of the agricultural educators in this study preferred to use teaching strategies that allow students time and opportunities to observe, discover, question, and collect data. Even though the majority of agricultural educators prefer this type of strategy, the adoption of IBL was only used sporadically or every now and then. Because agricultural educators see the advantage of IBL, approaches determining the reasons for the lack of adoption is warranted.

### *Influence of Agricultural Educators' Characteristics on IBL Adoption*

The first objective of this study was to determine how agricultural educators' characteristics (i.e., grade level taught, degree obtained, pathway taught and NAAE region) influenced their beliefs about agricultural education, self, and context of agricultural education. This study found that the adoption of IBL by agricultural educators was not significantly affected by the grade level they teach, suggesting when teachers utilize IBL, they are willing to create these lessons regardless of if they are teaching middle school students or college students. Further, there was no significant effect on their adoption of IBL based on where in the United States an agricultural educator was located.

However, there was a significant effect on teachers' adoption of IBL in regard to the degree obtained and the pathway taught. The positive correlation between the adoption of IBL and the degree obtained suggests the more training an educator receives the higher their adoption of IBL. As teachers continue their education, it makes sense that they would receive more training in creating and implementing IBL, which could lead to a higher self-efficacy in regard to IBL. Results from this study suggest that self-efficacy is one of the strongest predictors of the adoption of IBL; therefore, it is understandable that the more education teachers receive, the more likely they will be to adopt IBL. These results create an area for further research to investigate in what ways the degree obtained and the agricultural pathway affect their adoption of IBL.

In addition, the grade level(s) agricultural educators teach were also related to their self-efficacy and orientation to teach procedural knowledge: agricultural educators

teaching high school and/or college students were more likely to teach procedural knowledge and had greater self-efficacy in implementing IBL activities. Agricultural educators teaching older students can teach more procedural knowledge due to the background knowledge students have already obtained. By teaching procedural knowledge, agricultural educators are able to prepare students for IBL, making it easier to implement and thereby increasing their self-efficacy.

Further, the agricultural pathways taught by agricultural educators had an effect on their adoption of IBL. The agricultural pathways for this study consisted of general agriculture, agricultural sciences (agriscience, animal science, and horticulture), agricultural mechanics, and agricultural education. Agricultural courses dealing with more science-based concepts would have more opportunities to adopt IBL than those classes dealing strictly with agricultural mechanics. Educators teaching more science-based agricultural classes might also have received more training in the use of IBL strategies which would increase their self-efficacy to teach IBL, thereby increasing their adoption of IBL. This is an area for further research to determine how the agricultural pathway affects the adoption of IBL.

Finally, the grade levels taught by agricultural educators had no relationship to their adoption of IBL; whether an agricultural educator teaches seventh graders or pre-service agricultural education students did not seem to affect the adoption of IBL.

#### *Relationship of Agricultural Educators' Beliefs about Education, Self, and Context*

The second objective of the study was to determine how agricultural teachers' beliefs about agricultural education, the self, and context of agricultural education are

related to one another. Adoption of IBL activities by agricultural educators was related to nature of knowledge, orientation to teach substantive knowledge, orientation to teach procedural knowledge, self-efficacy, and perceived contextual hindrances.

A positive relationship was demonstrated between both IBL adoption and the orientation to teach substantive and procedural knowledge, with the higher correlation between procedural knowledge and the adoption of IBL. Therefore, agricultural educators who are more likely to adopt IBL would also spend more time teaching the procedural knowledge that is required for IBL activities, agreeing with Husbands (2011) who suggested that instructors who placed a higher priority on procedural knowledge would be more likely to engage their students in reasoning activities. An instructor's orientation toward teaching will also direct them to spend more time and effort in instructional approaches that are related to their orientation (Gess-Newsome & Lederman, 1999). Agricultural educators with higher self-efficacy to organize IBL activities indicated they utilize IBL more often in their classroom.

The relationship between the adoption of IBL and perceived contextual hindrances was negative. This indicates that when agricultural educators expect issues with IBL, they are less likely to implement these activities.

Agricultural educators' beliefs about the nature of knowledge were positively related to their orientation to teach substantive and procedural knowledge to their students. Because the nature of knowledge represents agricultural educators' epistemological beliefs, a correlation with teaching orientation is expected. Epistemological beliefs are the instructor's conceptions about inquiry and how students

will construct and evaluate knowledge (Hofer, 2001). Epistemological beliefs have been found to differ depending on the domain being taught but are influenced by domain-general beliefs (Muis et al., 2006). Further, the SEM created by Voet and DeWever (2018) found there were significant effect of nature of knowledge and orientation to teaching substantive and procedural knowledge for history teachers. Additionally, orientation to teach substantive and procedural knowledge was positively correlated with agricultural educators' self-efficacy to organize IBL activities.

Agricultural educators' self-efficacy was related to nature of knowledge, orientation to teach substantive and procedural knowledge, perceived student abilities, and perceived contextual hindrances. A positive relationship between agricultural educators' perceived ability to implement IBL and the perceived abilities of their students to be able to complete IBL activities was indicated. This agrees with Ashton and Webb's (1986) determination that teachers' self-efficacy showed a positive relationship with perceived student abilities due to the fact that teachers with high levels of self-efficacy tend to believe that all of their students can learn and are often less critical of the errors which their students perform. Next, the relationship between self-efficacy and perceived contextual hindrances was negative, indicating that the higher self-efficacy a teacher has, the less contextual hindrances are perceived. Tschannen-Moran and Hoy (2001) indicated self-efficacy beliefs are influenced by instructors' persistence and resilience in activities that do not go according to plan. Therefore, if instructors with high self-efficacy are persistent and resilient, there would be fewer perceived contextual hindrances to implementing IBL lessons. Conversely, Ketelhut

(2007) found teachers with low self-efficacy were more likely to equate failure to bad luck or the poor ability of students. Further, Pajares (1992) argued teachers with lower self-efficacy assume the problem to be more complex than it is in reality.

### *Influence of Agricultural Educators Beliefs on IBL Adoption*

The third objective of this study was to determine how agricultural educators' beliefs about agricultural education, self, and context of agricultural education influenced their adoption of IBL. SEM results indicated that 26.5 percent of the variance in IBL adoption in agricultural classrooms can be attributed to this framework. Two factors were found to be predictors of agricultural educators' decision-making in regard to IBL: the value of teaching procedural knowledge and their self-perception of competence in implementing IBL activities. Self-efficacy and the inclination to teach procedural knowledge were also found to be connected. These two may be connected due to the fact that an agricultural educator who is confident in organizing IBL activities would be more likely to spend a greater amount of their instructional time with activities that teach the kind of knowledge necessary.

Furthermore, results suggested that part of the difference in teacher confidence in preparing and organizing IBL activities can be attributed to their training. Teachers with advanced academic degrees, beyond a bachelor's degree, possess more self-efficacy in regard to implementing IBL in their agricultural classrooms. Voet and DeWever (2018) also found a connection between history teachers' academic degree level and their self-efficacy toward teaching IBL. History teachers' adoption of IBL was found to be affected by (a) the value of teaching procedural knowledge, (b) their feelings of

competence in implementing IBL activities, and (c) and perceived contextual hindrances. This study did not find perceived contextual hindrances to have a significant effect on the adoption of IBL in the SEM. However, there was a significant negative correlation with adoption of IBL, suggesting there is a connection between the two that was not represented by the model and will be discussed below; when teachers perceive there to be contextual hindrances, they may be less likely to create lessons that are inquiry-based.

Even though agricultural education and history are two very different domains, these findings of this study of IBL adoption by agricultural educators are in agreement with Voet and DeWever's (2018) regarding IBL adoption by history teachers. In that study, they found 38 percent of the variance in the adoption of IBL could be attributed to the SEM model. The findings from Voet and DeWever's (2018) SEM model and the current findings were similar in multiple ways. The SEM model of Voet and DeWever was able to predict more of the variance in the adoption of IBL than was found with agricultural educators; however, the influences of individual factors were similar. Voet and DeWever's (2018) major predictors of the adoption of IBL were teachers' beliefs about procedural knowledge, self-efficacy, and perceived contextual hindrances. In the current study, perceived student abilities were found to be a significant predictor of the adoption of IBL, whereas it was not for history teachers.

### **Recommendations for Practice**

Based on the conclusions and implications of this study, the following recommendations were developed for practice when working with the adoption of IBL.

First, Lotter et al. (2013) discovered that professional development often fails when the beliefs of the teachers are not considered. Past research has documented that, with regards to IBL, professional development has neglected to assess the beliefs of teachers (Capps et al., 2012). Basista and Mathews' (2002) study participants felt more prepared to implement IBL after professional development and were more likely to implement this teaching tool in their classrooms. Knowing agricultural instructors are more likely to adopt IBL if they feel confident in their abilities to organize IBL activities suggests a need for professional development (Silm et al., 2017). Those who plan and facilitate IBL professional development for agricultural educators should incorporate activities that enhance their knowledge of IBL, give them experience with IBL, and allow time for them to practice adapting their lessons to IBL. By increasing teachers' self-efficacy in creating IBL lessons through professional development, more agricultural educators will begin adopting IBL as a regular part of their practice.

Second, teachers' self-efficacy to teach with certain strategies can be influenced by their pre-service training (McDiarmid, 1994; Ozdilek & Bulunuz, 2009). The findings of this study also give facilitators of agricultural education pre-service programs the opportunity to create IBL-focused training. Programs for pre-service agricultural educators can increase these pre-service teachers' self-efficacy in IBL by providing opportunities and instruction in experiences to create and implement IBL lessons for future use. By increasing their self-efficacy in IBL, teachers are more likely to adopt IBL in their own classrooms. Many different dimensions of teacher preparation have been studied and indicated that self-efficacy is amenable depending on the experiences

that the pre-service teacher is exposed to (Jarrett, 1999; Ketelhut, 2007; Palmer, 2006; Pedersen & McCurdy, 1992; Weinburgh, 2007).

Further, these findings implicate the opportunity to develop support for agricultural educators currently implementing IBL in their classrooms. Because agricultural educators in this study were currently using IBL sporadically, providing support programs could lead agricultural educators to implement IBL more often in their classrooms. Providing monthly webinars where agricultural educators can discuss their success and issues with their IBL activities would allow agricultural educators to learn from one another and further increase their self-efficacy toward IBL. By giving agricultural educators the opportunity to communicate with one another, they can begin to get ideas of other ways to implement IBL in their own classrooms. Listening to other agricultural educators can provide opportunities to improve their self-efficacy in IBL.

Another recommendation for practice is to provide agricultural educators with more resources for adopting IBL in their classrooms. One of the perceived contextual hindrances for the adoption of IBL is time. Providing resources to agricultural educators, such as ready-to-implement IBL lessons, can alleviate some of the time restraints. Other resources might include newsletters with helpful tips on how to deal with time constraints and student abilities when dealing with IBL. Another perceived hindrance is a lack of training and/or understanding of IBL. To address this perceived hindrance, agricultural educators should be provided with resources explaining IBL and its importance and emphasizing the benefits to agricultural education students. By providing agricultural educators with resources to overcome their perceived contextual

hindrances, there could be an increase in the number of agricultural educators adopting IBL.

### **Recommendations for Research**

Based on the findings of this study, I recommend five areas of research. First, this study determined that degree obtained by agricultural educators had an effect on their adoption of IBL. Research needs to be conducted to determine how agricultural degree and pathway taught effect the adoption of IBL. By researching how the degree obtained affects the adoption of IBL, studies can be conducted to investigate what occurs during master's level courses that improve the likelihood of agricultural educators adopting IBL. Further researchers need to determine how the relationship between years teaching and degree obtained are linked in regard to IBL. The effect of the degree obtained on IBL might simply be due to teachers with master's degrees have more experience in the classroom, thereby increasing their self-efficacy.

Secondly, research needs to be conducted to determine how the agricultural pathway such as animal science, horticulture, or power mechanics affects the adoption of IBL. This study indicated there is an effect of the pathway taught on the adoption of IBL, but not in what way. Understanding what makes some courses more conducive to the implementation of IBL than others can lead to the development of professional development and resources for agricultural educators teaching different pathways. Knowing the challenges faced by each individual pathway will allow for professional development and resources to be more specific to the curriculum.

Thirdly, this study verifies the use of the theoretical framework constructed by Voet and DeWever (2018) and should prompt others to investigate the adoption of IBL in other domains/subjects taught. Voet and DeWever utilized the framework to investigate the adoption of IBL for history teachers, whereas this study utilized the framework to investigate agricultural educators. Even though agricultural educators and history teachers are two very different types of teachers with very different curricula, their beliefs about education, self, and context seem to predict their adoption of IBL similarly. Utilizing this framework in different domains will create a better understanding of how beliefs about education, self, and context affect teachers' adoption of IBL creating a conceptual framework for all domains.

Further, findings from this study also suggest that, among agricultural educators, there is a positive correlation between the adoption of IBL and teachers' confidence in their ability to develop and organize IBL activities. Further research should be conducted to determine how professional development and pre-service teacher training can be developed to improve agricultural educators' self-efficacy toward IBL. Researchers need to determine what affects agricultural educators' perceptions of their abilities to implement IBL. Discovering how to increase agricultural educators' self-efficacy in regard to IBL can lead to the development of professional development and pre-service courses geared toward increasing the adoption of IBL through increased self-efficacy.

Finally, research should be conducted to determine what other factors might impact teacher adoption of IBL in the agricultural classroom. Further research should also be conducted to determine the perceived contextual hindrances of agricultural

educators. Prior research in other domains has indicated the adoption of IBL to be related to the support teachers receive from administration and funding for supplies; these may serve as other areas for future research in the agricultural education domain. Understanding the perceived contextual hindrances specific to agricultural educators will allow for more effective support for the adoption of IBL.

Teacher belief systems are exceedingly complex. Understanding how agricultural educators' beliefs affect their adoption of various teaching strategies can allow for the development of pre-service agricultural education programs that support agricultural educators in adopting IBL into their classrooms. Understanding the effects of these belief systems can also aid in the professional development of current agricultural educators aimed at supporting their adoption of IBL in the classroom. The findings from this study are simply a glimpse into agricultural educators' belief systems and the effects on the adoption of IBL. Further exploration into what affects agricultural educators' adoption of IBL will provide a better understanding of the direction for pre-service agricultural educator programs and professional development.

### **Summary**

On average, NAAE agricultural educators' beliefs related to IBL are "moderate." Additionally, agricultural educators are using IBL only sporadically in their classrooms. Study findings indicated 26.5 percent of the variance in IBL adoption by agricultural educators can be attributed to beliefs/perceptions about agricultural education, self, and context of agricultural education. Of these perceptions, teachers' self-efficacy was the perception most indicative/predictive of their adoption of IBL. Concerning self-efficacy,

NAAE agricultural educators feel moderately effective in regard to IBL. However, these instructors' responses indicated students' perceived abilities to complete IBL activities to be minimal on average. These findings can be utilized to conduct further research not only in agricultural education, but in other domains as well.

## REFERENCES

- Achieve, Inc. (2015). *Building a strong relationship between competency-based pathways and career and technical education*. Retrieved from <https://careertech.org/sites/default/files/CTE-CompetencyBasedPathways.pdf>
- Achieve, Inc. (2018). *Next generation science standards*. Retrieved from <https://www.nextgenscience.org/>
- Achilles, C. M., & Hoover, S. P. (1996). *Transforming administrative praxis: The potential of problem-based learning (PBL) as a school-improvement vehicle for middle & high schools*. Paper presented at the Annual Meeting of the American Educational Research Association, New York, NY.
- Akpullukcu, S., & Gunay, F. Y. (2015) A case study on students' perceptions and views about inquiry based learning environments. *Journal of Science and Arts, 15*(1-2), 5-10.
- American Association for the Advancement of Science. (1993). *Benchmarks for science literacy*. New York, NY: Oxford University Press.
- Anderson, R. N. (2002). Reforming science teaching: What research says about inquiry. *Journal of Science Teacher Education, 13*(1), 1-12.
- Anderson, R. N., Greene, M. L., & Loewen, P. S. (1988). Relationships among teachers' and students' thinking skills, sense of efficacy, and student achievement. *Alberta Journal of Educational Research, 34*(2), 148-165.
- Arnold, S. K., Warner, W. J., & Osborne, E. (2006). Experiential learning in secondary education classrooms. *Journal of Southern Agricultural Education, 56*(1), 30-39.
- Ashton, P. T. (1990). Editorial. *Journal of Teacher Education, 41*, 2.
- Ashton, P. T., & Webb, R. B. (1986). *Making a difference: Teachers' sense of efficacy and student achievement*. New York, NY: Longman.
- Baker, M. A., Robinson, S. J., & Kolb, D. A. (2012). Aligning Kolb's experiential learning theory with a comprehensive agricultural education model. *Journal of Agricultural Education, 53*(4), 1-16. doi:10.5032/jae.2012.04001
- Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review, 84*(2), 191-215.

- Bandura, A. (1991). Human agency: The rhetoric and the reality. *American Psychologist*, *46*, 157-162.
- Basista, B., & Mathews, S. (2002). Integrated science and mathematics professional development programs. *School Science and Mathematics*, *102*(7), 359-370.
- Batdi, V., Semerci, C., & Aslan, A. (2018). A meta-analytic and thematic study concerning the effect of inquiry based instruction on learners' achievement. *Educational Policy Analysis and Strategic Research*, *13*(2), 51-68. doi:10.29329/epasr.2018.143.3
- Betz, N. E., & Hackett, G. (1981). The relationship of career-related self-efficacy expectations to perceived career options in college women and men. *Journal of Counseling Psychology*, *28*, 399-410.
- Blanchard, M. R., Southerland, S. A., Osborne, J. W., Sampson, V. D., Annetta, L. A., & Granger, E. M. (2010). Is inquiry possible in light of accountability: A quantitative comparison of relative effectiveness of guided inquiry and verification laboratory instruction. *Science Education*, *94*(4), 577-616.
- Blumenfeld, P. C., Soloway, E., Marx, R. W., Krajcik, J. S., Guzdial, M., & Palincsar, A. (1991). Motivating project-based learning: Sustaining the doing, supporting the learning. *Educational Psychologist*, *26*(3-4), 369-398.
- Blunch, N. J. (2013). *Introduction to structural equation modeling using IBM SPSS statistics and AMOS* (2<sup>nd</sup> ed). Los Angeles: Sage
- Blythe, J. M., DiBenedetto, C. A., & Myers, B. E. (2015). Inquiry-based instruction: Perceptions of national agriscience teacher ambassadors. *Journal of Agricultural Education*, *56*(2), 110-121. doi:10.5032/jae.2015.02110
- Bowen, N. K., & Guo, S. (2012). *Pocket guide to social work research methods*. Oxford University Press.
- Brown, J. S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher*, *18*(1), 32-42.
- Capps, D. K., Crawford, B. A., & Constat, M. A. (2012). A review of empirical literature on inquiry professional development: Alignment with best practices and a critique of the findings. *Journal of Science Teacher Education*, *23*, 291-318.
- Carin, A. A., & Bass, J. E. (2001). *Teaching science as inquiry* (9<sup>th</sup> ed). New Jersey: Merrill Prentice Hall.

- Cheek, J. G., Arrington, L. R., Carter, S., & Randell, R. S. (1994). Relationship of supervised agricultural experience program participation and student achievement in agriculture. *Journal of Agricultural Education, 35*(2), 1-5.
- Chiasson, T. C., & Burnett, M. F. (2001). The influence of enrollment in agriscience courses on the science achievement of high school students. *Journal of Agricultural Education, 42*(1), 61-71. Doi:10.5032/jae.2001.01061
- Christensen, C. R., Garvin, D. A., & Sweet, A. (1991). *Education for judgment: The artistry of discussion leadership*. Cambridge, MA: Harvard Business School.
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2<sup>nd</sup> ed). New York: Lawrence Erlbaum Associates.
- Costello, A. B., & Osborne, J. W. (2005). Best practices in exploratory factor analysis: Four recommendations for getting the most from your analysis. *Practical Assessment, Research & Evaluation, 10*(7), 1-9.
- Courtney, M. G. R. (2013). Determining the number of factors to retain in EFA: Using the SPSS R-Menu v2.0 to make more judicious estimations. *Practical Assessment, Research, & Evaluation, 18*(8), 1-14.
- Crawford, B. A. (2000). Embracing the essence of inquiry: New roles for science teachers. *Journal of Research in Science Teaching, 37*(9), 916-937.
- Deboer, G. E. (2002). Student-centered teaching in a standards-based world: Finding a sensible balance. *Science & Education, 11*(4), 405-417. doi:10.1023/A:1016075805155
- Dewey, J. C. (1910). *How we think*. Boston, MA: DC Heath.
- Dewey, J. C. (1916). *Democracy and education*. New York, NY: MacMillian.
- DiBiase, W., & McDonald, J. R. (2015). Science teacher attitudes toward inquiry-based teaching and learning. *The Clearing House, 88*, 29-38. doi:10.1080/00098655.2014.987717
- Dieker, L. A., & Hines, R. A. (2014). *Strategies for teaching content effectively in the inclusive secondary classroom*. Boston, MA: Pearson.
- Dillman, D. A., Smyth, J. D., & Christian, L. M. (2014). *Internet, phone, mail, and mixed-mode surveys: The tailored design method* (4<sup>th</sup> ed.). Hoboken, NJ: Wiley.
- Donner, R. S., & Bickley, H. (1993). Problem-based learning in American medical education: An overview. *Bulletin of the Medical Library Association, 81*(3), 294-298.

- Dorier, J., & Garcia, F. J. (2013). Challenges and opportunities for the implementation of inquiry-based learning in day-to-day teaching. *ZDM Mathematics Education*, 45, 837-849. doi:10.1007/s11858-013-0512-8
- Driver, R., Asoko, H., Leach, J., Mortimer, E., & Scott, P. (1994). Constructing scientific knowledge in the classroom. *Educational Researcher*, 23(7), 5-12.
- Duffy, G. and Anderson, L. (1984). Teachers' theoretical orientations and the real classroom. *Reading Psychology*, 5(1-2), 97-104.
- Dyer, J. E., & Osborne, E. (1996). Effects of teaching approach on achievement of agricultural education students with varying learning styles. *Journal of Agricultural Education*, 37(3), 43-51. doi:10.5032/jae.1996.03043
- Edelson, D. C., Gordin, D. N., & Pea, R. D. (1999). Addressing the challenges of inquiry-based learning through technology and curriculum design. *Journal of the Learning Sciences*, 8(3-4), 391-450.
- Fang, Z. (1996). A review of research on teachers' beliefs and practices. *Educational Research*, 38(1), 47-65. doi:10.1080/0013188960380104
- Fields, A. (2013). *Discovering statistics using IBM SPSS Statistics* (4<sup>th</sup> ed.). Los Angeles: SAGE.
- Geier, R., Blumenfeld, P. C., Marx, R. W., Krajcik, J. S., Fishman, B., Soloway, E., & Clay-Chambers, J. (2008). Standardized test outcomes for students engaged in inquiry-based science curricula in the context of urban reform. *Journal of Research in Science*, 45(8), 922-939
- Gejda, L. M., & LaRocco, D. J. (2006, October). *Inquiry-based instruction in secondary science classrooms: A survey of teacher practice*. Paper session at the 37<sup>th</sup> annual Northeast Educational Research Association Conference, Kerhonkson, New York.
- Gess-Newsome, J., & Lederman, N. G. (1999). Secondary teachers' knowledge and beliefs about subject matter and their impact on education. In J. Gess-Newsome & N. G. Lederman (Eds.), *Examining pedagogical content knowledge: The construct and its implications for science education* (pp. 51-94). New York, NY: Kluwer Academic Publishers.
- Gibson, H., & Chase, C. (2002). Longitudinal impact of an inquiry-based science program on middle school students' attitudes towards science. *Science Education*, 86(5), 693-705.
- Good, T. L. (1987). Teacher expectations. In D. C. Berliner & B. V. Rosenshine (Eds.), *Talks to teachers* (pp. 159-200). New York: Random House.

- Good, T. L., & Brophy, J. E. (2003). *Looking in classrooms* (9<sup>th</sup> ed.). USA: Allyn & Bacon.
- Gormally, C., Brickman, P., Hallar, B., & Armstrong, N. (2009). Effects of inquiry-based learning on students' science literacy skills and confidence. *International Journal for the Scholarship of Teaching and Learning*, 3(2). doi:10.20429/ijstl.2009.030216
- Grossman, P. (1990). *The making of a teacher: Teacher knowledge and teacher education*. New York, NY: Teachers College Press.
- Gulistan, M., Hussain, M. A., & Mushtaq, M. (2017). Relationship between mathematics teachers self-efficacy and students academic achievement at secondary level. *Bulletin of Education and Research*, 39(3), 171-182.
- Gutierrez, S. B. (2015). Collaborative professional learning through lesson study: Identifying the challenges of inquiry-based teaching. *Issues in Educational Research*, 25(2), 118-134.
- Hackett, G., & Lent, R. W. (1992). Theoretical advances and current inquiry in career psychology. In S. D. Brown & R. W. Lent (Eds.), *Handbook of counseling psychology* (2<sup>nd</sup> ed.) (pp. 419-451). New York: Wiley.
- Hiebert, J., Carpenter, T. P., Fennema, E., Fuson, K., Human, P., Murray, H., Olivier, A., & Wearne, D. (1996). Problem solving as a basis for reform in curriculum and instruction: The case of mathematics. *Educational Researcher*, 25(4), 12-21.
- Hofer, B. K. (2001). Personal epistemology research: Implications for learning and teaching. *Journal of Educational Psychology Review*, 13(4), 353-383.
- Hooper, D., Coughlan, J., & Mullen, M. (2008). Structural equation modeling: Guidelines for determining model fit. *Electronic Journal of Business Research Methods*, 6(1), 53-60.
- Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, 6(1), 1-55. doi:10.1080/10705519909540118
- Husbands, C. (2011). What do history teachers (need to) know? A framework for understanding and developing practice. In I. Davies (Ed.), *Debates in history teaching* (pp. 84-95). Oxon, UK: Routledge.
- Jarrett, O. S. (1999). Science interest and confidence among pre-service elementary teachers. *Journal of Elementary Science Education*, 11, 47-57.
- Jeskova, Z., Lukac, S., Hancova, M., Snajder, L. Gunis, J., Balgova, B., & Kires, M. (2016). Efficacy of inquiry-based learning in mathematics, physics, and informatics in relation to

- the development of students' inquiry skills. *Journal of Baltic Science Education*, 15(5), 559-574.
- Kagan, D. M. (1992). Implications of research on teacher beliefs. *Educational Psychologist*, 27(1), 65-90.
- Kaymakamoglu, S. E. (2018). Teachers' beliefs, perceived practice, and actual classroom practice in relation to traditional (teacher-centered) and constructivist (learner-centered) teaching (note 1). *Journal of Education and Learning*, 7(1), 29-37. doi:10.5539/jel.v7nlp29
- Ketelhut, D. J. (2007). The impact of student self-efficacy on scientific inquiry skills: An exploratory investigation in River city, a multi-user virtual environment. *Journal of Science Education and Technology*, 16(1), 99-111.
- Kline, P. (1999). *The handbook of psychological testing* (2<sup>nd</sup> ed.). London, UK: Routledge.
- Krajcik, J., Blumenfeld, P. C., Marx, R. W., Bass, K. M., Fredricks, J., & Soloway, E. (1998). Inquiry in project-based science classrooms: Initial attempts by middle school students. *The Journal of the Learning Sciences*, 7(3/4), 313-350.
- Krejcie, R. V., & Morgan, D. W. (1970). Determining sample size for research activities. *Educational and Psychological Measurement*, 30, 607-610.
- Kuhn, D., Black, J., Keselman, A., & Kaplan, D. (2000). The development of cognitive skills to support inquiry learning. *Cognition and Instruction*, 18(4), 495-523.
- Lazarides, R., Bucholz, J., & Rubach, C. (2018). Teacher enthusiasm and self-efficacy, student self-perceived mastery goal orientation, and student motivation in mathematics classroom. *Teaching and Teacher Education*, 69, 1-10. doi:10.1016/j.tate.2017.08.017
- Lent, R. W., Brown, S. D., & Hackett, G. (1994). Toward a unifying social cognitive theory of career and academic interest, choice, and performance. *Journal of Vocational Behavior*, 45, 79-122. doi:10.1006/jvbe.1994.1027
- Lent, R. W., Brown, S. D., & Larkin, K. C. (1986). Self-efficacy in the prediction of academic performance and perceived career options. *Journal of Counseling Psychology*, 33, 165-169.
- Levy, B. L. M., Thomas, E. E., Drago, K., & Rex, L. A. (2013). Examining studies of inquiry-based learning in three fields of education: Sparking generative conversation. *Journal of Teacher Education*, 64(5), 387-408. doi:10.1177/0022487113496430

- Lindner, J. R., Murphy, T. H., & Briers, G. E. (2001). Handling nonresponse research in social science. *Journal of Agricultural Education*, 42(4), 43-53. doi:10.5032/jae.2001.04043
- Liu, O. L., Lee, H., & Linn, M. C. (2010). Multifaceted assessment of inquiry-based science learning. *Educational Assessment*, 15, 69-86. doi:10.1080/10627197.2010.491067
- Loucks-Horsley, S., Hewson, P. W., Love, N., & Stiles, K. E. (1998). *Designing professional development for teachers of science and mathematics*. Thousand Oaks, CA: Corwin Press.
- Lotter, C., Rushton, T. T., & Singer, J. (2013). Teacher enactment patterns: How can we help move all teachers to reform-based inquiry practice through professional development. *Journal of Science Teacher Education*, 24(8), 1263-1291.
- Luft, J. A. (2001). Changing inquiry practices and beliefs: The impact of an inquiry-based professional development programme on beginning and experienced secondary science teachers. *International Journal of Science Education*, 23(5), 517-534. doi:10.1080/09500690121307
- Luft, J. A., & Roehrig, G. H. (2007). Capturing science teachers' epistemology beliefs: The development of the teachers' beliefs interview. *Electronic Journal of Science*, 11(2), 38-63.
- Magnusson, S., Krajcik, J., & Borko, H. (2001). Nature, sources, and development of pedagogical content knowledge for science teaching. In J. Gess-Newsome & N. G. Lederman (Eds.), *Examining pedagogical content knowledge: The construct and its implication for science education* (pp. 95-132). New York, NY: Kluwer Academic Publishers.
- Mao, S. L., Chang, C. Y., & Barufaldi, J. P. (1998). Inquiry teaching and its effects on secondary-school students' learning of earth science concepts. *Journal of Geoscience Education*, 46, 363-368.
- Marks, H. M. (2000). Student engagement in instructional activity: Patterns in the elementary, middle, and high school years. *American Educational Research Journal*, 37(1), 153-184. doi:10.3102/00028312037001153
- McCombs, B. L., & Whisler, J. S. (1997). *The learner-centered classroom & school: Strategies for increasing student motivation and achievement* (1<sup>st</sup> ed.). San Francisco, CA: Jossey-Bass.
- McDiarmid, G. W. (1994). Understanding history for teaching: A study of the historical understanding of prospective teachers. In M. Carretero & J. F. Voss (Eds.), *Cognitive*

and instructional processes in history and the social sciences (pp. 159-185). Hillsdale, NJ: Lawrence Erlbaum.

- Meals, A., & Washburn, S. (2015). Achieving next generation science standards through agricultural contexts: A Delphi study of outdoor education experts. *Journal of Agricultural Education*, 56(4), 1-16. doi:10.5032/jae.2015.04001
- Midgley, C., Feldlaufer, H., & Eccles, J. S. (1989). Change in teacher efficacy and student self- and task-related beliefs in mathematics during the transition to junior high school. *Journal of Educational Psychology*, 81(2), 247-258. doi:10.1037/0022-0663.81.2.247
- Minner, D. D., Levy, A. J., & Century, J. (2009). Inquiry-based science instruction—what is it and does it matter? Results from a research synthesis years 1984 to 2002. *Journal of Research in Science Teaching*, 47, 474-496. doi:10.1002/tea.20347
- Moar, D., & Taylor, P. C. (1995). Teacher epistemology and scientific inquiry in computerized classroom environments. *Journal of Research in Science Teaching*, 32(8), 839-854.
- Moore, G. (1988). The forgotten leader in agricultural education: Rufus W. Stimson. *Journal of Agricultural Education*, 29(3), 50-58. doi:10.5032/jaatea.1988.03050
- Muis, K. R., Bendixen, L. D., & Haerle, F. C. (2006). Domain generality and Domain-specificity in personal epistemology research: Philosophical and empirical reflections in the development of a theoretical framework. *Educational Psychology Review*, 18(1), 3-54.
- Mullis, I. V. A., Martin, M. O., Ruddock, G. J., O'Sullivan, C. Y., & Preuschoff, C. (2009). *TIMSS 2011 assessment frameworks*. Boston, MA: TIMSS & PIRLS International Study Center.
- Multon, K. D., Brown, S. D., & Lent, R.W. (1991). Relation of self-efficacy beliefs to academic outcomes: A meta-analytic investigation. *Journal of Counseling Psychology*, 38, 30-38. doi:10.1037/0022-0167.38.1.30
- Myers, B. E., Breja, L. M., & Dyer, J. E. (2004). Solutions to recruitment issues of high school agricultural education programs. *Journal of Agricultural Education*, 45(4), 12-21. doi:10.5032/jae.2004.04012
- Myers, B. E., Thoron, A. G., & Thompson, G. W. (2009). Perceptions of the National Agriscience Teacher Ambassador Academy toward integrating science into school-based agricultural education curriculum. *Journal of Agricultural Education*, 49(2), 27-37.
- National Association of Agricultural Educators. (n.d.). *Who we are*. Retrieved from [www.naae.org](http://www.naae.org)

- National Governors Association. (n.d.) Common Core State Standard Initiative. In *Common Core Standards*. Retrieved from <http://www.corestandards.org/>
- National Research Council. (1988). *Understanding agriculture: A new direction for education*. Washington, DC: National Academy Press
- National Research Council. (1996). *National science education standards*. Washington, DC: National Academy Press.
- National Research Council. (2000). *Inquiry and the National Science Education Standards: A guide for teaching and learning*. Washington, DC: National Academy Press.
- National Research Council. (2009). *Transforming agricultural education for a changing world*. Washington, DC: National Academies Press. doi:10.17226/12602.
- National Research Council (2011). *A framework for K-12 science education: Practices, crosscutting concepts, and core ideas*. Washington, DC: National Academy Press.
- Nespor, J. K. (1985). *The role of beliefs in the practice of teaching: Final report of the teacher beliefs study*. Washington, DC: National Institute of Education.
- New Mexico Agricultural Education & FFA Association. (n.d.) In *Center for Agricultural and Environmental Research and Training*. Retrieved from <http://www.nmffa.org/teachers.html>
- Nunnally, J. C. (1978). *Psychometric theory*. New York, NY: McGraw-Hill.
- Olowa, O. W. (2009). Effects of problem-solving and subject matter approaches to the problem solving ability of secondary school agricultural education. *Journal of STEM Teacher Education*, 46(1), 33-47.
- Op 't Eynde, P., De Corte, E., & Verschaffel, L. (2002). Framing students' mathematics-related beliefs: A quest for conceptual clarity and a comprehensive categorization. In G. C. Leder, E. Pekhonen, & G. Torner (Eds.), *Beliefs: A hidden variable in mathematics education?* (pp. 13-37). Dordrecht, The Netherlands: Kluwer Academic Publishers.
- Ozdilek, Z., & Bulunuz, N. (2009). The effect of guided inquiry method on pre-service teachers' science teaching self-efficacy beliefs. *Journal of Turkish Science Education*, 6(2), 24-42.
- Pajares, M. F. (1992). Teachers' beliefs and educational research: Cleaning up a messy construct. *Review of Educational Research*, 62(3), 307-332. doi:10.3102/00346543062003307

- Palmer, D. (2005). A motivational view of constructivist-informed teaching. *International Journal of Science Education*, 27(15), 1853-1881. doi: 10.1080/09500690500339654
- Palmer, D. (2006). Durability of changes in self-efficacy of pre-service primary teachers. *International Journal of Science Education*, 28(6), 655-671. doi: 10.1080/09500690500404599
- Pan, Y. (2014). Relationship among teachers' self-efficacy and students' motivation, atmosphere, and satisfaction in physical education. *Journal of Teaching in Physical Education*, 33, 68-92. doi:10.1123/jtpe.2013-0069
- Parr, B., & Edwards, M. C. (2004). Inquiry-based instruction in secondary agricultural education: Problem-solving-An old friend revisited. *Journal of Agricultural Education*, 45(4), 106-117. doi:10.5032/jae.2004.04106
- Peasley, D. D., & Henderson, J. L. (1992). Agriscience curriculum in Ohio agricultural education: Teacher utilization, attitudes, and knowledge. *Journal of Agricultural Education*, 33(1), 27-31.
- Pedaste, M., Maeots, M., Siiman, L., de Jong, T., Riesen, S. A. N., Kamp, E. T., Manoli, C. C., Zacharia, Z. C., & Tsouralidala, C. (2015). Phases of inquiry-based learning: Definitions and the inquiry cycle. *Educational Research Review*, 14, 47-61.
- Pedersen, J. E., & McCurdy, D. W. (1992). The effects of hands-on, minds-on teaching experiences on attitudes of pre-service elementary teachers. *Science Education*, 62(6), 655-671. doi:10.1002/sce.3730760203
- Phipps, L.S., & Osborne, E.W. (1988). *Handbook on agricultural education in public schools* (5<sup>th</sup> ed). Danville, IL: Interstate.
- Phipps, L. J., Osborne, E. W., Dyer, J. A., & Ball, A. L. (2008). *Handbook on agricultural education in public schools* (7<sup>th</sup> ed.). Clifton Park, NY: Delmar.
- Pizzini, E. L., Bell, S. A., & Shepardson, D. S. (1988). Rethinking thinking in the science classroom. *The Science Teacher*, 55(9), 22-25.
- Pozuelos, F., Gonzalez, G. T., & de Leon, P. C. (2010). Inquiry-based teaching: Teachers' conceptions, impediments, and support. *Teaching Education*, 21(2), 131-142. doi: 10.1080/10476210903494507
- Prince, M., & Felder, R. (2006). Inductive teaching and learning methods: Definitions, comparisons, and research bases. *Journal of Engineering Education*, 95(2), 123-138. doi:10.1002/j.2168-9830.2006.tb00884.x

- Quigley, C., Marshall, J. C., Deaton, C. C. M., & Cook, M. P. (2011). Challenges to inquiry teaching and suggestions for how to meet them. *Science Educator*, 20(1), 55-61.
- Reiff, R. (2002). *If inquiry is so great, why isn't everyone doing it?* In Proceedings of the Annual International Conference of the Association of the Education of Teachers in Science, Charlotte, NC. Retrieved from <https://files.eric.ed.gov/fulltext/ED465642.pdf>
- Rice, A. H., & Kitchel, T. (2018). Agriculture teachers' integrated belief systems and its influence on their pedagogical content knowledge. *Journal of Agricultural Education*, 59(1), 51-69. doi:10.5032/jae.2018.01059
- Richardson, V. (1997). Constructivist teaching and teacher education: Theory and practice (pp. 3-14). In V. Richards (Ed.), *Constructivist teacher education: Building a world of new understandings*. London, UK: Palmer Press.
- Ricketts, J. C., Duncan, D. W., & Peake, J. B. (2006). Science achievement of high school students in complete programs of agriscience education. *Journal of Agricultural Education*, 47(2), 48-55. Doi:10.5032/jae.2006.02048
- Roberts, T. G., Harder, A., & Brashears, M. T. (Eds). (2016). *American Association for Agricultural Education national research agenda: 2016-2020*. Gainesville, FL: Department of Agricultural Education and Communication.
- Ross, J. A. (1992). Teacher efficacy and effects of coaching on student achievement. *Canadian Journal of Education*, 17(1), 51-65. doi:10.2307/1495395
- Roth, W. M., & Bowen, G. M. (1995). Knowing and interacting: A study of culture, practices, and resources in a grade 8 open-inquiry science classroom guided by a cognitive apprenticeship metaphor. *Cognition and Instruction*, 13(1), 73-128.
- Sadri, G., & Robertson, I. T. (1993). Self-efficacy and work-related behavior: A review and meta-analysis. *Applied Psychology: An International Review*, 42, 139-152. doi:10.1111/j.1464-0597.1993.tb00728.x
- Sawada, D., Piburn, M. D., Judson, E., Turley, J., Falconer, K., Benford, R., & Bloom, I. (2002). Measuring reform practices in science and mathematics classrooms: The reformed teaching observation protocol. *Journal of School Science and Mathematics*, 102(6), 245-253. doi:10.1111/j.1949-8594.2002.tb17883.x
- Schank, R. C. (1999). *Dynamic memory revisited*. New York, NY: Cambridge University Press.
- Schoenfeld, A. H. (1983). Beyond the purely cognitive: Beliefs systems, social cognitions, and metacognitions as driving forces in intellectual performance. *Cognitive Science*, 7(4), 329-363. doi:10.1207/s15516709cog0704\_3

- Schunk, D. H. (2004). *Learning theories: An educational perspective* (4th ed.). Upper Saddle River, NJ: Prentice Hall.
- Shahzad, K., & Naureen, S. (2017). Impact of teacher self-efficacy on secondary students' academic achievement. *Journal of Education and Educational Development*, 4(1), 48-72.
- Shavelson, R. J. (1983). Review of research on teachers' pedagogical judgement, plans, and decisions. *Elementary School Journal*, 83(4), 392-413. doi:10.1086/461323
- Shavelson, R. J., & Stern, P. (1981). Research on teachers' pedagogical thoughts, judgements, decisions, and behavior. *Review of Educational Research*, 51, 455-498.
- Shelley-Tolbert, C. A., Conroy, C. A., & Dailey, A. L. (2000). The move to agriscience and its impact on teacher education in agriculture. *Journal of Agricultural Education*, 41(4), 51-61. doi:10.5032/jae.20000.04051
- Shinn, G., Baker, M., & Briers, G. (2007). Response patterns: Effect of day of receipt of an e-mailed survey instrument on response rate, response time, and response quality. *Journal of Extension*, 45(2)
- Shymansky, J. A., Kyle, W. C., & Alport, J. M. (1983). The effects of new science curricula on student performance. *Journal of Research in Science Teaching*, 20(5), 387-404. doi:10.1002/tea.3660200504
- Silm, G., Tiitsaar, K., Pedaste, M., Zacharia, Z. C., & Papaevripidou, M. (2017). Teachers' readiness to use inquiry-based learning: An investigation of teachers' sense of efficacy and attitudes toward inquiry-based learning. *Science Education International*, 28(4), 315-325.
- Singer, J., Marx, R. W., Krajcik, J., & Chambers, J. C. (2000). Constructing extended inquiry projects: Curriculum materials for science educational reform. *Educational Psychologist*, 35(3), 165-178. doi: 10.1207/S15326985EP3503\_3
- Skelton, P., Blackburn, J. J., Stair, K. S., Levy, N. & Dormody, T. J. (2018). Agriscience education through inquiry-based learning: Investigation factors that influence the science competence of middle school students. *Journal of Agricultural Education*, 59(1), 223-237. doi:10.5032/jae.2018.01223
- Smith, K. L., & Rayfield, J. (2016). An early historical examination of the educational intent of supervised agricultural experiences (SAEs) and project-based learning in agricultural education. *Journal of Agricultural Education*, 57(2), 146-160. doi:10.5032/jae.2016.02146

- Sparks-Langer, G. M., Starko, A. J., Pasch, M., Burke, W. Moody, C. D., & Gardner, T. G. (2004). *Teaching as decision making: Successful practices for the secondary teacher*. Upper Saddle River, NJ: Pearson.
- Stavery, J. R. (2015). Overview of problem-based learning: Definitions and distinctions. In A. E. Walerk., H. Leary, C. E. Hmelo-Silver, & P. Ertmer, (Eds.), *Essential readings in problem-based learning* (pp. 5-15). West Lafayette, IN: Purdue University Press.
- Teig, N., Scherer, R., & Nilsen, T. (2018). More isn't always better: The curvilinear relationship between inquiry-based teaching and student achievement in science. *Learning and Instruction, 56*, 20-29. doi:10.1016/j.learninstruc.2018.02-006
- Theriot, P. J., & Kotrlik, J. W. (2009). Effect of enrollment in agriscience on students' performance in science on the high school graduation test. *Journal of Agricultural Education, 50*(4), 72-85. doi:10.5032/jae.2009.04072
- Thompson, G. W., & Warnick, B. K. (2007). Integrating science into the agricultural education curriculum: Do science and agriculture teachers agree? *Journal of Agricultural Education, 48*(3), 1-12. doi:10.5032/jae.2007.03001
- Thoron, A. C., & Burseson, S. E. (2014). Students' perceptions of agriscience when taught through inquiry-based instruction. *Journal of Agricultural Education, 55*(1), 66-75. doi:10.5032/jae.2014.01
- Thoron, A. C. & Myers, B. (2011). Effects of inquiry-based agriscience instruction on student achievement. *Journal of Agricultural Education, 52*(4), 175-187. doi:10.5032/jae.2011.04175
- Thoron, A. C., & Myers, B. (2012). Effects of inquiry-based agriscience instruction on student scientific reasoning. *Journal of Agricultural Education, 53*(4), 156-170. doi:10.5032/jae.2012.04156
- Thoron, A. C., Myers, B. E., & Abrams, K. (2011). Inquiry-based instruction: How it is utilized, accepted, and assessed in schools with National Agriscience Teacher Ambassadors? *Journal of Agricultural Education, 52*(1), 96-106. doi:10.5032/jae.2011.01096
- Toulmin, S. (1982). The construal of reality: Criticism in modern and postmodern science. *Critical Inquiry, 9*, 93-111.
- Tretter, T. R., & Jones, G. M. (2003). Relationships between inquiry-based teaching and physical science standardized test scores. *Journal of School Science and Mathematics, 103*(7), 345-350. doi:10.1111/j.1949-8594.2003.tb18211.x

- Tschannen-Moran, M., & Hoy, A. W. (2001). Teacher efficacy: Capturing an elusive construct. *Teaching and Teacher Education, 17*, 783-805. doi:10.1016/S0742-051X(01)00036-1
- Ullman, J. B. (2013). Structural equation modeling. In B. G. Tabachnick & L. S. Fidell (Eds.), *Using multivariate statistics* (pp. 681-785). Boston, MA: Pearson.
- Van Driel, J. H., Bulte, A. M. W., & Verloop, N. (2007). The relationship between teachers' general beliefs about teaching and learning and their domain specific curricular beliefs. *Learning and Instruction, 17*, 156-171. doi:10.1016/j.learninstruc.2007.01.010
- Van Hover, S. D., & Yeager, E. A. (2003). Challenges facing beginning history teachers: An exploratory study. *International Journal of Social Education, 19*(1), 8-21.
- Voet, M., & De Wever, B. (2016). History teachers' conceptions of inquiry-based learning, beliefs about the nature of history, and their relation to the classroom context. *Teaching and Teacher Education, 55*, 57-67.
- Voet, M., & De Wever, B. (2017). History teachers' knowledge of inquiry methods: An analysis of cognitive processes used during a historical inquiry. *Journal of Teacher Education, 68*(3), 312-329.
- Voet, M., & De Wever, B. (2018). Teachers' adoption of inquiry-based learning activities: The importance of belief about education, the self, and the context. *Journal of Teacher Education, 1-18*. doi:10.1177/0022487117751399
- Walker, A., Leary, H., Hmelo-Silver, C. E., & Ertmer, P. A. (2015). *Essential readings in problem-based learning*. Indiana: Purdue University Press.
- Washburn, S. G., & Myers, B. E. (2010). Agriculture teacher perceptions of preparation to integrate science and their current use of inquiry-based learning. *Journal of Agricultural Education, 51*(1), 88-98. doi:10.5032/jae.2010.01088
- Weinburgh, M. (2007). The effect of *Tenebrio obscurus* on elementary pre-service teachers' content knowledge, attitudes, and self-efficacy. *Journal of Science Teacher Education, 18*, 801-815. doi:10.1007/s10972-007-9073-4
- Weinstein, T., Boulanger, F. D., & Walberg, H. J. (1982). Science curriculum effects in high school: A quantitative synthesis. *Journal of Research in Science Teaching, 19*(6), 511-522. doi:10.1002/tea.3660190610
- Welch, W. W., Klopfer, L. E., Aikenhead, G. S., & Robinson, J. T. (1981). The role of inquiry in science education: Analysis and recommendations. *Science Education, 65*(1), 33-50. doi:10.1002/sce.3730650106

- Witt, P. A., Ulmer, J. D., Burris, S., Brashears, T., & Burley, H. (2014). A comparison of student engaged time in agriculture instruction. *Journal of Agricultural Education*, 55(2), 16-32. doi:10.5032/jae.2014.02016
- Woolfolk, A. (2004). *Educational psychology* (9<sup>th</sup> ed.). Upper Saddle River, NJ: Merrill.
- Woolfolk Hoy, A. Davis, H., & Pape, S. J. (2006). Teacher knowledge and beliefs. In P. A. Alexander & P. H. Winne (Eds.), *Handbook of educational psychology* (pp. 715-738). New York, NY: Routledge.
- Yilmaz, K. (2008). Social studies teachers' conceptions of history: Calling on all historiography. *Journal of Educational Research*, 101(3), 158-176.
- Zafra-Gomez, J. L., Roman-Martinez, I., & Gomez-Miranda, M. E. (2015). Measuring the impact of inquiry-based learning on outcomes and student satisfaction. *Assessment & Evaluation in Higher Education*, 40(8), 1050-1069. doi:10.1080/02602938.2014.963836

APPENDIX A

TAMU INSTITUTIONAL REVIEW BOARD APPROVAL DOCUMENTATION

IRB Application (Human Research) (Version 1.3)

1.0 General Information		
<b>*Please enter the full title of your study:</b>		
Agricultural Teachers' adoption of inquiry-based learning: The effects of beliefs about Education, Self, and Context		
<b>*Please enter a reference or other description for this study. This field is required, but will not be referenced by the staff. It is for your use:</b>		
Barriers to Inquiry-based learning * This field allows you to enter an abbreviated version of the Study Title to quickly identify this study.		
2.0 Add Department(s)		
<b>2.1 List departments associated with this study. If the study is funded, please associate it with the correct A&amp;M System member.:</b>		
<b>Primary Dept?</b>	<b>Department Name</b>	
<input checked="" type="radio"/>	TAMU - College Of Agriculture - Ag Leadership, Education & Communication	
<input type="radio"/>	TAMU - Texas A&M University - Not Specified	
3.0 Assign key study personnel (KSP) access to the project		
<b>3.1 *Please add a Principal Investigator for the study:</b>		
Murphrey, Theresa PESL		
<b>3.2 If applicable, please select the Research Staff personnel. Please note if you do not find the personnel needed, please contact the iRIS support line at 845-4969. IRB Note: These personnel will need to sign off on the initial application submission.</b>		
A) Additional Investigators		
Baldock, Kalynn Protocol Director Briers, Gary Co-Investigator		
B) Research Support Staff		
<b>3.3 *Please add a Study Contact:</b>		
Baldock, Kalynn		

The Study Contact(s) will receive all important system notifications along with the Principal Investigator. (e.g. The project contact(s) are typically either the Study Coordinator or the Principal Investigator themselves).		
<b>3.4 If applicable, please add a Faculty Advisor:</b>		
Murphrey, Theresa PESL		
<b>3.5 Please select the Designated Department or Supervisor Approval(s)(not required for Animal Use Protocol):</b>		
Gill, Clare <i>Department Chair</i>		
For IRB and IBC, add the name of the individual authorized to approve and sign off on this protocol from your Unit (e.g. the Department Chair or Dean).		
<b>3.6 If applicable, please select the Administrative Assistant(s)(i.e., Designee) Note: These personnel will not need to sign off on the initial application submission. Please do not use for IRB applications.</b>		
<b>4.0 Request to the Human Research Protection Program :: Please Select <b>ONE</b> of the options below.</b>		
<b>4.1 I am conducting Human Subjects Research, and I want to proceed to the regular application.</b>		
<input checked="" type="radio"/> Yes <input type="radio"/> No Which IRB reviews your research? <input checked="" type="radio"/> TAMU IRB <input type="radio"/> Dentistry IRB		
<b>4.2 I am requesting a determination - is my project human subjects research?</b>		
<input type="radio"/> Yes <input checked="" type="radio"/> No		
<b>4.3 I am requesting to defer to an external IRB (that is not IRB TAMU or IRB Dentistry).</b>		
<input type="radio"/> Yes <input checked="" type="radio"/> No		
<b>4.4 I am requesting a "Delayed Onset" of human subjects research determination.</b>		
<input type="radio"/> Yes <input checked="" type="radio"/> No		
<b>4.5 A non-Texas A&amp;M researcher is requesting to use people at Texas A&amp;M as human subjects (staff use only).</b>		
<input type="radio"/> Yes <input checked="" type="radio"/> No		
<b>5.0 Study Personnel Qualifications</b>		

### 5.1 Study Personnel Qualifications

Select the Study Personnel from the list created earlier in the application. Then provide the qualifications and role information for that study personnel selection as applicable to this study.

Study Personnel	Qualifications	Role in Study and Duties delegated by PI
Baldock, Kalynn	Doctoral student with training in qualitative and quantitative research.	Protocol Director - will collect and analyze data.
Murphrey, Theresa PESL	Qualitative and quantitative researcher. Faculty advisor.	Will guide the graduate student in her research and review all work.
Briers, Gary	Qualitative and quantitative researcher. Faculty advisor.	Will guide the graduate student in her research and review all work.

### 5.2 External Site or Study Personnel

Please list the study personnel on your study who are not associated with Texas A&M. Additional documentation and agreements may be needed for these individuals.

Will an external site review the research?

Yes  No

If yes, what is the name of the external site?

Texas Tech University

Name	Institution	Telephone	E-mail	Role
John Rayfield	Texas Tech University	806-834-1956	john.rayfield@ttu.edu	Graduate Committee Chair

Name (from above)	Briefly describe how the person will participate in human subjects research activities	Experience, training, education for these activities	Most recent CITI / alternative training date
No records have been added			

*The IRB only needs education or CITI certificate for external personnel if there is no other IRB reviewing the research or if they are a part of the TAMU team.*

## 6.0 Texas A&M University Human Research Protection Program Project Application Form Study Introduction

### 6.1 Application Checklist

The following checklist is a guide for researchers regarding supporting documents that must be considered for and/or uploaded with this application for review and approval before use.

- Informed Consent Document

- Information Sheet
- Waiver of HIPAA Authorization
- Parental Permission Form/Minor Assent Form
- Recruitment materials (i.e. flyers, emails, advertisements, telephone scripts, social media posts)
- Site Authorization Letter (for study conduct and/or access to administrative records)
- Survey/Questionnaire/Data Collection/Abstraction Forms
- Grant Applications (cover to cover), required if funded or grant submitted
- Instructions
- Protocol Investigator's Brochure (for clinical trials only)
- Case report form (for clinical trials only)
- Device Manual (if using an approved or investigational device)
- Thesis/dissertation proposal
- Waiver of parental permission/minor assent form
- Letter of cultural evaluation for international research (link to SOP)
- IRB approvals from collaborating institutions
- Any other documents related to the research
- CVs for all investigators when proposed activities are more than minimal risk
- CITI training for all personnel

### 6.2 Proprietary Information

This protocol includes confidential and/or proprietary information to be protected from disclosure.

Yes  No

### 6.3 Is this research funded?

Please identify your funding source, if applicable.

View Details	Sponsor Name	Sponsor Type	Funding Through	Contract Type:	Project Number	Award Number
No Sponsor has been added to this Study						

Please provide the name of the PI on the funding/grant if it is different from this IRB application.

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Will funds from Qatar be used to fund this research?

Yes  No

*\* If the response to this question is Yes, then approval by an IRB in Qatar may also be required.*

### 6.4 Has an entity conducted a scientific peer-review of this research?

Yes  No

If Yes, please specify:

---

### 6.5 Fee for Service Information

Is a company providing contract services associated with this research in which no company personnel are considered collaborators in the research (will not receive professional recognition or included in presentations or publications about the research)?

Yes  No

If yes, please provide the name of the company and the contact name.

If a contract exists for this study, was the fee for service information included in the primary award information?

Yes  No

If yes, please provide a copy of the contract.

Version	Title	Category	Expiration Date	Document Outcome	Checked Out	View Document
No Document(s) have been attached to this form.						

**6.6 Is this project part of a dissertation, thesis, or record of study?**

Yes  No

If available, please attach the proposal under Other Study Documents at the conclusion of the application. If not yet available, submit it as an amendment form when available.

**7.0 Study Scope**

**7.1 Research Classification**

Select all that apply:

- Social/Behavioral
- Biomedical
- Both
- Clinical Trial
- Other, specify

For Social/Behavioral Research, select all that apply.

- Questionnaire/Survey
- Observation (investigator observing participants)
- Retrospective study of records existing at time of this application
- Exposure to some type of stimulus or intervention (includes device or substance)
- Participant observation (investigator acts as participant)
- Interview
- Focus Group
- Other, specify

**7.2 Vulnerable Populations**

Identify any vulnerable populations that will be included in the study:

- Children (for example, in Texas, under 18)
- Pregnant women, human fetuses, neonates
- Individuals with physical disabilities
- Individuals with cognitive disabilities

- Economically or educationally disadvantaged persons
- Prisoners
- Other (for example, individuals with psychiatric disorders, emotional/social impairments, depression, etc.)
- No Vulnerable Populations will be included.

If Other, then please explain:

Describe additional safeguards planned to protect the rights and welfare of vulnerable subjects:

Names will not be kept with data. Names will be deleted once data collection is complete.

If a subject transitions into one of the vulnerable populations (pregnant women or cognitively impaired), will the study procedures place them at any additional risk?

Yes  No

If a subject becomes incarcerated (including awaiting sentencing, court-mandated treatment, or in prison), contact the IRB immediately.

Please justify the use of vulnerable/special populations.

## 8.0

### Project Overview - Protocol Section Begins Here

#### 8.1 Project Summary

In the space below, provide a summary of the project. Include information about background and rationale for the study including preliminary data, purpose, objectives, specific aims, and research questions. Character limit: 5,000 (applies to first box).

Agricultural instructors have been utilizing components of inquiry-based learning for decades through project-based learning, problem-solving, and experiential learning (Baker et al., 2012; Dyer & Osborne, 1996; Moore, 1988; Phipps et al., 2008). Parr and Edwards (2004) synthesized research on inquiry-based and problem-solving methods in science and agricultural education discovering significant agreement between the two pedagogical strategies. Utilizing a problem-solving approach in agricultural classrooms increases student's scores on achievement tests when compared to a subject matter approach (Dyer & Osborne, 1996). Washburn and Myers (2010) studied agricultural educators in the state of Florida and found these educators were implementing teacher-oriented inquiry three times per week and student-oriented inquiry at least once per month.

In recent years, researchers have begun investigating the benefits of inquiry-based learning opportunities in agricultural classrooms. Inquiry-based learning opportunities are those activities allowing students to pose questions, make observations, and formulate explanations for their findings (NRC, 2000). Witt, Ulmer, Burris, Brashears, and Burley (2014) found students spent more time engaged in agricultural lessons when inquiry-based learning was utilized. Thoron and Myers (2012) discovered inquiry-based learning in the agriscience classroom increased students' scientific reasoning. Thoron and Myers (2011) had previously concluded that inquiry-based instruction improved students' content knowledge when utilized in the agriscience classroom. Further, it has been found that inquiry-based learning improves students' attitudes towards agriculture in their daily lives and towards their agriscience classes (Thoron & Burleson, 2014).

Multiple studies have been conducted to examine teachers' perceptions and attitudes about inquiry-based instruction (Blythe et al., 2015; DiBiase & McDonald, 2015). Voet and De Wever (2018) found history teachers' adoption of inquiry-based was significantly impacted by their self-efficacy related to organizing inquiry-based learning activities and the perceived hindrances of implementing these activities. Further, Thoron, Myers, and Abrams (2011) found, with proper training, agricultural teachers have positive attitudes towards utilizing inquiry-based instruction. Students have a more favorable opinion of agriscience and have positive responses regarding the importance of agriculture when taught through inquiry-based learning activities (Thoron & Burleson, 2014).

The adoption of inquiry-based learning in the agricultural classroom has not been widely researched. Examination of the current literature demonstrates need for further research to be conducted to determine the hindrances to adopting inquiry-based learning in the agricultural classroom. By gaining a better understanding of the variables that can impact agricultural teachers' adoption of inquiry-based learning,

professional development and pre-service teacher courses can be improved to include the support to overcome these variables.

Guiding questions for the study:

1. How do agricultural teachers' beliefs about education effect their adoption of IBL?
2. How do agricultural teachers' self-efficacy effect their adoption of IBL?
3. How do agricultural teachers' beliefs about context effect their adoption of IBL?

The purpose of this study is to examine the belief system of agriculture teachers about agricultural education, self, and context in regards to their adoption of IBL. The objectives for the study are:

1. Determine how agriculture teachers' beliefs about agricultural education, the self, and context of agricultural education influence their adoption of IBL.
2. Determine how agriculture teachers' beliefs about agricultural education, the self, and context of agricultural education are related to one another.
3. Determine how agriculture teachers' characteristics, such as teaching degree and pathway taught, influence their beliefs about agricultural education, the self, and context of agricultural education.

#### Procedures Involved:

In the space below, Describe and explain the study design. Provide a description of all research procedures being performed and when they are performed.

List each procedure or test and how often the procedure or test will occur for each participant.

Include a procedure schedule or table of events, if applicable - clinical studies.

Describe: All source records that will be used to collect data about subjects. This includes surveys, scripts, recordings and data collection forms; all test articles including dietary supplements, drugs and devices used in the research and the purpose of their use, and their regulatory (FDA) approval status.

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#### *Population and Sampling*

The target population of this study will be agricultural educators who are members of the National Association of Agricultural Educators (N=7800). Contact information of 2,000 members will be randomly selected from NAAE membership data, with a target sample size of 367 based on the recommendations of Krejcie and Morgan (1970). Once 367 responses have been received no more members will be contacted. The sample will be randomly selected by staff members of NAAE who will send the contact information to the researchers. The researcher will send out an email with the link to the Qualtrics survey to those members who were randomly selected. It is the hope of the researcher that the sample will include a homogenous sample of members from each of the six NAAE regions.

#### *Instrumentation Development*

Determining the dimensions of belief systems of agricultural educators that explain their adoption of IBL requires development of an instrument. A review of literature led to the discovery of an instrument developed by Voet and De Wever (2018) which was utilized to capture history teachers' beliefs systems about education, self, and context, and how it affected their adoption of IBL. Internal consistencies of this instrument are reported as Cronbach's  $\alpha$ : Objectivism = .71, Substantive knowledge = .73, Procedural knowledge = .80, Self-efficacy = .78, Perceived student ability = .72, Perceived contextual hindrances = .83, Adoption of inquiry-based learning = .69 (Voet & De Wever, 2018). Permission has been gained from Voet to adapt this instrument to agricultural teachers' beliefs systems about education, self, and context. After making adaptations to this instrument, a pilot test utilizing pre-service agricultural teachers will be conducted to determine the reliability and validity of the new instrument.

The instrument, adapted from Voet and De Wever (2018), will address the framework items as follows: conceptions of nature of knowledge (4 items), substantive knowledge (3 items), procedural knowledge (3 items), self-efficacy (4 items), perceived student ability (3 items), perceived contextual hindrances (4 items), and adoption of inquiry-based learning (4 items). Each of these items will use a six-point Likert scale. The nature of knowledge, perceived student abilities (which will be reverse-coded), and perceived contextual hindrances will have Likert scale ratings of "completely disagree" to "completely agree". Substantive and procedural knowledge will have Likert scale ratings of "very unimportant" to "very important". Self-efficacy items will have Likert scale ratings of "completely unable" to "completely able". Finally, the adoption of inquiry-based learning will have Likert scale ratings of "never" to "very often".

#### *Data Collection*

Data will be collected from members of the NAAE. A link to the questionnaire, hosted by Qualtrics, will be emailed to participants. A five-contact e-mail strategy, as suggested by Dillman, Smyth, and Christian (2014), will be utilized. Non-response errors will be handled according to the methods recommended by Linder, Murphy, and Briers (2001).

#### *Instrument Validation*

The quality of the questionnaire will be determined through factorial validity and internal consistency. To accomplish this, the data will be split into two random subsets, which will then be used to conduct an exploratory

factor analysis (EFA) and confirmatory factor analysis (CFA). For each scale, the entire data set will be utilized to calculate the Cronbach's  $\alpha$ . Exploratory factor analysis will be carried out utilizing SPSS with maximum-likelihood estimation and rotation through oblique Promax as recommended by Costello and Osborne (2005) and Fields (2013). The number of factors to be retained will be determined by comparing Kaiser's eigenvalues greater than one and Cattell's Scree test as recommended by Courtney (2013). Confirmatory factor analysis will be conducted using the "Lavaan" Package of R 3.1 to determine if the data has a good fit index. Internal consistency for each scale will be calculated.

#### Analysis

The Likert-type scales will be used to examine how teachers' beliefs influence the adoption of IBL. R 3.1 will be used to estimate a structural equation model. One within-scale correlation will be allowed as recommended by Hu and Bentler (1999).

- Drugs
- Devices
- Supplements

Significance:

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Priority area four of the National Research Agenda for the American Association for Agricultural Education states, "Enhanced understanding of learning and teaching environments could result in the development of present-day best practices and research-based pedagogies and technologies that not only meet the goal of agricultural education but also society's greatest challenges" (Roberts, Harder, & Brashears, 2016, p. 39). The use of inquiry-based learning opportunities within the agricultural classroom creates a learning environment that requires further research. Inquiry-based learning has many positive effects when implemented in the agricultural classroom, including students' motivation to take the course, as supported by the literature review. Gaining a better understanding of the barriers that effect instructors' decision to adopt inquiry-based learning will allow for the development of pre-service instruction and professional development to support instructors' adoption of inquiry-based learning.

Subjects, enrollment, recruitment, inclusion and exclusion criteria, and informed consent:

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**Study Design:** This study will consist of quantitative survey focused on understanding how teachers' beliefs about education, self, and context affect their implementation of inquiry-based learning in Agricultural Education courses. **Procedures:** A link to the questionnaire, hosted by Qualtrics, will be emailed to a target sample size of 367 participants. A five-contact e-mail strategy, as suggested by Dillman, Smyth, and Christian (2014), will be utilized. Non-response errors will be handled according to the methods recommended by Lindner, Murphy, and Briers (2001). **Enrollment:** An informational email will be sent through Qualtrics to individuals. Those who agree to participate will be provided with the information sheet (see submitted file) and a link to the survey. **Recruitment:** Staff at the National Association of Agricultural Educators (NAAE) will randomly select NAAE members contact information to share with the researchers. **Inclusion and exclusion criteria:** The participant must be a member of National Association of Agricultural Educators in order to be considered for this study. **Informed Consent:** An information sheet will be provided to participants.

Will audio recordings be collected?

- Yes  No

Will visual images be collected?

- Yes  No

If visual images will be collected, are they full, facial identifiable images?

- Yes  No

## 8.2 Locations

List locations or facilities where the research will be conducted (e.g. building name, physical address).

Online survey being used. Respondents will complete from their own location.

Are any of the locations listed above non-Texas A&M facilities?

Yes  No

What is the role of each location?

Each individual will complete the online survey at a location of their choice.

Is the PI of this IRB study application the lead investigator of a multicenter study (i.e. the study is taking place at multiple institutions that are obtaining their own IRB approval and you are coordinating and overseeing the research)?

Yes  No

Has IRB approval been sought at another institution?

Yes  No

Please submit the Site Authorization letter(s) with this application as a study document or indicate when site authorization will be obtained. Guidance is available at <http://rcb.tamu.edu/humansubjects/resources/site-authorization-letter>

### 8.3 Other Committee Approvals

Select all that apply.

- None
- Animal Use
- Biohazards
- Chemical
- Radiation
- Other

If any committee approvals apply, please provide the permit number and approval date.

## 9.0

### Study Population

#### 9.1 Number of Participants

Approximately how many subjects do you plan to enroll?

2000

Provide the rationale for the number of subjects requested (for example, power analysis, sponsor requirements, etc.).

The desired number of respondents is 367. It is anticipated that more than 367 will need to be able to be contacted due to non-response. After the initial responses are collected up to 2000 subjects will be contacted until the desired 367 responses have been collected.

Will human subjects be used from the Qatar population?

Yes  No

*\* If Yes, then approval by an IRB in Qatar may also be required.*

Will human subjects be used from another international population?

Yes  No

*\*If Yes, then approval by an international review board or government may also be required.*

Will human subjects be used from a Native American population?

Yes  No

*\*If Yes, then approval by a tribal IRB(s) may also be required.*

If Yes for research in Qatar, in another country, or with Native Americans, provide justification for that research being conducted in that particular community.

**9.2 Provide the age groups being enrolled into this study (Note the consent documents required for each age group listed in parentheses):**

- 0-6 (parental consent only, Pediatric Assessment required for Clinical Trials)
- 7-11 (child's assent plus parental permission, Pediatric Assessment required for Clinical Trials)
- 12-17 (consent plus parental permission, Pediatric Assessment required for Clinical Trials)
- 18+ (consent only)

Enter the specific age range for study population (if overlap or specific within a category):

\_\_\_\_\_

**9.3 Indicate the gender of participants being enrolled into this study:**

- Male
- Female
- Both male and female

**9.4 Inclusion/Exclusion Criteria**

What are the inclusion and exclusion criteria for study participation?

In order to participate in this study members must be a member of the National Association of Agricultural Educators. Participants will be sent an information sheet and be able to decide whether or not to participate by the click of a button.

Do the exclusion criteria exclude specific populations or individuals based on gender, culture, language, economics, race, or ethnicity?

Yes  No

If Yes, then justify each exclusion:

**9.5 Describe the setting where the informed consent process will take place (e.g. classroom, clinic, laboratory, office, park, personal computer, etc.).**

If a waiver of documentation of informed consent is requested, then describe how participants will review the information sheet.

At a personal computer. An information sheet will be shared and the respondent will decide to complete the survey with the click of a button.

**9.6 Experience of Subjects**

<p>Describe the experience of subjects while participating in this research. (Please describe what the participant will experience from the time of learning of the study through completion.)</p> <p>Respondent will choose whether or not they want to complete the online survey. Respondent can exit the survey at any time.</p> <p>How long will the participants be engaged in the research (length of time, e.g., 15 minutes, 45 minutes on Day 1, 60 minutes on Day 2, etc.)?</p> <p>The survey will take approximately 10 minutes to complete.</p>
---

## 10.0 Privacy and Confidentiality

<p><b>10.1 How will the identities of subjects be protected in all research records? The information collected/analyzed is:</b></p>	
<p><i>Note: Data that are coded, where the key to the code is accessible to researchers, are considered confidential information and subject to privacy regulations.</i></p> <p> <input type="checkbox"/> Anonymously: The identity of the participant cannot readily be determined by the investigator AND the identity of the participant is not connected to information gathered.  <input checked="" type="checkbox"/> Confidential: Research participants can be identified; however, information gathered will be protected.  <input type="checkbox"/> Neither: Research participants can be identified, and information gathered may be connected to the participant.         </p> <p>Summarize procedures to protect the confidentiality and anonymity of participants (e.g., replies coded, etc.).</p> <p>Once responses are received all identifying information will be erased from the database leaving only the survey information.</p> <p>What are the plans for retention and/or destruction of linkages between study data and personal identifying information? (Specify when and how personal identifying information will be destroyed.)</p> <p>Once responses have been received all identifying information will be removed from the database.</p> <p>If these linkages will not be destroyed, explain how you will maintain confidentiality of the personally identifying information.</p> <p>The names of respondents will be deleted after data collection is complete.</p> <p>If personally identifying information will not be kept confidential, then justify and explain the informed consent process for sharing this information.</p> <p>Will a Certificate of Confidentiality (through DHHS or another Federal agency) be utilized?  <a href="https://humansubjects.nih.gov/coc/index">https://humansubjects.nih.gov/coc/index</a></p> <p> <input type="radio"/> Yes <input checked="" type="radio"/> No         </p>	

<p><b>11.0 Potentially Sensitive Subject Matter and Procedures</b></p>	
<p><b>11.1 Will this type of information be collected?</b></p>	
<p> <input type="radio"/> Yes <input checked="" type="radio"/> No         </p>	

**11.2 Select all that describe the information.**

- No sensitive matters
- Abortion
- Alcohol
- Body composition
- Criminal activity
- Depression
- HIV/AIDS
- Learning disability
- List of current medications
- Medical/dental problems
- Medical history
- Potential child abuse/neglect
- Psychology/psychiatry
- Sexual activity
- Suicide
- Unethical behavior
- Other

If other, please specify:

---

If Medical History or Mental Health History information will be collected, please describe:

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**11.3 Deception**

Will deception be used as part of the study?

Yes  No

If Yes, please describe the deception.

Please describe the debriefing procedures to be used.

Provide justification for the deception.

**12.0 Risks and Benefits**

**12.1 Regulatory definition of minimal risk is that the probability and magnitude of harm or discomfort anticipated in the research are not greater in and of themselves than those ordinarily encountered in daily life or during the performance of routine physical or psychological examinations or tests (45 CFR 46.102(h)(i)).**

Identify the types of risk associated with participation in the study:

- Physical
- Privacy
- Confidentiality
- Psychological/emotional
- Social
- Legal
- Other

If Other, please describe the risks:

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<p>Describe the potential risks or discomforts to participants. Include justification of the known risks, which were selected above.</p> <p>No risks are expected to participants.</p> <p>Describe the approaches you will take to minimize these risks and/or to minimize their impact.</p> <p>n/a</p> <p>What alternatives are available to subjects outside the research (i.e., what is the standard of care, is the research intervention available without participating)?</p> <p>The alternative is not to participate.</p>	
<p><b>12.2 What are the potential benefits of this study to individual participants? (This does not include payments, compensation, or incentives.)</b></p>	
<p>No direct benefits to the participate will occur. However indirect benefits will be gained through the knowledge gained from the study through development of professional development for the agricultural educators profession.</p>	
<p><b>12.3 What are the potential benefits of this study to the population or society?</b></p>	
<p>The knowledge gained from this study will allow for the development of pre-service agricultural educator courses and professional development for current agricultural educators which will help support them in the adoption of inquiry-based learning.</p>	
<p><b>13.0 Personally Identifiable Information</b></p>	
<p><b>13.1 Indicate which of the following personally identifiable information (PII) will be accessed or recorded in association with this study:</b></p>	
<p><input type="checkbox"/> None</p> <p><input checked="" type="checkbox"/> Name</p> <p><input type="checkbox"/> Web addresses (URLs)</p> <p><input type="checkbox"/> Full Face Photographic Image</p> <p><input type="checkbox"/> Internet IP Address</p> <p><input type="checkbox"/> Health Plan Beneficiary Number</p> <p><input type="checkbox"/> Certificate/ License Number</p> <p><input type="checkbox"/> Any Other Unique Identifier or Combination</p> <p><input type="checkbox"/> Geographic Information (including city and ZIP)</p> <p><input type="checkbox"/> Vehicle Identification Number and Serial Numbers Including License Plate Number</p> <p><input type="checkbox"/> Telephone Number</p> <p><input checked="" type="checkbox"/> Email address</p> <p><input type="checkbox"/> Fax number</p> <p><input type="checkbox"/> Social Security Number</p> <p><input type="checkbox"/> Medical Record Number</p> <p><input type="checkbox"/> Account Number</p> <p><input type="checkbox"/> Medical Device Identifiers</p> <p><input type="checkbox"/> Biometric Identifiers</p> <p><input type="checkbox"/> Dates directly related to an individual (including birth, death, admission, discharge, date of procedure)</p> <p><input type="checkbox"/> Educational Records</p> <p>Will any PII in your possession be coded?</p> <p><input type="radio"/> Yes <input checked="" type="radio"/> No</p> <p>Will you have the code in your possession?</p> <p><input type="radio"/> Yes <input checked="" type="radio"/> No</p>	

Is this personally identifiable information considered Protected Health Information (PHI)? (PHI is any of the 18 identifiers listed above collected by or received by a covered entity, which includes a healthcare provider, healthcare clearing house, or as defined in the University SAP 16.99.99.M0.01.)

Yes  No

*\*If Yes, additional requirements may be involved such as HIPAA authorization, Waiver of Authorization, or Data Use Agreement, or other agreements.*

**13.2 Explain why you need to obtain personally identifiable information (list all of the data fields to be collected):**

Respondents' names and emails will be used to send out the survey and will be known. Once data collection has completed -- names and emails will be deleted.

**13.3 Does this study involve use of Protected Health Information (PHI) being received from a Covered Entity (e.g. healthcare provider, healthcare clearing house, health plan)?**

Yes  No

Will the provider be a collaborator on this study who will maintain the code to the PHI in their possession?

Yes  No

If yes, identify the covered entity and provide the data use agreement or business associate agreement.

Version	Title	Category	Expiration Date	Document Outcome	Checked Out	View Document
No Document(s) have been attached to this form.						

Covered Entity:

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Does this study involve collection of PHI from participants or receipt of PHI from a covered entity?

Yes  No

Does this study involve distribution of PHI to a Covered Entity (e.g. healthcare provider, healthcare clearing house, health plan)?

Yes  No

If Yes to any of these three previous questions, PHI authorization or a waiver of PHI authorization is required. Is a waiver of PHI authorization being requested? For more information, see the additional information online: <http://rcb.tamu.edu/humansubjects/resources/consentinfo>

Yes  No

Please attach the HIPAA Authorization as needed to the application.

Version	Title	Category	Expiration Date	Document Outcome	Checked Out	View Document
No Document(s) have been attached to this form.						

**13.4 Will the PHI used in this study be stored with encryption?**

Yes  No

How is PHI transmitted electronically being protected?

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<p>How is PHI data protected?</p> <hr/> <p>Who has access to PHI?</p> <hr/>	
<b>14.0 Retrospective Details</b> (Please note: This refers to the analysis of data, documents, records, or specimens that were existing as of the date of the IRB application.)	
<b>14.1 Will existing data or documents be used (e.g., patient records/charts, samples/specimens, public records, surveys, evaluation tools, etc.)?</b> <b>NOTE: If you answer NO to this question, please skip the remaining questions in this section.</b>	
<p><input type="radio"/> Yes <input checked="" type="radio"/> No</p> <p>If Yes, then: Describe the data or documents that will be used.</p> <p>What is the date range of the original data collection?</p> <hr/> <p>How will the existing data be obtained? Additional information may be required to establish authority to use the data previously collected.</p>	
<b>14.2 Will your research be limited to only existing data or specimens?</b> <b>NOTE: If data/specimens will be collected after submission of this application, then the answer here is "No". If you answered NO to this question and the main question above, please skip the remaining questions in this section.</b>	
<p><input type="radio"/> Yes <input checked="" type="radio"/> No</p>	
<b>14.3 Will existing specimens be used (e.g., human blood, tissue, saliva, etc.)?</b>	
<p><input type="radio"/> Yes <input checked="" type="radio"/> No</p> <p>If Yes, then describe the specimens that will be used and how they will be obtained.</p> <hr/> <p>Indicate the number of specimens.</p> <hr/> <p>How will the specimens be obtained?</p> <hr/> <p>Provide the documentation from the holder of the samples that gives you permission to use the samples for research purposes. If the samples were collected for research purposes, provide a copy of the approved informed consent document used to obtain the samples.</p>	
<b>14.4 Retrospective Details – Publicly Available</b>	
<p>Is the source of the data for your research accessible by the general public?</p> <p><input type="radio"/> Yes <input checked="" type="radio"/> No</p> <p>Provide the link if applicable.</p> <hr/>	
<b>14.5 Retrospective Details – Identity</b>	

<p>Will it be possible to determine a subject's identity directly or indirectly through a link (e.g., Medical Record Number (MRN), participant code, IP address, email)?</p> <p><input type="radio"/> Yes <input checked="" type="radio"/> No</p>	
<p><b>14.6 Retrospective Details – Waiver of Informed Consent</b></p>	
<p>Is it impractical to obtain informed consent from the subjects?</p> <p><input type="radio"/> Yes <input checked="" type="radio"/> No</p> <p>If Yes, then please complete the Waiver of Informed Consent information in the next section.</p>	
<p><b>14.7 Retrospective Details - Waiver of Document of Informed Consent</b></p>	
<p>Is it possible to obtain informed consent, AND the only link between the data and the human subject would be the signed informed consent document?</p> <p><input type="radio"/> Yes <input checked="" type="radio"/> No</p>	
<p><b>15.0 Costs and Compensation</b></p>	
<p><b>15.1 What are the costs to participants (monetary, time, expense, etc.)? Identify the costs and specify the amount.</b></p>	
<p>The cost of participating in this study will be the time, 10 minutes, that it takes to complete the survey.</p>	
<p><b>15.2 Will participants receive any compensation for participation in the study?</b>  <b>Note: For payments to participants, please see University SAP Payment of Survey and Research Participants 21.01.99.M0.03. (<a href="http://rules-saps.tamu.edu/PDFs/21.01.99.M0.03.pdf">http://rules-saps.tamu.edu/PDFs/21.01.99.M0.03.pdf</a>)</b></p>	
<p><input type="radio"/> Yes <input checked="" type="radio"/> No</p> <p>If Yes, then identify the amount of compensation, method of payment, payment schedule, and justification. If more than a single session with the participant, then the schedule should include incremental payments.</p>	
<p><b>15.3 In case of injury, explain who will pay for the treatment. (If not applicable, then note "N/A.") Is there a contract in place - is subject injury covered by an outside entity?</b></p>	
<p>n/a</p>	
<p><b>15.4 What extra costs will be incurred by third-party payers because of subjects' participation?</b></p>	
<p>n/a</p>	
<p><b>16.0 Recruitment</b></p>	
<p><b>16.1 How will potential subjects be identified? (How do you know who to contact to participate in the study?)</b></p>	
<p>The staff of the National Association of Agricultural Educators will randomly selected the needed email addresses and relay this information to the researchers.</p>	

**16.2 Bulkmail**

Will Texas A&M University bulkmail be used for recruitment?

Yes  No

*Please note that bulkmail recruitment applies to main campus, Health Science Center (HSC), Law School, and Galveston only. Recruitment to the Qatar campus may be require approval by an IRB in Qatar.*

**16.3 How will potential subjects be recruited? Select all that apply:**

- Direct contact in a medical setting
- Direct contact in a non-medical setting
- Newspaper ad
- Television
- Radio
- Website
- Social/professional networking site
- Posted notice(s)
- Letter
- Telephone solicitation
- Email
- Recruiting Pool (See next question)
- Other (specify):

If you selected Recruitment Pools option above, please identify the groups below.

- Economics
- Marketing
- Motor Behavior
- Motor Neuroscience
- Psychology
- Sociology
- TTI

*\* Skip to the next section if using a Recruitment Pool.*

**16.4 How will initial contact be made with potential participants?**

The initial contact will be via email. An information sheet will be provided at the start of the survey. Participants will click a button agreeing to participate in the study. If the participant does not agree to participate then they will exit the survey.

**16.5 How will the researchers protect subject privacy *during the recruitment process?***

Email addresses will be entered into the Qualtrics system, then deleted following data collection.

**16.6 Who will do the recruiting?**

Kalynn Baldock will send an email requesting participation.

<b>16.7 Will recruiting be conducted off Texas A&amp;M University property?</b>	
<input checked="" type="radio"/> Yes <input type="radio"/> No If Yes, describe (Site Authorization(s) may be required.) The recruitment will be online. Once individuals receive the email they will decide whether or not to participate in the study.	
<b>16.8 Will screening or recruiting be from or through the patient base of a healthcare provider?</b>	
<input type="radio"/> Yes <input checked="" type="radio"/> No	
<b>16.9 Do you have any relationship other than as an investigator with participants (e.g. doctor-patient, teacher-student, counselor-student, family member, etc.)?</b>	
<input type="radio"/> Yes <input checked="" type="radio"/> No If Yes, then specify the relationship.  Describe how you will avoid any type of coercion.	
<b>16.10 If the subject is a student who is participating in the research for course credit, then how will you ensure that the subject was not coerced into participating?</b>	
<b>16.11 If this study meets a requirement for course research credit, then how is this study suited to the course for which research credit is required?</b>	
<b>16.12 What alternatives to the participation in the research without negative consequences will you allow (e.g., not to participate, alternative assignment)?</b>	
<b>16.13 Will there be any penalties or other disadvantages for those declining to participate?</b>	
<input type="radio"/> Yes <input checked="" type="radio"/> No	
<b>16.14 Will any pre-screening surveys or questions be used?</b>	
<input type="radio"/> Yes <input checked="" type="radio"/> No If Yes, then please describe and include in Other Study Documents.	
<b>17.0 Data Management</b>	
<b>17.1 General Information</b>	

## STANDARD ADMINISTRATIVE PROCEDURE

### 15.99.03.M1.03 The Responsible Stewardship of Research Data

<http://rules-saps.tamu.edu/PDFs/15.99.03.M1.03.pdf>

Do you agree to adhere to the SAP with your data?

Yes  No

Where will the data be stored? Indicate building and room number on TAMU property.

Data will be stored in a locked file cabinet in AGLS Rm 236

How long will the data be stored? (Note: This time period should be a minimum of 3 years post completion of the research and perhaps longer, depending on sponsor requirements.)

The required 3 years post completion of the research.

If you are storing or transmitting collected data, is the storage and transmission of the data encrypted?

Yes  No

Please note that PHI must be stored and transmitted with encryption.

Who will have access to the data?

## 17.2 Data Safety Monitoring Plan

Yes  No

If so, then:

How is it managed?

With what frequency is data reviewed for this project?

How often does the DSMB meet?

What is the frequency of reports from the DSMB?

Describe any planned interim analysis.

Provide names, affiliations, and qualifications of members.

## 18.0

## Informed Consent

### 18.1 Select all that apply and attach to the application:

For templates and guidance regarding informed consent, see <http://rcb.tamu.edu/humansubjects/resources/consentinfo>

- Informed Consent Document (signed consent, typically needed in Texas for research involving adults)
- Parent Informed Consent Document
- Parent Permission Form
- Assent Form (typically needed in Texas for research involving children under 18)
- Recruitment Script (verbal)
- Recruitment Email
- Information Sheet (also select Waiver of Documentation of Informed Consent)

<input type="checkbox"/> Waiver of Informed Consent <input type="checkbox"/> Waiver of Documentation of Informed Consent <input type="checkbox"/> Other If other, please specify: <input type="text"/>	
<b>18.2 Please provide the readability statistics for each informed consent document in terms of the Flesch-Kincaid Grade Level. In general, informed consent document for adults should be on an 8th grade level.</b>	
<a href="http://rcb.tamu.edu/humansubjects/resources/tipsconsentforms">http://rcb.tamu.edu/humansubjects/resources/tipsconsentforms</a>	
<b>18.3 Please describe the informed consent process. Include how participants will be adequately informed of what they will be asked to do in the study as well as how they will be protected. Include how the forms selected above will be used in the process including that the participants will have sufficient time to review any information provided to them.</b>	
<p>If a waiver of documentation of informed consent is requested, then the information sheet use must be described here.</p> <p>An email will be sent to potential respondents describing the study and asking for participation with a link to the online survey. An information sheet will be provided at the beginning of the survey. Participants will select to participate by clicking agree to participate. The survey will take approximately 10 minutes to complete.</p>	
<b>18.4 Where will the informed consent process take place (e.g. building name, physical address)?</b>	
<p>Consent will take place online at a location of the participant's choosing.</p> <p>Where will the informed consent documents be physically stored?</p> <input type="text" value="n/a"/> <p>Who will have access to the Informed Consent documents?</p> <input type="text"/>	
<b>18.5 For studies involving research on children, will participants who reach age of majority be consented?</b>	
<input type="radio"/> Yes <input type="radio"/> No	
<b>18.6 Have the PI, Co-I(s), and any persons interacting with study subjects completed CITI training?</b>	
<input checked="" type="radio"/> Yes <input type="radio"/> No <p>If No is selected, have the PI, Co-I(s), and any persons interacting with study subjects completed alternative human subjects training? If so, please provide a description and copy of the alternative training.</p> <input type="text"/>	
<b>18.7 Please indicate the research personnel who will be obtaining informed consent from participants. (Use N/A to indicate that informed consent will not be collected.)</b>	
<input type="text" value="n/a signed consent will not be collected."/>	
<b>18.8 What project-specific training/experience have individuals obtaining informed consent received (e.g. verbal instruction by the PI, practice with the PI)?</b>	

n/a	
<b>18.9 Will the subject have the opportunity to review the informed consent document or Information Sheet, ask questions, and understand the details of the study prior to participation?</b>	
<input checked="" type="radio"/> Yes <input type="radio"/> No If Yes, then how much time will be provided?  The participant can spend as much time as they desire reviewing the information sheet prior to completion of the survey.	
<b>18.10 How will cultural issues, including language, be addressed?</b>	
No issues are anticipated. The survey is based upon prior research.	
<b>18.11 Will non-English speaking people be approached to participate in this study?</b>	
<input type="radio"/> Yes <input checked="" type="radio"/> No Will a translation be available for non-English speaking subjects? <input type="checkbox"/> Verbally (provide script) <input type="checkbox"/> In writing (provide documents) <input type="checkbox"/> Both <input type="checkbox"/> Neither	
<b>18.12 If the study involves minors, then describe the informed consent process of parental permission and how the assent of the minor will be sought. Attach the documents to the application.</b>	

## APPENDIX B

### STUDY RECRUITMENT MATERIALS

#### <<EMAIL RECRUITMENT>>

Dear <<First Name>> <<Last Name>>,

I am conducting a study in collaboration with Dr. Theresa Murphrey, faculty at Texas A&M University, focused on understanding the effects of beliefs about education, self, and context on the adoption of inquiry-based learning in agricultural classrooms. The goal is to develop strategies to support the use of inquiry-based learning.

You are receiving this email because you are a member of the National Association of Agricultural Educators and we believe that your input would be valuable.

The study consists of a short 10-minute survey, which I am hopeful that you will be willing to complete. We value your time and hope you will consider participating in this study. Participation in this study is completely voluntary. All identifiers will be removed from responses to ensure confidentiality and your name will not be associated with the study. An information sheet is provided at the following link along with the survey.

<<Click here to access the information sheet.>>

<<Click here to access the survey.>>

Thank you,

Kalynn Baldock  
Graduate Student Texas A&M University

Theresa Murphrey, PhD  
Faculty, Texas A&M University



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APPENDIX C  
SURVEY INSTRUMENT

9/14/2018

Qualtrics Survey Software

**Block 4**

Agricultural Teachers Adoption of Inquiry-based learning: The effects of beliefs about education, self, and context: Ten Minute Survey

This study focuses on understanding the affects that beliefs about education, self, and context have on the adoption of inquiry-based learning. The goal is to determine how these things affect the adoption of inquiry-based learning in order to create pre-service agriculture education courses and professional development to assist instructors in implementing inquiry-based learning.

I have created a short ten minute survey. As an agricultural instructor I am hopeful that you will be willing to participate in this study to improve educational strategies.

To access the information sheet click the following:

"link to survey"

**Block 5**

I have read and understood the above information sheet and desire of my own free will to participate in this study.

I agree to participate

No – I do not want to participate

**Teacher and Program Characteristics**

How many years have you been a teacher?



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Qualtrics Survey Software

What grades do you teach?



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<https://tamug.az1.qualtrics.com/ControlPanel/Ajax.php?action=GetSurveyPrintPreview>

2

What subjects do you teach?

What is the highest degree you have received?

What endorsements or certifications do you have?

What training or professional development have you had on inquiry-based teaching?

**Goals and Approaches to Agricultural Education.**

Please rank the following statements. In my classroom, a student who excels in agriculture is one who....

knows the history and facts of FFA and agricultural industries, and is able to relate changes within industries to common events in history.

demonstrates a balanced development of knowledge and skills, and is able to identify, analyze,



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and criticize information sources.

is able to tackle new content, which means: answering a research question based on an analysis of information sources, drawing on facts from agricultural lessons.

develops a technical skill which can be used in the agricultural workforce.

To teach effectively, taking the available time and student level into account....



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The most logical and effective approach is to explain the most important facts, concepts, and skills in a clear and structured way, and to ensure that underlying relationships are clear.

It is important to provide sufficient support for the learning of facts, concepts, and skills, by effectively alternating between an analysis of information sources and plenary sessions, reciprocal teaching, and feedback.

It is necessary to give students time and opportunities to observe, discover, and ask questions about important facts, concepts, and skills. Students have to apply, experiment with, and compare them, to achieve understanding.

**Perceived contextual hindrances (PCH).**

Conceptions of the nature of knowledge: (NKO). To what extent do you agree with the following statements about agricultural education? For each statement, check the answer that is closest to your opinion.

	take the form of problems and questions currently being faced by agricultural industries.		Completely Disagree	Disagree	Rather disagree than agree
NKO1. The goal of agricultural education is practical application and the transfer of knowledge and skills to real-world settings.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
NKO2. The emphasis of Agricultural education should be on learning by doing.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
NKO3. Agricultural Education should be shaped according to the needs of the individual learner.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
NKO4. Agricultural education topics should	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	



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Rather agree  
than  
disagree

Agree

Completely  
Agree

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Orientation toward teaching: Substantive (OTS) and procedural knowledge (OTP). How important do you think the following goals of school agriculture are for the grade and study



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track in which you teach agriculture most frequently? For each goal check the answer that is closest to your opinion.

	Very unimportant	Unimportant	Rather unimportant than important	Rather important than unimportant	Important	Very Important
OTS1. Building a historical framework for situating agricultural events and phenomena.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
OTS2. Gaining insight into the most important characteristics of different agricultural industries.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
OTS3. Developing a basic knowledge of turning points in agriculture.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
OTP1. Experiencing how knowledge is generated in agriculture through inquiry.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
OTP2. Learning to solve a problem statement through careful investigation of a series of information sources.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
OTP3. Learning about the criteria for good agricultural research.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



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Self-efficacy (SEF). At this moment, to what extent do you feel able to organize and support the following learning activities during the agricultural lesson? For each statement, check the answer that is closest to your opinion.

Completely unable	Unable	Rather unable than able	Rather able than unable	Able	Completely Able
----------------------	--------	-------------------------------	-------------------------------	------	--------------------



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	Completely unable	Unable	Rather unable than able	Rather able than unable	Able	Completely Able
SEF1. Discussing cases that clarify the role of evidence and interpretation in agricultural research.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
SEF2. Making students use information sources to form their own, well-grounded interpretations about agricultural issues.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
SEF3. Having students make a report of an inquiry with sources, based on sound arguments.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
SEF4. Making students formulate a critical conclusion based on contradictory information.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Perceived student ability (PSA). To what extent do you feel hindered by the following barriers to teaching competences related to agricultural inquiry? For each statement, check the answer that is closest to your opinion.

PSA1. Students are not able to apply the basic methods of agricultural inquiry correctly.	<input type="radio"/>					
PSA2. Students have too little prior knowledge of agriculture to conduct their own investigations.	<input type="radio"/>					
PSA3. Students lack the motivation to scrutinize information sources on their own.	<input type="radio"/>					



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Rather disagree than agree		R		Completely agree	
<input type="radio"/>	<input type="radio"/>	a			
		t			
		h	<input type="radio"/>		<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	e			
		r			
		a	<input type="radio"/>		<input type="radio"/>
		g			
		r	<input type="radio"/>		<input type="radio"/>
		e			
		e			
			<input type="radio"/>		<input type="radio"/>
		t			
		h			
		a			
		n			
		disagree		Agree	
				<input type="radio"/>	<input type="radio"/>
				<input type="radio"/>	<input type="radio"/>
				<input type="radio"/>	<input type="radio"/>



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*Perceived Conceptual Hindrances (PCH)*. To what extent do you agree with the following statement about the context of the grade and study track in which you teach agriculture most frequently. For each statement, check the answer that is closest to your opinion.

	Completely Disagree	Disagree	Rather Disagree than Agree	Rather agree than disagree	Agree	Completely agree
PCH1. You have to overcome a great deal of obstacles before you can have students conduct their own investigation of an agricultural issue or problem.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
PCH2. Whenever you ask students to scrutinize information sources and report their findings, it does not take long for problems to occur	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
PCH3. It takes a lot of extra effort to make students experience how knowledge about agriculture is generated.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
PCH4. When I plan to have students conduct a structured investigation, the reality of the classroom often prevents this from happening.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

#### Adoption of inquiry-based learning (AIL).

<https://tamug.az1.qualtrics.com/ControlPanel/Ajax.php?action=GetSurveyPrintPreview>



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Adoption of inquiry-based learning (AIL). How often do you organize the following learning activities during the agriculture lesson, in the grade and study track in which you teach agriculture most frequently?

Never      Seldom      Sporadic      Now and Then      Regularly      Very often



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	Never	Seldom	Sporadic	Now and Then	Regularly	Very often
AIL1. Making students carefully scrutinize information sources to solve a problem statement.	<input type="radio"/>					
AIL2. Demonstrating and having students practice the basic methods of an agricultural inquiry.	<input type="radio"/>					
AIL3. Making students conduct a stepwise investigation of a certain agricultural fact or phenomenon.	<input type="radio"/>					

Powered by Qualtrics


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 IRB APPROVAL DATE: 09/17/2018

APPENDIX D  
INFORMATION SHEET

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TEXAS A&M UNIVERSITY HUMAN SUBJECTS PROTECTION PROGRAM  
INFORMATION SHEET

---

**PROJECT TITLE:** Agricultural Teachers' Adoption of Inquiry-based learning:  
The effects of beliefs about education, self, and context

**You are invited to take part in a research study being conducted by Kalynn Baldock and Theresa Murphrey at Texas A&M University. The information in this form is provided to help you decide whether or not to take part. If you decide you do not want to participate, there will be no penalty to you, and you will not lose any benefits you normally would have.**

**Why Is This Study Being Done?**

The purpose of this study is to understand the barriers that exist for agricultural instructors trying to implement inquiry-based learning. Understanding how the beliefs about education, self, and context affect the implementation of inquiry-based learning we can develop pre-service teacher education and professional development activities to support teachers and their implementation of inquiry-based learning.

**Why Am I Being Asked To Be In This Study?**

You are being asked to be in this study because you are an agricultural instructor and member of the National Association of Agricultural Educators. As a member of the national association of agricultural educators you show a desire to improve agricultural education for our high school students.

**How Many People Will Be Asked To Be In This Study?**

Up to 2000 participants will be invited to participate in this study.

**What Are the Alternatives to being in this study?**

The alternative to being in the study is not to participate.

**What Will I Be Asked To Do In This Study?**

You will be asked to complete a brief ten-minute survey about your beliefs about education, self, and context as it pertains to agricultural education. Instructors will be asked to answer question on a six-point likert scale. There will also be some questions ranking your beliefs.

**Are There Any Risks To Me?**

The things that you will be doing are no more risks than you would come across in everyday life. You do not have to answer anything you do not want to answer.

**Will There Be Any Costs To Me?**

Aside from your time, there are no costs for taking part in the study.

**Will I Be Paid To Be In This Study?**

You will not be paid for being in this study.

**Will Information From This Study Be Kept Private?**

The records of this study will be kept private. No identifiers linking you to this study will be included in any sort of report that might be published. Research records will be stored securely



**TEXAS A&M UNIVERSITY HUMAN SUBJECTS PROTECTION PROGRAM**

---

**INFORMATION SHEET**

and only Kalynn Baldock and Theresa Murphrey will have access to the records. Information about you will be removed following data collection. Information about you will be kept confidential to the extent permitted or required by law. People who have access to your information include the Principal Investigator and research study personnel. Representatives of regulatory agencies such as the Office of Human Research Protections (OHRP) and entities such as the Texas A&M University Human Subjects Protection Program may access your records to make sure the study is being run correctly and that information is collected properly.

**Who may I Contact for More Information?**

You may contact the Project Director, Kalynn Baldock, to tell her about a concern or complaint about this research at (575) 760-9589 or [kalynn.baldock@tamu.edu](mailto:kalynn.baldock@tamu.edu) or Principal Investigator, Theresa Murphrey, PhD, at (979) 458-2749 or [t-murphrey@tamu.edu](mailto:t-murphrey@tamu.edu).

For questions about your rights as a research participant, or if you have questions, complaints, or concerns about the research, you may call the Texas A&M University Human Subjects Protection Program office at (979) 458-4067 or [irb@tamu.edu](mailto:irb@tamu.edu).

**What if I Change My Mind About Participating?**

This research is voluntary and you have the choice whether or not to be in this research study. You may decide to not begin or to stop participating at any time. If you choose not to be in this study or stop being in the study, there will be no effect on your student status, medical care, employment, evaluation, or relationship with Texas A&M University.

By participating in the survey, you are giving permission for the investigator to use your information for research purposes.

Thank you.



## APPENDIX E

### TAMU INSTITUTIONAL REVIEW BOARD AMENDMENT & OUTCOME LETTER

#### IRB Amendment (Version 1.0)

1.0	Texas A&M University Human Subjects Protection Program Amendment Application for the Use of Human Subject Research
<b>1.1 Title of Project:</b>	
	Agricultural Teachers' adoption of inquiry-based learning: The effects of beliefs about Education, Self, and Context
<b>1.2 Describe what changes do you want to make to the study. Be specific.</b>	
	We need to increase the number of people to reach out to for completion of the instrument due to a low response rate. We originally asked to access 1000 people. We want to increase that number to 2000.
<b>1.3 Provide the rationale for these changes:</b>	
	As of today we have 137 completed instruments. We need 367 completed instruments to run the data. Thus, we would like to increase the number of individuals we reach out to from 1,000 to 2,000.
<b>1.4 Is this change to replace procedures previously described?</b>	
	<input type="radio"/> Yes <input checked="" type="radio"/> No If Yes, describe which documents/processes are no longer to be used (if no, skip) _____
<b>1.5 Does this increase risk to subjects?</b>	
	<input type="radio"/> Yes <input checked="" type="radio"/> No (If No, explain why/If Yes, explain how) <div style="border: 1px solid black; padding: 2px; margin-top: 5px;">No, the same procedures will be followed. We are merely wanting to contact additional potential respondents.</div>
<b>1.6 Will subjects be notified of this/these change(s)?</b>	
	<input type="radio"/> Yes <input checked="" type="radio"/> No (If No, explain why/If Yes, explain how) <div style="border: 1px solid black; padding: 2px; margin-top: 5px;">No, this will not impact those who have already been contacted. We are merely contacting additional people.</div>
<b>1.7 Due to the requested changes, are revisions to the consenting instruments necessary?</b>	
	<input checked="" type="radio"/> Yes <input type="radio"/> No (If No, explain why/If Yes, explain how) <div style="border: 1px solid black; padding: 2px; margin-top: 5px;">The information sheet will be updated to reflect the new number.</div>

1.8 Revisions should be incorporated into the currently approved IRB documents in which the change effects (e.g., Initial Application, Consent documents, Recruitment Materials). Modifications to Key Study Personnel are separate from the revised application. If changes are not addressed in the Amendment documents they will not be approved.

Edit/View	Version	Title
	1.3	IRB Application (Human Research) (Version 1.3) - Attached

Version	Title	Category	Language	Expiration Date	Consent Outcome	Checked Out	View Document
No Consent(s) have been attached to this form.							

Version	Title	Category	Expiration Date	Document Outcome	Checked Out	View Document
1.3	Revised Information sheet	Other		Approved		 3.30 MB

Only fill out this section if you are making changes to your Key Study Personnel List.

Please indicate any Key Study Personnel to be added by using the appropriate Add buttons below.

If there are Key Study Personnel who need to be removed, use the last question in this section.

**If applicable, please add the new Principal Investigator for the Study:**

**If applicable, please select the new Research Staff personnel:**

A) Additional Investigators

B) Research Staff

**If applicable, please add any new Study Contact:**

---

The Study Contact(s) will receive all important system notifications along with the Principal Investigator.

**If applicable, please add a new Faculty Advisor:**

**If applicable, please select any existing Personnel you wish to remove:**

Please add any study personnel who are not employees of Texas A&M (or not able to log into iRIS):

Name	Institution	Telephone	E-mail	Role
John Rayfield	Texas Tech University	806-834-1956	john.rayfield@ttu.edu	Graduate Committee Chair

## EXEMPTION DETERMINATION

December 13, 2018

Type of Review:	Amendment
Title:	Agricultural Teachers' adoption of inquiry-based learning: The effects of beliefs about Education, Self, and Context
Investigator:	Theresa PESL Murphrey
IRB ID:	IRB2018-1134M
Reference Number:	085532
Documents Reviewed:	IRB Amendment Version 1.0; IRB Application Version 1.3; Revised Information sheet Version 1.3

Dear Theresa Murphrey:

The HRPP determined on 12/13/2018 that this research continues to meet the criteria for Exemption in accordance with 45 CFR 46.101(b) under Category 2: Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior unless: the information is recorded in an identifiable manner and any disclosure of the subjects' responses outside of research could reasonably place the subject at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability or reputation.

This determination applies only to the activities described in this IRB submission and does not apply should any changes be made. If changes are made you must immediately contact the IRB. You may be required to submit a new request to the IRB.

Your exemption is good for five (5) years from the initial Approval Start Date of 09/17/2018. At that time, you must contact the IRB with your intent to close the study or request a new determination.

If you have any questions, please contact the IRB Administrative Office at 1-979-458-4067, toll free at 1-855-795-8636.

Sincerely,  
IRB Administration

750 Agronomy Road, Suite 2701  
1186 TAMU  
College Station, TX 77843-1186

Tel. 979.458.1467 Fax. 979.862.3176  
<http://rcb.tamu.edu>

## APPENDIX F

### TTU INSTITUTIONAL REVIEW BOARD APPROVAL DOCUMENTATION

Date: 4-16-2019

IRB #: IRB2018-901

Title: Agricultural Teachers' Adoption of Inquiry-based Learning: The effects of Beliefs about Education, Self, and Context

Creation Date: 10-8-2018

End Date:

Status: **Approved**

Principal Investigator: John Rayfield

Review Board: Institutional Review Board

Sponsor:

---

#### Study History

---

Submission Type	Initial	Review Type	Exempt	Decision	<b>Rely on External IRB</b>
-----------------	---------	-------------	--------	----------	-----------------------------

---

#### Key Study Contacts

---

Member	Kalynn Baldock	Role	Primary Contact	Contact	kalynn.baldock@ttu.edu
Member	John Rayfield	Role	Principal Investigator	Contact	john.rayfield@ttu.edu

---

## Initial Submission

---

### 1: Human Subject Research

Answer the following questions to determine if you need IRB review and approval.

---

#### 1.1 Research

---

**Research is defined by 45 CFR 46.102(d) as:**

A systematic investigation, including research development, testing and evaluation, designed to develop or contribute to generalizable knowledge.

---

**Does your proposed study meet the definition of research?**

Yes

No

#### 1.2 Human Subjects

---

**Human Subject is defined by 45 CFR 46.102(f) as:**

A living individual about whom an investigator (whether professional or student) conducting research obtains data through intervention or interaction with the individual, or identifiable private information.

---

**Does your proposed study involve and meet the definition of human subjects?**

Yes

No

**If you answered YES to all questions in Section 1 complete the rest of the sections.**

---

## 2: Review Type

Complete the following section.

---

### Review Type

2.1

---

Select the appropriate review type.

Exempt

Expedited

Full Board

Relying on IRB approval from another institution (IAA)

Texas Tech University's IRB will rely on another institution's IRB approval.

---

In **Section 2.2** select collaboration then select another institution will serve as the IRB of record.

---

The HRPP Section Manager will initiate an Institutional Review Board Authorization Agreement (IAA) with the institution providing IRB review. For questions regarding an IAA please contact the HRPP Section Manager at [hpp@ttu.edu](mailto:hpp@ttu.edu) or 806-742-2064.

---

### External Collaboration

2.2

---

Only select collaboration if there are Non Texas Tech researchers, employees, and/or students working on this research.

✓ Collaboration

2.2a **Select which Institution will review and approve the IRB.**

---

Texas Tech University will serve as the IRB of Record

✓ Another institution will serve as the IRB of Record.

2.2a(1) **Attach the institutional letter of approval.**

---

[IRB Outcome\\_Letter \(1\).pdf](#)

2.2a(2) **Attach the approved protocol.**

---

[Dissertation IRB Approval Packet \(1\).pdf](#)

Each institution will conduct its own IRB review.

### **International Research**

---

2.3

Research will be conducted outside of the United States of America and/or data will be shared across borders.

International Research

## 4: Research Team

Complete the following section. List all researchers involved with recruitment, data collection, and analysis.

---

### 4.1 Principal Investigator

---

[TTU OP 74.09](#)

#### 4.1a Check the appropriate box.

---

TTU full-time or tenured faculty member

4.1a(1) **College**

---

Agricultural Sciences and Natural Resources

4.1a(2) **Department**

---

Agricultural Education and Communications

TTU full-time employee with a terminal degree in their discipline

---

#### Find and add PI to the submission.

---

4.1b Name: John Rayfield  
Organization: Ag Education and Communication  
Address: 2500 Broadway MS2131, Lubbock, TX 79409  
Phone: 8068341956  
Email: john.rayfield@ttu.edu

4.1a(3)a Attach human subject training.

---

## Primary Contact

---

4.2

Primary contacts need to be included in section 4.3 as a co-investigator if they are not the principal investigator. The primary contact and principal investigator will receive all notifications and letters

**Find and add primary contact to the submission.**

---

4.2a Name: Kalynn Baldock  
Organization: Ag Education and Communication  
Address: , Lubbock, TX 79409-1035  
Phone:  
Email: kalynn.baldock@ttu.edu

## Co-Investigators

---

4.3

Include investigators assisting with instrument development, recruitment, data collection, and data analysis.

4.3a **Select all investigators involved with this research project.**

---

None

List TTU Faculty or Staff Co-Investigator(s):

List TTU Graduate or Undergraduate Co-Investigator(s):

External Researchers: Co-investigators outside of Texas Tech University

**List non-TTU investigator(s) engaged in this research. Provide their contact information, title, and place of work.**

---

Dr. Theresa Murphrey  
Associate Professor  
Texas A& M University Department of agricultural Leadership, Education and

4.3a(3) Communications  
t-murphrey@tamu.edu  
979-458-2749  
236 Agriculture and Life Sciences, 2116 TAMU

Dr. Murphrey is the graduate committee chair and will assist the graduate student throughout the dissertation research.

This study is a Doc at a Distance program between Texas Tech University and Texas A&M. Texas A&M will be the IRB of record. Texas Tech will be relying on Texas A&M's IRB. Texas Tech will rely on Texas A&M's IRB through the UT Reciprocity Agreement.

4.3a(3)a **Check all that apply.**

---

- Developing instrument
- Recruiting participants
- Interaction with participants
- Working with de-identified data
- Working with identifiable data
- Assisting with writing manuscript
- Other

4.3a(3)b **Attach human subject training.**

---

## 5: Funding

Complete the following section.

---

### 5.1 Funding

---

Funding is used to supplement the cost of the research and/or participant payment.

#### 5.1a Select the type of funding to be used.

---

External (Office of Research Services - ORS)

Internal (TTU Funding)

Personal Monies

No Funding

### 5.2 Future Funding

---

If funding is secured, a modification will be required.

#### 5.2a Enter the potential sponsor(s) name below.

---

### Conflict of Interest

---

**Guidance:** A conflict of interest refers to a situation in which an employee(s) financial, professional, or other personal considerations may directly or indirectly affect, or have the appearance of affecting, the employee(s) judgment in exercising any duty or responsibility, including the conduct or reporting of research, owed to the institution ( [TTU OP 10.20](#) (2)(d)).

- 14.1 "Significant business or financial interest" means anything of monetary value including, but not limited to, salary or other payments for services (e.g., consulting fees or honorarium; equity interests (e.g., stocks, stock options, or other ownership interests); and intellectual property rights (e.g., patents, copyrights, and royalties from such rights). ([TTU OP 74.17](#)).

"...a set of conditions in which an investigator's judgment concerning a primary interest (e.g., subject welfare, integrity of research) could be biased by a secondary interest (e.g., personal or financial gain)." Institutional Review Board Management and Function, Bankert and Amdur, 2006, p. 167.

- 14.1a Does anyone on the research team have a potential conflict of interest with the research project?
- 

Yes

✓ No

## 15: Investigator Attestations

I, as the PI and co-investigators, understand Texas Tech University's policy concerning research involving human subjects and by checking below, I certify:

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- ✓ I have read [The Belmont Report "Ethical Principles and Guidelines for the Protection of Human Subjects of Research"](#) and subscribe to the principles it contains.

- ✓ I have read [45 CFR 46, Protection of Human Subjects](#) and subscribe to the regulations it contains.

- ✓ I accept responsibility for the scientific and ethical conduct of this research study and understand my responsibility.

- ✓ I will ensure that all study personnel are appropriately trained and are competent to perform the study.

- ✓ I will obtain prior approval from the Institutional Review Board (IRB) before making any modifications of the previously approved research, including modifications to the informed consent process and document.

- ✓ I will submit a Study Closure Submission upon completion of this study and agree to honor any other commitments.

- ✓ I will immediately report to the IRB any deviations, violations, non-compliance, unanticipated problems, and adverse events related to subjects or others which occurred or possibly occurred as a result of this study.

[45 CFR 46.103\(a\)](#) and [TTU IRB Policy 5.4](#) require Adverse Events, Unanticipated Problems and Deviations from the research protocol to be reported **IMMEDIATELY** to the HRPP office.

**Human Research Protection Program**

**Box 41075**

**Lubbock, Texas 79409**

**Phone: (806) 742-2064**

**Email: [hrpp@ttu.edu](mailto:hrpp@ttu.edu)**

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**16: Additional Information**

**16.1 Include any additional points to help clarify the research, if applicable.**

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16.1a

**16.2 Enter or attach any additional documentation.**

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16.2a

**For HRPP Use Only**

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Attachments

No Attachments