THE INFLUENCE OF THE CASE CURRICULUM ON AGRICULTURE TEACHERS’ USE OF INQUIRY-BASED METHODS THROUGH SCIENCE INTEGRATION

by

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As members of the Master's Committee, we certify that we have read the thesis prepared by
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Final approval and acceptance of this thesis is contingent upon the candidate's submission of the
final copies of the thesis to the Graduate College.

I hereby certify that I have read this thesis prepared under my direction and recommend that it be
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Abstract

The central research question that guided this study was: how does completion of the Southwestern Land Grant University CASE AFNR professional development institute influence behavior patterns of agriculture teachers for incorporating inquiry-based learning through science integration in high school classrooms? This research was conducted utilizing a multi-case study design where each teacher who participated served as an individual case. Nine currently certified CASE teachers were interviewed, observed, and had lesson plan documents analyzed to capture how they were utilizing the CASE curriculum and integrating inquiry-based methods into the classroom. There were five major themes that emerged from the data including: 1) barriers to CASE implementation that impacted teacher behavior, 2) experience in industry professions leads to increased teacher efficacy for inquiry-based strategies, 3) traditionally certified teachers more likely to fall back on didactic teaching orientations, 4) disconnect between student capacity and CASE expectations of inquiry-based methods, and 5) in state training and networking support system played a vital role in teachers’ perceptions of CASE institute. The major themes that emerged from this study highlighted various opportunities for further research and practice. For further research, there is a need for rigorous qualitative and quantitative research on how teachers are implementing this curriculum within their classroom with broader scopes to provide insight on how lead teachers, regions, or curriculum pathways can affect implementation of inquiry-based learning. Recommendations for practice include: increased collaboration among CASE certified teachers in each state, development of a statewide online platform for all teachers, and increased opportunities for financial and resource support for currently certified CASE teachers and teachers who are interested in achieving CASE certification.
Introduction

After the reauthorization of the Carls D. Perkins Career and Technical Education (CTE) Act of 2006, there was a call to administrators and teachers to identify, support, and rigorously evaluate evidence-based, innovative strategies and activities to improve and modernize CTE programs and align workforce skills to the labor market. Employers nationwide are seeking employees who demonstrate professional and people skills along with technical skills within their discipline (Casner-Lotto & Barrington, 2006). Specifically, the ability to contribute problem-solving, critical thinking, and planning initiatives in a team-based environment (Taylor, 2005), which can be achieved through involvement in secondary level CTE programs.

Pedagogical research conducted since the early 1970s supports the need for CTE teachers to shift their instructional methodology from passive, teacher-centered instruction to active, student-centered instruction (Smith, Shepard, Johnson & Johnson, 2005). These student-centered methods encourage students to reach higher levels of critical thinking needed in professional settings. In science education and applied sciences specifically, one pedagogical method applied to this call is the use of inquiry-based learning. Inquiry-based learning can be defined as students learning and/or applying material to meet a challenge or solve a problem (Nilson, 2010). This method can include: questioning, experimentation, and interpretation of data. When used effectively, inquiry-based learning is focused on students utilizing their prior knowledge and experiences, with the assistance of instructor support, through engagement in higher-order thinking and problem-solving skills combined with meaningful reflection (National Research Council, 2000).

Historically, School Based Agricultural Education (SBAE) programs across the United States have been at the forefront of integrating science techniques, including inquiry, in the
agriculture curriculum (Conroy, Dailey, & Shelly-Tolbert, 2000). The 2006 Perkins CTE Act revisions reinforced the need for teachers to look for new methodologies and techniques to engage students in higher-level thinking skills. The role of the teacher, their knowledge, and support they provide to students during an experiential learning cycle of inquiry is a major factor for student success with this method (Baker, Brown, Blackburn, & Robinson, 2014). The call for teacher involvement and shifts in methodology is not limited to content knowledge acquisition, but also working to employ those transferable competencies of problem-solving, critical thinking, and computing skills to align with the current job market.

The National Council for Agricultural Education (2007), a group dedicated to promoting success for students and teachers involved in SBAE programs nationwide, developed various goals for the agricultural education profession to increase quality and growth of programs. One goal was to create a national curriculum model to establish a sequence of agricultural education courses with enhanced delivery of content using student-centered methods. From this goal the Curriculum for Agricultural Science Education (CASE) project was created to provide a structured course sequence validated through alignment of lessons with national standards for agriculture, science, mathematics, and English. According to the mission and vision of CASE (2018), the project requires teachers to undergo an extensive professional development experience complete with hands-on lab instruction delivered through inquiry methods to achieve certification.

Professional development in school systems is commonly used to assist teachers in developing the content knowledge, pedagogical knowledge, and skills they need to succeed in the classroom (Vrasidas & Glass, 2004). Schools offer various teacher professional development workshops throughout the summer and during the school year to inspire methodology and
technology use to match the culture of the 21st century (Lee, Cerreto, & Lee, 2010). However, professional development does not always lead to a change in teacher behavior (Porter, Garet, Desimone, Yoon, & Birman, 2000). For professional development to be successful, Guskey’s Model of Teacher Change (2002) identifies four key stages of ideal professional development including: (1) learning about the professional development topic in depth; (2) putting the professional development to practice; (3) determining how students learn as a result of the change in teaching methods; and (4) addressing any change in behavior that results from implementation. The professional development CASE provides, along with the structure of the curriculum and the focus on inquiry-based learning, should promote teacher behavior change, yet there is little research to support the effect of CASE professional development on teacher behavior.

Need for the Study

While CASE professional development institutes are designed to promote inquiry-based learning and science integration, little research has been completed on current certified CASE teachers to determine the impact of these institutes within their local programs. Currently, there are two empirical studies within agricultural education specifically focused on the CASE curriculum (Lambert, Velez, & Elliot, 2014; Carraway, 2015). Lambert, et al. (2014) explored teachers’ experiences when implementing CASE. The five themes that emerged from this study included: adaptability towards the curriculum being student-centered, teachers enjoyed the content regardless of not making it through all the curriculum, materials and equipment were vital to the success of implementation, the summer institute was extremely important to their success, and the curriculum allowed teachers to refocus.
The second empirical study was a dissertation from Texas Tech University exploring the integration of science into agricultural education through CASE (Carraway, 2015). Carraway (2015) found a majority of science teachers surveyed had an optimistic attitude toward the implementation of CASE in SBAE programs because CASE does support the integration of scientific concepts through inquiry practices. Carraway (2015) also conducted a study of preservice agriculture teachers who received CASE training during an integrated institute semester course. Participants in this study had positive views towards science integration through the CASE curriculum. These participants identified some barriers of incorporating the CASE curriculum including the expense of supplies and equipment needed to implement CASE. Carraway (2015) suggested further investigation of the CASE curriculum and the impact the curriculum has on student achievement.

Following the recommendations of each of these studies for further research, this study can provide information on practicing certified agriculture teachers. CASE is promoted to agricultural educators nationwide, but with little research supporting the curriculum and its implementation, it is unknown what behaviors patterns are being exhibited by teachers after completing certification.

Purpose of the Study and Central Question

The purpose of this study is to determine the influence of CASE Agriculture, Food, and Natural Resources (AFNR) certification on the behavior patterns of high school agriculture education teachers in one Southwestern state, specifically investigating their use of inquiry-based learning through the integration of science curriculum. The American Association for Agricultural Educators (AAAE) National Research Agenda (2016-2020) calls for meaningful learning within SBAE programs to engage students in the process of learning and the need for
motivated teachers to facilitate that engagement (Edgar, Retallick, & Jones, 2016), which fits with the purpose of this study. My central question was: How does completion of the Southwestern Land Grant University (SWLGU) CASE AFNR professional development institute influence behavior patterns of agriculture teachers for incorporating inquiry-based learning through science integration in their high school classrooms?

Review of the Literature

Inquiry-Based Learning Through Science Integration

There are countless definitions for inquiry-based learning and what it looks like in the classroom; however, for the sake of this research the definition of inquiry-based learning I utilized is a student-centered approach that involves formulating questions, investigating to find answers, and building new knowledge that students communicate to others (Stephenson, 2015 as cited in Carraway, 2015). The National Research Council (2000) identified the major features of the inquiry-based learning process to be very similar to steps within the scientific method, which is what allows this process to promote strong scientific reasoning and critical thinking skills in students.

Inquiry-based learning is best described through a spectrum (see figure 1) between teacher-centered and student-centered methods. From the left side beginning with more teacher-centered approach, inquiry can be the teacher posing a question but knowing exactly what outcome the students should come up with. An example of this kind of lesson would be to have students take the pH of different substances (e.g. coca-cola in which the teacher knows the pH will come out to be acidic). Moving along the middle of the spectrum to a more student-centered approach, inquiry can be the teacher poses a question not knowing the results of the students’ findings before-hand. An example of this would be a lab where students test the “5-second rule”
of dropping food on the ground to observe what bacteria colonies might grow. Students have some autonomy in the experimental design by choosing what floor to drop the food on; therefore, the teacher does not know the exact outcome of each experiment. Finally, at the far-right side of the spectrum with increased student-centered learning, the students pose their own question and design their experiment. Agriscience Fair, a National FFA Organization program designed to recognize research conducted by students in the application of agricultural scientific principles (National FFA Organization, 2017), is an excellent example of this type of inquiry-based learning that falls on the right side of the spectrum.

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

Figure 1. Inquiry-based learning spectrum (National Research Council, 2000).

When teaching within the inquiry-based learning spectrum, there are five major science features to consider for any content area. These features include: 1) students’ engagement with scientifically oriented questions, 2) collection and analysis of evidence (i.e. data), 3) formulation of explanations based on scientific evidence, 4) connection between scientific concepts and collected evidence, and 5) communication and justification of outcomes (National Research Council, 2000). Each of these five main features can also span the student versus teacher centered spectrum, depending on the approach chosen by the teacher. For example, in a lesson on soil porosity, the teacher could choose from a variety of pedagogical approaches along the inquiry-based spectrum for feature four alone, which describes the connection between scientific concepts and collected evidence. The teacher may approach the lesson from the far-left side of the spectrum (i.e. more teacher centered) by providing the students with all connections to scientific concepts of soil porosity through a lecture following an in-class lab. Alternatively, the
teacher could have the student independently examine other credible resources to form connections between the lab and the current scientific body of knowledge on their own, approaching the lesson from the far-right side of the spectrum (i.e. more student/learner centered). These pedagogical decisions are highly dependent on student cognitive level, skills, desired outcomes, and teacher choice of how to best structure the content for the students and their learning needs.

Inquiry-based learning is an effective tool that benefits students’ retention of content more than traditional teacher-centered methods, and it is a highly recommended method for science and applied science teachers to include in their classrooms (Skelton, Blackburn, Stair, Levy, & Dormody, 2017). It is common for teachers who do not receive explicit training as pre-service or practicing teachers to be responsible for integrating science and inquiry learning methods into their classrooms (Thoron & Myers, 2011; Skelton, et al., 2017). However, this method can be difficult for teachers to implement successfully. In past research, inquiry-based learning methods are most commonly conducted in the middle of the teacher- and student/learner- centered spectrum (see figure 1), and often the focus is still predominately teacher-centered (Washburn & Myers, 2010). To be effective for students, the structure of the inquiry needs to be a “knowledge-in-action” approach where students are challenged to think on their own and problem solve to construct an answer that may or may not be correct, while teachers are facilitating the learning process (Blythe, DiBendetto, & Myers, 2015).

Conceptual Framework

Figure 2 depicts the conceptual framework for inquiry-based learning utilized within this research, adapted from an empirical study on the effects of inquiry-based agriscience instruction on student achievement (Thoron & Myers, 2011). Effective inquiry-based learning lies within a
teaching and learning process that is affected by static attributes of the teachers, students, and
social-cultural context. If all these components align, students are expected to develop scientific
reasoning skills, argumentation skills, and academic achievement as outcomes from this method.

Figure 2. Conceptual model for the effects of inquiry-based instruction (Adapted from Thoron, 2011).

Within the teaching and learning process, inquiry-based learning promotes three types of
interactions including: student to instructor, instructor to student, and student to student. These
interactions are fluid and depend on a variety of factors. Student to instructor and instructor to
student interactions deal specifically with the instructor acting as a facilitator of learning to
students. These are two-way interactions and can be differentiated by who is initiating the
interaction. The interactions between students and teachers can be observed through a variety of
exchanges including: the amount and level of questions students are asking the teacher, how well
the students understand the content they are learning, and students’ understanding of how this
information can be applied in the real world. Teacher to student interaction can also be present during the teacher’s preparation of the lesson or lab and the creation of learning objectives. Although the teacher does not need to know all the answers, the teacher does need to have strong foundational knowledge to help guide the students to where they can find the required information to address their question.

Within inquiry-based learning, there is also a strong focus on student-to-student interaction built upon social and cultural contexts. These interactions help students work together in a constructive manner by developing their communication skills with diverse peers (Thoron, 2011). Both classroom and school environment can affect the interactions between students and teachers. The classroom environment is comprised of the physical setting, the psychological environment created through social contexts, and instructional components related to teacher characteristics and behaviors (Moss, 1980). Through this process of teaching and learning, students can develop and practice their scientific reasoning and argumentation skills that lead to career and college success.

The outermost circle of the figure represents the static attributes that exist regardless of individual teacher or student action. These attributes can impede on every part of the teaching and learning process which affects the implementation of inquiry-based methods. These static attributes include those of the teacher, student, and social cultural context. For a teacher implementing inquiry-based learning, their effectiveness is dependent on their academic background, teaching experience, and knowledge of inquiry-based instructions. The academic background of a teacher can affect their pedagogical content knowledge (Rice & Kitchel, 2015), impacting their teaching effectiveness (Gardner, 2006). Teachers need to have knowledge in the subject and content being taught as well as appropriate ways to breakdown and relay the
information to students. The teaching experience of a teacher, both years taught and quality of experiences, can affect their ability to implement inquiry-based methods. If a teacher has never taught a lesson before their confidence in their ability might be lowered compared to a teacher who has taught the lesson numerous times (Williams, Warner, Flowers, & Croom, 2014). Finally, a teacher’s knowledge of inquiry-based instructions is vital because if they do not know what inquiry is and how to implement this method successfully, they will have a much more difficult time executing these lessons.

Static student attributes that can affect inquiry-based learning includes socio-economic status, age, gender identity, race, ethnicity, and abilities. The environment students are within, including their school, home, and local community, can also play a role in the students’ learning process. Inquiry-based learning is derived from a constructivist lens of learning where students can be affected by individual, interpersonal, and communal factors when constructing knowledge (Schunk, 2008). These individual static factors, such as age and maturity, can affect how students take responsibility for their own learning, including self-regulation strategies and metacognitive approaches to learning. Although some of these static attributes of the teacher and student can change over time, this framework captures a moment in time of incorporating inquiry-based learning into the classroom. For example, a teacher’s teaching experience can develop; however, at that moment of doing an inquiry-based lesson, their teaching experience will remain the same. Teachers must account for these static attributes when incorporating inquiry-based methods in their classroom, even though they cannot be changed by the teacher.

Theoretical Framework

The Theory of Planned Behavior (TPB) (see figure 3) was originally constructed by Icek Ajzen (1985) to explain the behavioral intentions of people. For there to be a change in
someone’s behavior there is a behavioral intention (BI) as a precursor. The intent of changing behavior stems from both indirect and direct determinants. The direct determinants, the factors that most directly affect behavioral intention, include: attitude toward the behavior (AB), subjective norm (SN), and perceived behavioral control (PBC). The indirect determinants, which are factors that prelude the direct determinants, include: behavioral belief (ABI), normative beliefs (SNI), and control beliefs (PCBI) (Ajzen, 1985).

![Diagram](image)

**Figure 3.** Theory of planned behavior (Adapted from Ajzen, 1985 as cited in Lee, Cerreto, & Lee, 2010).

Attitude refers to how the individual views the behavior. For behavioral intention to happen, the individual’s attitude towards behavior change needs to be positive. Subject norm contributes to the way individuals perceive that other significant people want them to engage in the behavior. When important people in an individual’s life view this behavior change as something positive or necessary, it becomes more important to the individual to have the intent to change their behavior. Finally, perceived behavioral control is when the individual believes they can perform the behavior successfully. If the individual does not believe they will be successful when exhibiting this behavior, it is not going to be a behavior they will pursue. (Lee, et al., 2010).
All these direct determinants have a specific influential indirect determinant. Behavioral beliefs (ABI) link the behavior of interest to expected outcomes. An individual must be interested in the behavior and believe it is going to have a positive outcome. Normative beliefs (SNI) refers to the way the individual perceives behavioral expectations of important individuals which could include: teacher, doctor, administrator, boss, and/or coworkers. These normative beliefs when combined with an individual’s motivation determine the prevalent subjective norm. Finally, control beliefs (PBCI) relate the perceived presence of factors that may facilitate or impede performance of a behavior. If an individual believes there is going to be some impeding factor to carrying out the behavior successfully then they are less likely to pursue the intention of changing the behavior (Ajzen, 1985).

This theory was utilized in my study to consider the change that has, or has not, been implemented by CASE certified teachers. Although the institutes for CASE are more rigorous than many professional development workshops, teachers will not change their methodology if they are not completely “bought-into” the idea. Professional development can only go so far, if teachers do not value inquiry-based learning and science integration in their teaching, they will not incorporate it into their classroom (Lee, et al., 2010).

CASE Curriculum

The CASE curriculum is designed to promote common understanding of agricultural concepts by aligning the lessons to the National AFNR Standards and Next Generation Science Standards. The curriculum is delivered through a structured sequence of courses to enhance the total program of SBAE. The pathways of courses are structured upon 10 CASE course curriculums: Introduction to AFNR, Agricultural Science- Animal, Agricultural Science- Plant, Agricultural Power and Technology, Natural Resources and Ecology, Animal and Plant
Biotechnology, Food Science and Safety, Mechanical Systems in Agriculture, Environmental Science Issues, and a capstone of Agricultural Research and Development. To complete a pathway, teachers must get certified in all the relevant curriculums. For the sake of this research, I am focusing on the Introduction to AFNR curriculum, which is typically the first CASE curriculum in which teachers become certified.

CASE is currently on its 12th year of implementation after the National Council for Agricultural Education launched the curriculum in 2007. CASE claims to enhance the rigor and relevance of the agricultural curriculum by highlighting science, mathematics, and English language arts concepts throughout the curriculum. This rigor stems from the utilization of science inquiry learning taught through activity-, project-, and problem-(APP) based instructional strategies (CASE, 2018). The use of these activities is what stagers the curriculum across the spectrum of inquiry-based learning (see figure 1) of the instructor knowing, or not knowing, the input (i.e. what information the student has to work with when completing the lesson) and output (i.e. the results the students will come up with at the end of the lesson) (see figure 4).

<table>
<thead>
<tr>
<th>Activity</th>
<th>Input</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activity</td>
<td>Known input</td>
<td>Known output</td>
</tr>
<tr>
<td>Project</td>
<td>Known input</td>
<td>Unknown output</td>
</tr>
<tr>
<td>Problem</td>
<td>Unknown input</td>
<td>Unknown output</td>
</tr>
</tbody>
</table>

*Figure 4. CASE activity, project, and problem-based format (CASE, 2018).*
Methods

This research used a multiple case study design where each CASE certified teacher served as an individual case. This multi-case design was grounded in Yin’s (2014) case study research to answer how and why teachers are incorporating CASE and inquiry-based learning into their classrooms. Having every teacher as an individual case allows each person’s individual experience to be captured within the research. Case studies can be used to observe a process, which will allow the complex dynamics of the CASE curriculum in the classroom to be analyzed (Yin, 2014). An individual teacher and their practical application of the CASE curriculum and integrating inquiry-based learning within their classroom creates the need for grounding this research in Yin’s (2014) case study design.

Epistemology

In line with Yin’s (2014) case study research design, I used a pragmatic approach as my epistemological lens. Pragmatism is the uncritical exploration of the practical applications of an idea or value (Crotty, 2012). When looking through a pragmatic lens, the view of the world can change depending on the person experiencing it (Yazan, 2015). Grounding my study in pragmatism allowed me as the researcher to evaluate the knowledge and process of each participant case for the effectiveness of the practical application, while attempting to answer the “how” and “why” questions of teachers implementing CASE into their classrooms (Yin, 2014).

Positionality Statement

To avoid any biases in my research, it is important I disclose my positionality (Creswell, 2014). I was provisionally certified in the CASE AFNR curriculum in the Fall of 2017 at a SWLGU in the inaugural integrated institute offered to pre-service teachers. The integrated CASE institute changes the length of the institute from a 10-day professional development to a
semester long course for college credit. There are currently only eight universities across the United States that offer the integrated institute, with only five of those certifying in AFNR (CASE, 2018). Provisional certification means I have gone through the professional development and am eligible for full certification once a final fee is paid. During my graduate studies, I was the teaching assistant for the 2018 integrated institute course. In addition to those experiences, I also student taught for a semester and integrated a few of the CASE lessons into my teaching. Being in the first cohort at the SWLGU to become provisionally certified is what sparked my interest in the CASE curriculum. Prior to my undergraduate experience, I was a student in a high school agriculture program; however, neither of my teachers were CASE certified.

Description of the Case

This study only focused on CASE certified teachers currently in the chosen Southwestern state to be congruent with required state agriculture and science standards. To become certified in CASE, teachers attended a 10- day institute, which covered the lessons within the AFNR curriculum and how to incorporate the APP method into their classrooms. These institutes are taught by two CASE certified agriculture teachers, known as lead teachers, who are currently implementing CASE. Potential new lead teachers are identified by existing lead teachers as someone who stood out during the institute they attended. Lead teachers are only allowed to facilitate an institute for a curriculum that they are certified in. Those who participated in this had to fully complete the CASE institute hosted by the SWLGU’s Department of Agricultural Education in the Summer of 2018. This specific CASE institute was chosen because it was initially open to only in-state teachers before expanding to registrations from other states. This provided numerous in-state teachers to be available to participate in the research who had the exact same professional development experience to maintain consistency among participants.
Once the teacher is certified in a curriculum, they are certified their whole career and receive updates of the curriculum as CASE makes revisions. The final requirement to participate in this study was the teachers had to be actively implementing CASE AFNR in at least one course during the 2018-2019 school year.

Participants

Participants for this study consisted of a purposive sample of nine agriculture teachers who completed the SWLGU CASE AFNR summer institute certification. Of the original 20 participants at the SWLGU institute, only thirteen were agriculture teachers in the chosen Southwestern state. One individual taught at the collegiate level making them ineligible for the study and three individuals opted out of the study. For eight of the participants, this institute was the first CASE curriculum certification. One participant had previously been trained in the Animal and Plant Biotechnology curriculum; however, that teacher did not implement any of the corresponding lessons or material into their classroom instruction due to fit within their agriculture program. Participating teachers had a variety of teaching experience within the classroom ranging from 1-38 years and obtained certification through various avenues. Teaching certifications included traditional certification (i.e. goes through a college or university teacher preparation program) or alternative certification (i.e. teacher who did not go through a teacher preparation program, but instead met requirements through work in the agriculture industry) (State Department of Education, 2018). Pseudonyms were assigned to each of the 9 participants to protect their identity and any personal information disclosed within the research. Table 1 includes the participants' names, range of years teaching, teaching certification (e.g. traditional or alternative), and type of SBAE program (e.g. rural or urban school setting).
Table 1.

*Summer 2018 CASE Institute Southwestern State Teachers’ Experience and SBAE Program Description*

<table>
<thead>
<tr>
<th>Pseudonym</th>
<th>Range of Years Teaching</th>
<th>Teacher Certification</th>
<th>Type of SBAE Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tommy</td>
<td>4-6</td>
<td>Traditional</td>
<td>Rural</td>
</tr>
<tr>
<td>Scarlett</td>
<td>1-3</td>
<td>Traditional</td>
<td>Urban</td>
</tr>
<tr>
<td>Barbara</td>
<td>11+</td>
<td>Traditional</td>
<td>Rural</td>
</tr>
<tr>
<td>Elyse</td>
<td>1-3</td>
<td>Alternative</td>
<td>Urban</td>
</tr>
<tr>
<td>Gretchen</td>
<td>11+</td>
<td>Traditional</td>
<td>Urban</td>
</tr>
<tr>
<td>Michael</td>
<td>4-6</td>
<td>Alternative</td>
<td>Urban</td>
</tr>
<tr>
<td>Theodore</td>
<td>11+</td>
<td>Traditional</td>
<td>Rural</td>
</tr>
<tr>
<td>James</td>
<td>7-10</td>
<td>Traditional</td>
<td>Rural</td>
</tr>
<tr>
<td>Jessica</td>
<td>1-3</td>
<td>Alternative</td>
<td>Urban</td>
</tr>
</tbody>
</table>

**Data Sources and Collection**

To follow the outline of a quality case study (Yin, 2014), multiple data sources were collected for triangulation. These data sources included a pre-interview, recorded observation with field notes, post-interview and a textual analysis of lesson plan documents. I collected data for each CASE certified teacher. Figure 5 provides a time line for the data collection process.

<table>
<thead>
<tr>
<th>Day 1 (Via Zoom Call)</th>
<th>Day 2 (In Person)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Interview</td>
<td>Classroom Observation with Field Notes</td>
</tr>
<tr>
<td></td>
<td>Textual Analysis of Documents</td>
</tr>
<tr>
<td></td>
<td>Post Interview</td>
</tr>
</tbody>
</table>

*Figure 5. Data collection timeline*

**Pre-Interview.**

The semi-structured pre-interview was conducted over a Zoom video call prior to the observation of a CASE lesson, and later was transcribed verbatim for analysis. The purpose of
the initial pre-interview was to illicit the perceptions of the CASE curriculum, their understanding of inquiry-based learning, and their process of incorporating inquiry-based learning into their classroom instruction. Questions in the pre-interview were derived from the conceptual and theoretical framework. The beliefs discussed in this pre-interview could be an indirect determinant for the attitude towards incorporating CASE and inquiry-based learning into their classroom. An example of one of the questions within the pre-interview was, “How do you expect your students to interact with each other during these inquiry lessons?” This question provided insight towards the student-to-student interactions within the teaching and learning process while incorporating inquiry methods.

Observation and Textual Document Analysis.

Following the pre-interview, I visited each teacher to observe one CASE lesson, which allowed me to see their inquiry and science integration in action. Each lesson lasted between 45-90 minutes depending on the length of the class at the respective teacher’s school. Due to the timing of visiting each teacher, I could not guarantee they all were going to be teaching the same CASE lesson. However, all the observations were conducted during the Spring 2019 semester, meaning all teachers were at least in unit three of AFNR, which is the beginning of the science content. During the observation, I requested the teachers’ permission to video record the lesson to refer to during analysis. I took field notes during the observation looking for the various interactions within the classroom, types and frequency of questions being posed, and depth of scientific explanations. Table 2 outlines additional information on observations conducted for each participant, including their self-identified utilization of the CASE curriculum within this first year of teaching. Minimal utilization was defined as less than 25% use of the curriculum, moderate utilization was defined as 25%-50% use of curriculum, and heavy utilization was
defined as more than 50% use of the curriculum. Table 2 also includes information on what unit was taught during the observation, the grade level of the students taught during the observation, within what classes the teacher integrates CASE, and the total length of classroom observation. It is important to note that one participant, Theodore, was unable to be observed due to school restrictions, but participated in the pre- and post-interview interviews and this data was included in the study.

Table 2.

**Participant Observation and Course Information**

<table>
<thead>
<tr>
<th>Pseudonym</th>
<th>Utilization of CASE *</th>
<th>CASE Unit Taught for Observation</th>
<th>Level of Students</th>
<th>Course with CASE Integration</th>
<th>Time of Class Observed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tommy</td>
<td>Minimal</td>
<td>Natural Resources</td>
<td>Freshman</td>
<td>Introduction to Agriculture</td>
<td>55 min</td>
</tr>
<tr>
<td>Scarlett</td>
<td>Moderate</td>
<td>Ag Power and Technology Plants and Animals</td>
<td>Freshman</td>
<td>Introduction to Agriculture</td>
<td>90 min</td>
</tr>
<tr>
<td>Barbara</td>
<td>Heavy</td>
<td>Natural Resources</td>
<td>Freshman</td>
<td>Introduction to Agriculture</td>
<td>55 min</td>
</tr>
<tr>
<td>Elyse</td>
<td>Heavy</td>
<td>Natural Resources</td>
<td>Freshman</td>
<td>Introduction to Agriculture</td>
<td>55 min</td>
</tr>
<tr>
<td>Gretchen</td>
<td>Heavy</td>
<td>Natural Resources</td>
<td>Freshman</td>
<td>Applied Biological Systems</td>
<td>45 min</td>
</tr>
<tr>
<td>Michael</td>
<td>Heavy</td>
<td>Natural Resources</td>
<td>Freshman</td>
<td>Applied Biological Systems</td>
<td>45 min</td>
</tr>
<tr>
<td>Theodore</td>
<td>Minimal</td>
<td>No Observation Plants and Animals</td>
<td>Various</td>
<td>Various</td>
<td>N/A</td>
</tr>
<tr>
<td>James</td>
<td>Minimal</td>
<td>Plants and Animals</td>
<td>Freshman 1 and Agriculture 2</td>
<td>55 min</td>
<td></td>
</tr>
<tr>
<td>Jessica</td>
<td>Minimal</td>
<td>Plants and Animals</td>
<td>Freshman 2 and Applied Biological Systems</td>
<td>95 min</td>
<td></td>
</tr>
</tbody>
</table>

*Note. Minimal = <25% utilization, Moderate = 25%-50% utilization, Heavy = more than 50% utilization*

In addition, I requested the teachers to provide me with any documents they provided to their students, so I could conduct a document analysis to observe if anything about the document was changed from the original materials CASE provides to their certified teachers. Through
video recording and analysis of documents, I was able to observe the interactions that the teachers had with students, the students had with the teacher, and students had with their peers (See Figure 2).

Post-Interview.

Immediately after the in-class observation, I conducted a post-observation interview with the teacher that was audio recorded and later transcribed. This interview allowed the teachers to reflect on the lesson they just taught to better recall and explain their thoughts on the amount of inquiry and science integration they included within the lesson. Questions for the post-interview were also derived from the theoretical and conceptual framework. An example of a question from the post-interview was, “Has your teaching style at all changed since getting certified in CASE?” This question delved deeper into behavioral changes of teachers that were potentially impacted by CASE certification and institute participation. Teachers were also asked to self-identify where they believed the lesson observed fell on the inquiry-based methods chart for each of the five main features.

Data Analysis.

I used Nvivo 12 as my data management software for all interviews, observations, field notes, and textual documents. I analyzed all data sources using both deductive and inductive analytical approaches and engaged in open, axial, and selective coding to let findings emerge from the data and to establish relationships across concepts (Creswell, 2014). After the first round of inductive coding, there was 220 individual open codes. Pattern matching was implemented following open coding, attending to the multiple sources of data within individual cases and across multiple cases to examine similar issues or trends (Yin, 2014), which yielded twenty-five emergent categories across all cases. Deductive analysis was also conducted by
matching initial open codes with a structured coding framework derived from my theoretical and conceptual framework. Finally, categories from both inductive and deductive analytic processes were collapsed into five overall themes that served as the basis for my findings.

Trustworthiness

Tracey (2010) identifies criteria for developing excellent qualitative research with strong credibility marked by thick description, triangulation or crystallization, multivocality, and member reflections. In my study, I utilized triangulation by collecting different data sources: pre- and post-interviews, classroom observations, and textual document analysis of curriculum materials (Creswell, 2013). To ensure the opportunity for participant input in the analysis process, I reached out for member checking of my findings. Additionally, I addressed researcher bias by disclosing my positionality (Creswell, 2013). Finally, I provided thick and rich description of the participant’s experiences by including quotes and examples from the direct data sources (Tracy, 2010).

Findings and Discussion

Five central themes emerged from the data that centered on the influence of CASE curriculum on teacher behavior for incorporating inquiry-based teaching methods through science integration. These themes included: 1) barriers to CASE implementation that impacted teacher behavior, 2) experience in industry professions leads to increased teacher efficacy for inquiry-based strategies, 3) traditionally certified teachers more likely to fall back on didactic teaching orientations. 4) disconnect between student capacity and CASE expectations of inquiry-based methods, and 5) in state training and networking support system played a vital role in teachers’ perceptions of CASE institute. Each of these themes will be presented beginning with the description of the theme supported by data and immediately followed with discussion of the
theme as it relates to the current body of literature. The decision to present findings and discussion concurrently was made to increase clarity and to strengthen the linkage between findings and relevant discussion for each theme.

**Theme 1: Barriers to CASE Implementation that Impacted Teacher Behavior**

There were varying amounts of CASE AFNR curriculum utilization within the classroom for each participant during the 2018-2019 school year (see Table 2). James identified that he had only utilized a total of three lessons from the CASE curriculum during the fall 2018 semester, while in contrast Gretchen identified that she utilized CASE for the majority of her lessons during the fall. Reasons for this large variance in CASE implementation among participants directly related to real and perceived barriers within the planning process for lessons and overall curriculum integration and access to materials needed for conducting labs and activities.

Each participant was asked, “When teaching an inquiry-based lesson, what are some of the things you have to plan for?” The purpose of this question was to highlight the process of implementing an inquiry lesson to identify the components of the teaching and learning process outlined in the conceptual framework. When asked about planning, Gretchen said “It is a very difficult and very different way of teaching, so I am glad that it [CASE] is kind of planned for me because I don’t think I would know how to do that.” This was echoed by numerous teachers in the study including Elyse who claimed:

I have I think a more personal problem because I suck at planning ahead and just a lot of the CASE lessons require you spend the night before setting up the lab or cutting out stuff or laminating it or whatever. Which I’m such a procrastinator. I suck at it and so I am really bad at that side of CASE. Otherwise, I think it would be my best friend.
The CASE curriculum is inclusive of all instructional materials including PowerPoints, worksheets and assessments. All documents are provided in both pdf and editable Microsoft Office formats that teachers can alter to fit the needs of their classroom. However, none of the teachers used this editable version option for the student activity worksheet during classroom observations. Despite a lack of alterations for those observed lessons, numerous participants discussed ways that they have adjusted previous CASE lessons or notes they have made to themselves about alterations for future lessons. Even with CASE being an all-inclusive, pre-planned curriculum package, there is still an element of planning teachers must engage in for individual lesson components, accompanying instructional materials, and overall curriculum integration.

Following any CASE institute, teachers have the responsibility to figure out how this curriculum is going to fit into their individual courses and classrooms. Gretchen and Michael took a proactive approach to integration by incorporating CASE into their curriculum maps prior to the start of the school year. Following the institute, Gretchen and Michael collaborated over multiple days to identify where CASE and inquiry-based lessons would best fit within their individual course plans. Gretchen and Michael were two of four participants with heavy utilization and integration of the CASE curriculum. James, a participant with minimal utilization, suggested in his post-interview, “We needed time in the institute or after to be like here is what you need to do next.” James had difficulty implementing CASE in his own school, but also did not identify time set aside for curriculum planning. It is also important to note that teachers in multi-teacher departments or in more urban areas with easier access to other teachers using CASE were more likely to engage in proactive planning approaches to CASE integration.
The second barrier to CASE implementation that emerged among multiple participants was acquiring the consumable materials and capital supplies needed to execute labs and activities. James and Barbara both had initial uncertainty in participating in the study because they perceived their utilization of the CASE curriculum was impeded by not having acquired all the materials from the CASE purchasing manual. This hesitance exemplified the perception that materials and supplies were a control belief factor which affected their perceived behavioral control since they did not believe they could be successful executing inquiry-based methods without the materials listed by CASE. After reassurance, James and Barbara both agreed to participate.

CASE provides a list for materials required in their purchasing manual for all courses including AFNR; however, it is very expensive to purchase in its entirety and targets specific vendors for specialized equipment. During the pre-interview when asked to describe his institute experience, James surfaced his hesitance in purchasing materials for his rural program. “The only thing I didn’t like...I really haven’t done a lot with CASE this year because I don’t have a lot of this stuff that I said I wouldn’t be able to afford myself or from the school.” The teachers who struggled with obtaining the materials to successfully incorporate CASE were mostly from rural schools with a lower socio-economic status. This is a static attribute of the school environment with a lower budget and lack of funding to go towards the materials for CASE. Barbara explained, “funding for the equipment is very limited at my school so I am trying to piecemeal [supplies and equipment].” During James’ classroom observation, he taught a CASE lesson that required no major supplies from the CASE purchasing manual. However, this did not negatively impact James’ ability to incorporate inquiry-based approaches, as his lesson fell in the middle of the inquiry-based spectrum for all five science features. The lack of materials did not
hinder his ability to utilize effective questioning strategies, probe students to think deeply and
critically about the content, and connect to their lives beyond the classroom, all demonstrated
during the classroom observation.

All participants in this study acknowledged that the materials are a vital part of the
success of the CASE curriculum, even if materials are purchased from vendors not recommended
through the CASE purchasing manual. Each participant spoke a little differently about how to
obtain the needed materials and this was often guided by individual school or district limitations
and regulations. Many participants were creative in their approaches to purchasing the needed
materials to execute labs and activities. Gretchen explained in her post-interview that she uses
“water bottles instead soil profile tubes”, “cups instead of beakers”, and is constantly looking for
ways to not have to buy materials.

Theme 1: Discussion

The aforementioned barriers to CASE implementation ultimately affected the
participants’ behavior for incorporating inquiry-based methods through science integration.
Equipment and supplies are vital for the successful implementation of the CASE curriculum
(Lambert, et al., 2015; Carraway, 2015). Implementing the CASE curriculum can be a costly
investment including the fee of attending an institute and the initial start-up cost of materials and
capital equipment that are recommended by CASE. Participants who had difficulty getting
started with integrating the curriculum and inquiry-based methods due to the lack of supplies
echoes Carraway’s (2015) findings that supplies and equipment affect initial implementation of
CASE. This is an essential control belief that can lead participants to believe they will not be
successful in implementing the curriculum and inquiry-based methods when they do not have all
of the supplies and equipment.
The second major barrier to emerge from the data was lesson and course planning. Ball, Knobloch, and Hoop, (2007) outlined that the planning for a lesson can directly influence the delivery of content and student achievement outcomes. Although the CASE curriculum includes fully developed lessons and assignments (CASE, 2018), there are still aspects of the curriculum that must be set up or coordinated beforehand, which was the difficulty that some participants faced. Planning is a direct component of the teaching and learning process outlined in the conceptual framework used in this study. This lack of planning daily can originate from not planning on a larger scale. Course planning has been a known obstacle for agriculture teachers (Smalley & Smith, 2017) that can hinder their preparation for each unit and individual lesson. It is important for teachers to outline their existing curriculum maps to figure out where the CASE curriculum fits into their class(es). The two participants who collaborated and outlined their curriculum maps for the entire year had the most integration of the curriculum in their classrooms.

**Theme 2: Experience in Industry Professions Leads to Increased Teacher Efficacy for Inquiry-Based Strategies**

All participants in this study identified that the purpose of agricultural education, at least in part, was for students to develop technical skills in the agricultural classroom that were transferable to their future careers. This belief was amplified during classroom observations and interviews for participants who possessed personal experience working in the agriculture industry. Six of the nine participants were employed in other careers within the agriculture industry prior to entering the classroom. This career experience ranged from government employment, to business ownership, to Cooperative Extension agent roles. Just because the participant had experience in industry prior to teaching, does not automatically mean they were
alternatively certified. Three of the six participants who had industry experience prior to entering the classroom still achieved traditional certification through a teacher preparation program.

Each of these six participants with real-world industry experience exhibited more student-centered inquiry-based approaches during classroom observations and self-identified as falling on the right-hand side of the inquiry spectrum. These participants were able to reach deeper levels of inquiry through a strong connection to science utilized within industry and reported feeling more comfortable with inquiry-based methods. When asked about her beliefs surrounding inquiry-based learning in general, Jessica, who had over ten years of previous industry experienced responded, “Well I’ve always been all about that [inquiry]. So, CASE aligns with the practices I already like to do.” Overall, this industry background influenced the following behaviors in teachers related to implementing inquiry-based methods effectively: a stronger felt need to learn when introducing content, emphasis on problem solving approaches, development of employability skills in students, and higher overall expectations for critical thinking and real-world connections of content.

The CASE AFNR curriculum is a complete curriculum package that includes PowerPoints of content, objectives for lessons, lab and activity protocols, and assessment questions. However, one of the components that is arguably missing from CASE AFNR curriculum is developed interest approaches for individual lessons and overall units. Since this component was not provided by CASE, the strategies for developing a felt need to learn in students using interest approaches varied from participant to participant. Teachers with industry experience consistently taught using interest approaches that connected closely to real world industry applications as evidenced through my observations. Moreover, interviews with teachers also surfaced stronger ties to the agriculture industry and overt attention was given to bridging
the gap between scientific content and industry applications. An example from Barbara was her inclusion of personal stories during her interest approach on animal systems. While many teachers may have been inclined to focus singularly on how systems work together, Barbara took it a step farther by connecting animal systems to various industry competencies and skills. This impacted the classroom environment as students reciprocated by posing new questions that related to their current jobs and Supervised Agricultural Experience (SAE) projects, all within the context of animal systems. When Barbara was ready to move into new content, she had 100% student engagement and verbal conformation that they understood the importance of animal systems not only for the purpose of the classroom lesson and activity, but also for the future workplace.

During my observations I paid careful attention to teacher questioning strategies, noting the types of questions asked (e.g. open ended vs. directed), use of probes when necessary, frequency of questioning overall, and depth of questions (e.g. what vs. why). James, who had worked previously with the United States Department of Agriculture before going through a teacher preparation program for certification, spent almost 1/3 of his class time questioning students to surface the purpose and applicability of the concepts being taught. He asked questions that began with “why” throughout the entire observation. In his post interview James said, “My personal experience helps when students ask why do we need to learn this? And I’ve seen a lot of the application of what we teach in real life and bring those points up to my students.” When observing Jessica, I noticed that she was reluctant to simply answer a student question posed to her, but instead posed new questions to help students consider the content from a different perspective. Teachers with industry experience asked more questions total during my
observations regardless of content context and challenged students to reach higher cognitive levels of thinking through the types of questions they posed.

Other participants took their industry experiences as opportunities to teach their students problem solving and critical thinking skills through inquiry-based methods and science integration. Elyse spoke of her philosophy of problem solving during her post interview. She said:

I will go to my grave saying the most important skill you can learn whether it’s through jobs or school or whatever is problem solving. It’s the number one skill I learned by being in FFA. That’s the number one thing that a lot of my old bosses say that we can give you anything and you’ll figure it out. And I pride myself on that and try to give that to my students. You know when you had a bad employee, you’re like why are they bad? It’s because they didn’t know how to problem solve or take your initiative.

Jessica exemplified similar values about the importance of critical thinking and problem-solving skills. She pushed for students to take ownership of their learning by solving issues on their own prior to interacting with her as the teacher. When asked, “How do you expect students to interact with you as the teacher during inquiry lessons?” Jessica responded with, “I have the expectation/rule that if the students ask me a question that can be answered in their lab procedures, they get points marked off their lab. This forces them to figure problems out together instead of relying on me.” This decision to hold students accountable for procedural skills is an important component of workplace employability. James took this a step further by expecting students to not only be able to answer the reflection questions provided by CASE, but to be able to verbally articulate the why behind their answers. He verbally engaged in a class wide question
and answer session after collecting student worksheets, to reduce student reliance on their written answers. Additionally, James pulled in previous concepts from other lessons, such as the role of the xylem and phloem within plants. This extension of content and forcing students to verbally articulate the science behind the process lends itself to argumentation skills and scientific reasoning, which are both important outcomes for students present in the conceptual framework.

**Theme 2: Discussion**

Duncan and Ricketts (2008) published a study that compared the efficacy of traditionally and alternatively certified agriculture teachers. One conclusion from this study was that traditionally certified agriculture teachers had higher efficacy in most total program pieces but compared to their alternatively certified counterparts had lower efficacy in technical agriculture content knowledge. Although not all the participants that supported this theme were alternatively certified, their experience in industry gave background and technical knowledge to help students understand the need to learn the concepts and their applicability to the real world. The value of this experience cannot be overlooked in terms of its impact on the delivery of CASE curriculum.

Teachers with background knowledge of the industry can explain the concepts included in the CASE curriculum with deeper science explanations. Some states require additions for a standard teaching license beyond degree completion, including examinations, portfolios, and verification of occupational work experience in agriculture (Talbert, Vaughn, & Croom, 2005). This occupational work experience can be achieved through paid and unpaid internship positions. An internship qualifies as a high impact learning experience that can give opportunities to experience the relevancy of learned concepts through real-world applications (Murphrey, Odom, & Sledd, 2016). In addition, teachers with industry background understand
employability skills that are vital for success including: problem solving skills, critical thinking, and teamwork (Casner-Lotto & Barrington, 2006). As the agricultural education profession continues to answer the call for career readiness from the Perkins Act of 2006, teachers must develop pedagogical content knowledge for all content areas in relation to industry practices and critical thinking skills.

**Theme 3: Traditionally Certified Teachers More Likely to Fall Back on Didactic Teaching Orientations**

Teachers who have been traditionally certified in a teacher preparation program were more likely to deviate from the student-centered inquiry-based approaches to the CASE curriculum. Instead, they fell back on more didactic teaching orientations that are indicative of traditional teacher preparation prior to the inquiry-based learning movement. A teacher with a didactic orientation to teaching would view the teacher as a distributor of knowledge in a predominately one-way exchange between teacher and student. The method most commonly utilized by teachers with didactic orientations to pedagogy is lecture and subsequent assessments would be traditional paper/pencil exams. Within the structure of CASE, there is foundational knowledge provided within each unit of instruction that falls on the knowledge and/or comprehension levels of Bloom’s taxonomy (Anderson & Krathwohl, 2001). This background information is most commonly present in static PowerPoint presentations or within the glossary of each unit. Much of the instruction within the CASE curriculum however, is present in the form of questions, lab protocols, and the activity, project, and problem-based structure of CASE to promote inquiry-based learning strategies.

There were two participants, both traditionally certified, that noted it was difficult to not rely on traditional pedagogical strategies that more closely align with didactic teaching.
orientations. This stemmed from a desire to be in control of the classroom, which is easier to maintain with traditional lecture or discussion-based approaches where the teacher initiates most of the interactions. Michael described his experience before utilizing CASE, “I used to give directions in incredible detail to put a lot more of the responsibility in my hands.” Although classroom management is important, the nature of inquiry-based learning is to have the students inquire into a subject, which requires teacher to transfer some control from teacher to student.

During my observation of Tommy, I witnessed his regression from more student-centered approaches to traditional teacher centered during a single lab session. For the first half of the observation, he responded to student questions that could be easily answered by the lab protocol with, “what do your instructions say?” However, as the observation went on and the class period grew shorter, Tommy fell back into the didactic orientation by simply answering the questions that the students posed, even though they had the resources to discover the answers on their own.

Scarlett showcased similar difficulties to Tommy during her lesson on electrical power. She told one group while walking around the classroom, “Do not do it that way... You will set it up wrong and it will not work correctly.” Although she was just trying to be helpful, she took away the students’ opportunity to make mistakes and problem-solve on their own. Her focus was centered on students’ arriving at the correct answer instead of the process of scientific investigation. However, in her pre-interview Scarlett said, “I am definitely more comfortable now with students doing things. I used to be like ‘You want me to just let them do it by themselves? That doesn’t seem like a thing.’” She identified that giving up control of learning to her students was sometimes uncomfortable and she was actively working towards providing students with more responsibility.
This focus on the students getting the correct answers was a concern of the majority of the traditionally certified teachers. With standardized testing initiatives and subsequent administrator expectations of high student achievement on these exams, teachers are commonly expected to have students test their content knowledge through traditional exam questions that yield one correct answer. Inquiry-based learning challenges that expectation by allowing students to problem-solve with critical thinking skills, a greater focus on the process vs. product of learning. Michael, who was alternatively certified after working in industry, has grasped on to this idea when he explained in his pre-interview, “I mean, just the structure of going through the process is more important to me than did I get the correct answer” and then explained in his post-interview that a majority of his grading is based off of completion of the process rather than accuracy of the product. In reverse, Gretchen expressed frustration towards CASE’s assessments because, “they are so vague, the students do not know what to put, and then it is very difficult to grade.” This challenges the true meaning of student achievement as an output of inquiry-based learning when considering how the student will be assessed on their knowledge.

Theme 3: Discussion

Traditionally trained and certified teachers were more likely to fall back into traditional, didactic orientations for teaching when attempting to integrate inquiry-based learning. Washburn and Myers (2010) found that inquiry-based learning methods can be very difficult to implement for agriculture teachers and when implemented often focus predominately on the teacher-centered side of the inquiry spectrum (National Research Council, 2000). Since the early 1970s there has been a push for teachers to move towards active, student-centered instruction within the classroom (Smith, et al., 2005); however, professional development cannot force teachers to
integrate inquiry-based methods. Teachers must value both inquiry-based learning and science integration to effectively incorporate these pieces into the classroom (Lee, et al., 2010).

Traditionally certified teachers were trained in teacher preparation programs where the primary method of teaching often stemmed from didactic orientations. Teachers with didactic orientations toward instruction generally relay information through lecture and discussion where students are accountable for knowing facts in order to test (Gess-Newsome & Lederman, 1999). This directly correlates to both teacher to student and student to teacher interactions within the conceptual framework of this study. In didactic approaches to instruction, the classroom environment promotes teacher to student interactions as the primary source of knowledge and information. Didactic orientations may limit student questioning to the teacher or reduce their likelihood for seeking out answers from and collaborating with their peers.

Teachers attempting to incorporate inquiry-based learning into their classrooms are being pulled in two directions by constraints of the system. On one hand, they are being asked to develop critical thinking and problem-solving skills in students that sometimes means not getting the correct answer. On the other hand, they are expected to prepare students to be tested on factual information for the purposes of standardized testing. This raises the question- is standardized testing on factual information the best way is to assess students’ knowledge or is it simply the most convenient? Although foundational knowledge is necessary to develop understanding of scientific concepts, students should be encouraged to move beyond simply memorizing information to reach higher levels of critical thinking.
Theme 4: Disconnect between Student Capacity and CASE Expectations of Inquiry-Based Methods

Inquiry-based methods inherently force the teacher into the mindset of a facilitator of learning rather than the primary source of content knowledge for students. CASE is designed with a plethora of labs and hands-on learning opportunities for students to apply the AFNR concepts to real world scenarios. Eight participants identified that age affects inquiry-based learning, specifically discussing the maturity of the students to complete the labs and projects. Tommy discussed his difficulties related to student maturity and time when implementing CASE curriculum:

You’re trying to teach them something and at the same time you are trying to handle all of these students… The student maturity level actually makes it where I can’t get through most of the curriculum that I want or stay within my time boundaries that I want to get a unit done in.

Multiple participants surfaced pushback from students on inquiry-based learning methods because they viewed it as more difficult when compared to their experiences in other classes. Scarlett shared that many of her freshmen students come from a variety of feeder schools, “And so a lot of them when you do inquiry it is very kind of a high expectation for them to put in some effort to figure something out. A lot of them are not willing to do that at first and not comfortable doing that. And so they are like ‘Why can’t we just do a worksheet? Why can’t we just watch a video?’ The issue of students not liking the agriculture course they were enrolled in, or having difficulty understanding the learning that was occurring, surfaced in six of the participants’ interviews. Most noted that it was due to lower expectations of students in their prior education experiences.
James pointed out a generational shift in students by saying, "Kids today don't think for themselves. We could teach it to them today and they wouldn't be able to do it tomorrow on their own." The prior expectation for these students before CASE was focused on learning information and being able to take a test on the concept. This school culture and the students' past experiences are static attributes of the environment that affected the incorporation of inquiry-based learning. James said in his post-interview, "You can't skim by with CASE, you have to do the work." This is the component that students struggled with the most, leading them to push back on inquiry-based learning and ask for easier tasks.

Most of the participants tried to combat this push back from students with a heavier focus on group work and collaboration among students. Collaboration mirrors problem-solving skills that students would experience in the real world. When asked about expectations of student to student interactions within inquiry-based lessons, Scarlett said, "It [group work] helps the students. More minds are not a bad thing. If we are all looking at the same thing together, we might see different things." Students can experience frustration when working on problems alone; however, in real world situations, they would have access to other resources than just their own mind. Collaboration is a vital component of inquiry-based learning and can increase motivation for students during these lessons.

**Theme 4: Discussion**

A majority of participants surfaced that the success of inquiry-based methods in the classroom is deeply affected by student maturity. The maturity of the student is an individual influencer on their learning according to Vygotsky's Sociocultural Theory (Schunk, 2008). This directly relates to age as a static attribute outlined in the conceptual framework of this study. The CASE curriculum contains built in expectations of students' abilities to follow directions,
practice safety in labs, and collaborate with peers. A lack of student maturity can hinder the teacher's ability to facilitate these activities and labs for the entire class. There is a difference between going through the labs and activities at the CASE institute and facilitating the labs and activities with high school students. One of the key stages for professional development according to Guskey's Model of Teacher Change (2002), is determining how students learn after a change in teaching methods. A meaningful discussion of how inquiry-based learning methods can be implemented and continuously facilitated for students of different age and experience ranges could enhance teacher ability for effectively integrating this new methodology into their curriculum and reduce the urge to fall back on didactic teaching orientations that do not promote inquiry.

Additionally, some participants expressed difficulty implementing CASE curriculum because students pushed back on inquiry-based approaches. Students are often accustomed to receiving information from a lecture and memorizing that information for testing purposes, within the current school system structure. However, this does not match the assessments necessary for inquiry-based methods that focus on real world situations where students would have resources to use including books, people to collaborate with, and access to the internet (Schwartz, 1991). This type of assessment is more elaborate and time consuming than sequestered problem-solving assessments because students are constructing and practicing learning through the test itself. Since the school environment has created a culture where students are not exposed to inquiry and discovery methods as much as traditional classroom methods, teachers are likely to experience pushback when attempting to deliver these types of strategies within the classroom (Corkin, Ekmerkei, & Coleman, 2016).
Theme 5: In State Training and Networking Support System Played a Vital Role in Teachers’ Perceptions of CASE Institute

All nine of the participants identified that having other teachers from the same state at their institute enhanced their overall experience. They surfaced strong collaboration with their colleagues and discussion about the curriculum in the context of their home state and standards as particularly valuable. When asked about his institute experience, Theodore, an experienced teacher, described it as “Warm because of the relationships in there with my peers. Us older teachers, it’s good for us to be with young teachers and frankly they helped build my confidence a little bit.” Jessica, a beginning teacher, explained “The other great thing about the CASE institute that was really great as a new ag teacher is I initially didn’t know everyone in that room but I bonded with them over the experience and can talk to them now at FFA events and got to know some of the in-state teachers a little bit more intimately because I was in that institute.”

Four participants shared that the reason they chose to get CASE certified was from the testimonials of their colleagues in the same state who had previously gotten certified. This subject norm is what led the teachers to begin their intent to change behavior for incorporating inquiry-based learning through the CASE curriculum. Two other participants surfaced that CASE was the direction that the state’s profession was heading. During his pre-interview Theodore said, “CASE is the future and that is where the profession is headed.” The collaboration and partnerships developed with other participants from the same state fostered the desire and drive to adopt the behavior of incorporating inquiry-based methods into their classroom. These relationships and accountability could also lead to maintained behavior in the future.
Theme 5: Discussion

All participants genuinely enjoyed the in-state institute and discussed benefits related to most of the other participants being from the same state. This theme highlighted the theoretical framework of this study, with colleague support and endorsement serving as a subject norm and catalyst for behavioral change. There were numerous participants who chose to get CASE certified and subsequently make the shift to inquiry-based methods because of their other colleagues in the agricultural education profession already teaching CASE curriculum. With a state-wide endorsement for CASE certification, there is a normative belief that this behavioral change contains an expectation to incorporate inquiry-based methods. The subject norm of having valued colleagues both encouraging and collaborating for the integration of inquiry-based methods is extremely vital (Azjen, 1985).

On a national scale, CASE has recognized the importance of collaboration and having resources available to CASE certified teachers. CASE has recently expanded its presence in each state by developing a group of state CASE leaders including: a representative from the state department of education, a state university representative, and a current, experienced CASE certified teacher to bridge the gap of communication between CASE staff and CASE certified teachers (J. Kaltenbach, personal communication, November 6, 2018). This expansion has allowed CASE certified teachers to have someone within their state to go to with questions or assistance and can potentially increase the likelihood that behaviors related to inquiry-based methods and science integration will continue.
Recommendations

Recommendations for Further Research

As more states and individual teachers adopt CASE curriculum, the need for rigorous qualitative and quantitative research on how teachers are implementing this curriculum within their classrooms. Currently there is a paucity of research on CASE, with only two empirical studies conducted to date. My study was limited due to the time frame for data collection and investigation into only a single institute and content area. I recommend that future research include an increased number of observations on CASE certified teachers to surface additional change and development for incorporating inquiry-based methods.

Additionally, this study focused on immediate behavior change and discovered that within the course of a year it was easy for teachers to fall back into didactic orientations for teaching. Therefore, I recommend a longitudinal study to observe if the behavior change for incorporating inquiry-based methods is maintained after years of implementation. An additional longitudinal study would be beneficial to see if there is an increased efficacy in incorporating inquiry-based methods through science integration. Finally, I recommend broadening the scope of the study to observe behavior change over a variety of settings including multiple institute experiences with different lead teachers, regional differences in implementation of the curriculum, and other CASE curriculums outside of AFNR.

Recommendations for Practice

The major themes that emerged from this study highlight various opportunities for future practice that could benefit CASE certified teachers. My first recommendation is increased collaboration among CASE certified teachers within each state. This could be facilitated through collaboration sessions planned by the state CASE leaders and integrated during summer
teachers' conference (or a similar professional development experience depending on the state) or as a separate professional development event delivered in-person or over an online meeting platform. This opportunity would allow for CASE teachers to share ideas for curriculum integration, assessment, and alternative materials that can be used for each lesson, within the context of individual states.

Discussions can specifically target implementation of the curriculum according to state standards and regulations, as well as sharing new and innovative ideas for integrating the curriculum into the classroom. State CASE leaders can share ideas of integrating methods of preparing students for future content. These methods can include incorporating lab preparation days where students become familiar with the background information to prevent any delay of labs and exploring flipped-classroom methods where students are assigned background research of the lesson for homework the night before. This networking opportunity could also allow for teachers to share strategies for integrating inquiry-based methods into their teaching and how to establish expectations with students to increase their motivation to engage in inquiry-based lessons. Integrating a collaboration and networking opportunity for CASE certified teachers can decrease potential barriers of implementation, as well as provide a support system that showed to be crucial within the fifth theme of the findings.

In addition to collaborative professional development sessions, I recommend each state design and implement an online platform available to all teachers that is maintained by the state CASE leaders. Information on this platform could include access to CASE purchasing manuals, contact information for CASE state leaders and their areas of expertise, opportunities for implementation grants, and a general page with frequently asked questions. This could also serve as a resource for teachers who are considering getting CASE certified to help them understand
the process and financial implications when presenting the opportunity to district and school administrators. This platform could be a static way of facilitating the collaboration valued by participants in this study to strengthen their efficacy when implementing CASE and inquiry-based methods.

Although an online platform exists for CASE at the national level, there could be additional benefits to addressing these components at the state level. The online state CASE platform could include information that is specific to the local communities, state standards, and financial opportunities unique to the area. A potential opportunity for the online platform, either at the national or state level, would be providing an extra level of access for currently certified teachers. With this extra level of access teachers can have access to extra resources of information covered within the institute to refer to later in the school year. The information can include recommendations of lab set up, recordings of lead teachers incorporating lessons into their high school classrooms, assessments to utilize, and background content knowledge for each lesson. In the 10-day summer institute, a plethora of information is covered with the teachers in attendance, but content knowledge can occasionally get lost in the need to get through each of the activities, projects, and problems. To support this platform, teachers can subscribe to the platform to gain access to these extra materials. This could benefit teachers who have difficulty or need support with planning for lessons, implementing the curriculum, and falling back into didactic orientations of teaching.

Finally, I recommend increased opportunities for financial and resource support for currently certified CASE teachers and teachers who are interested in achieving CASE certification. This could include more grant opportunities for CASE institute attendance and implementation scholarships for supplies. Local community and industry sponsors should be
sought out to provide financial support for implementation of the curriculum at the state level, in addition to current national level grants and scholarships. Finally, current opportunities of grants, scholarships, and financial support should continue to be advertised to teachers, so they are aware of opportunities they are eligible for and to minimize barriers to implementation.
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