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Keywords

inquiry, modeling, CASE, professional development, preservice, literacy, pedagogical content knowledge, content knowledge

Disciplines

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Comments

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Exploring Content, Pedagogy, and Literacy Strategies among Preservice Teachers in CASE Institutes

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Abstract

Educational leaders implement professional development activities to facilitate teacher learning and growth. Each summer, scores of secondary agriculture teachers attend Curriculum for Agricultural Science Education (CASE) institutes as a form of professional development. Recently, teacher preparation programs have begun offering CASE institutes for preservice teachers. This study explored the lived experiences of preservice teachers in two CASE institutes. Three central themes emerged from the data: 1) preservice participants wrestled with adoption of inquiry teaching strategies as a teaching method, 2) contextualized literacy in the agriculture classroom helped preservice participants understand their role as a teacher of literacy, and 3) participant content knowledge growth was intertwined with self-growth in formative assessment, classroom management/grouping, and literacy strategies. The findings were presented through vignettes to provide a thick, rich description of the case. Recommendations include offering modified CASE institutes for preservice teachers, use of lead teachers who are familiar with the developmental challenges of preservice teachers, and monitoring participant content knowledge to facilitate growth in pedagogical content knowledge.

Keywords: inquiry; modeling; CASE; professional development; preservice; literacy; pedagogical content knowledge; content knowledge

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Introduction

"The intended purpose of teacher education programs is to prepare prospective teachers to teach in our schools" (Mueller & Skamp, 2003, p. 432). Preservice teacher preparation programs include a combination of pedagogical and content courses to prepare preservice teachers for a culminating student teaching experience (Darling-Hammond, 2010; Roberts & Kitchel, 2010). Despite specialized coursework and a lifetime of observational learning, many beginning teachers are not equipped to deal with the challenges of managing their own classrooms (Darling-Hammond & Bransford, 2005). Beginning agriculture teachers face issues of stress and burnout, and must fulfill additional roles beyond classroom instructor, including managing laboratories, student leadership organizations, and supervising student projects (Torres et al, 2009).

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To compound these issues, less than 60% of newly hired agricultural educators earned certification through a traditional preparation program, suggesting one in three beginning agriculture teachers did not receive teacher preparation as part of their undergraduate education (Smith et al., 2018). In an analysis of several federal databases, Sutcher et al. (2016) found alternatively certified teachers across subjects were two to three times more likely to leave teaching after their first year than their traditionally prepared counterparts, and uncertified teachers left at twice the rate of certified teachers within five years. Teacher preparation is important, but it is unrealistic to expect agriculture teacher preparation programs to fully prepare new teachers for the complex challenges of managing a classroom, curriculum, and secondary agriculture program (Greiman, 2010).

Deep and flexible content knowledge is a cornerstone of effective teaching (Hill et al., 2008). Agriculture teachers need content knowledge to plan and deliver curriculum to help students apply content to real-world settings (Edwards & Thompson, 2010). Novice agriculture teachers reported deficiencies in content knowledge, some of their students knew content better than they did, and feeling lost and unprepared by their teacher preparation programs to teach content (Rice & Kitchel, 2016; Rice, 2015). This content knowledge shortage may be magnified by a lack of hands-on application in collegiate agricultural content classes and a reduction in the content credit hours required for certification (Edwards & Thompson, 2010).

Beginning teachers also struggle with pedagogy and pedagogical content knowledge (Rice & Kitchel, 2016). Pedagogical Content Knowledge (PCK) is the intersection of content knowledge and pedagogy; PCK is the mixing of content and pedagogy and represents the contextualized content knowledge needed to organize, adapt, and represent content for instruction (Mishra & Koehler, 2006; Shulman, 1987). Content knowledge and pedagogical content knowledge are the two essential teacher knowledge domains; in the sciences, PCK can only be developed once teachers have adequate content knowledge (Etkina, 2010; Hill et al., 2008). Grossman (1990) proposed four main sources of PCK: 1) disciplinary education, 2) observation of classes, 3) classroom teaching experiences, and 4) specific courses or workshops. Van Driel et al. (2002) proposed teaching experience is the strongest predictor of teachers' PCK, suggesting novice teachers may not have the PCK tools needed to adapt content knowledge for student consumption. In agricultural education, an agriculture teacher's personal experiences were a significant predictor of Common Content Knowledge, Knowledge of Content and Students, and Knowledge of Content and Teaching, and years spent teaching, suggesting agriculture teachers continue to learn both subject matter and pedagogical content knowledge while on the job (Rice & Kitchel, 2015).

Schools and universities have widely implemented professional development and mentoring programs as a formal mechanism to support teacher learning and growth (Smith & Ingersoll, 2004). In agricultural education, professional development opportunities are key to teacher change (Shoulders & Myers, 2014). Short, focused professional development, such as one-day workshops, are often preferred by busy teachers; teachers identify "one-and-done" workshops as good sources of technical knowledge (Hurst et al., 2015; Rice & Kitchel, 2015). However, the traditional "one and done" approach has limited effect on teacher practice, due to its abbreviated length (Desimone, 2009; Desimone, et al., 2002; Garet et al., 2001). Teachers must be given opportunities to think about how new information can be integrated into their classrooms (Putnam & Borko, 2000) and develop relationships with facilitators and other participants.

Literacy skills and strategies are foundational for quality teaching, yet many secondary teachers feel unprepared by their preparation programs to implement literacy strategies within their classrooms, and literacy strategy integration often runs counter to traditional secondary instructional methods (Buehl, 2011; Cantrell & Callaway, 2008; Hasselquist et al., 2019). Practicing teachers purport various attitudes toward teaching reading in the content areas, including a) content area teachers cannot or

should not teach reading, b) teaching reading is the responsibility of others, c) teaching reading in the content is important, or d) content area teachers would like to teach reading but do not know how (Hall, 2005).

Career and Technical Education (CTE) teachers have noted the importance of a community of practice when incorporating literacy skills and activities in their classrooms (Santamaria et al., 2010). Communities of Practice are groups of peer teachers who are guided to develop new practices with and through support of peers within a community (Handley et al., 2006). Using a community of practice has been noted to help improve teacher anxiety related to literacy integration (Cantrell et al., 2008). One study found 71% of middle and secondary non-English content area teachers used their community of practices as a primary source for literacy instruction ideas (Cantrell, et al., 2008). When content area teachers attended literacy related professional development they were more likely to implement literacy activities in their classrooms (Adams & Pegg, 2012; Santamaria et al., 2010). Teachers are also more efficacious regarding literacy and could provide specific examples of how it helped them incorporate literacy skills (Cantrell, et al., 2008).

A majority of agriculture teachers have attended literacy-focused professional development in and outside of the local school district (Hasselquist & Kitchel, 2016b). However, Florida agriculture teachers reported literacy-related professional development did not meet their needs (Warner & Myers, 2011). This view of literacy-specific professional development may explain why professional development held outside the district was not influential on the frequency of classroom literacy activities (Hasselquist & Kitchel, 2016a). Despite the challenges associated with literacy-focused professional development, professional development is an important component of teacher growth. "Although professional development by itself may be insufficient to bring about significant improvement in education, it is an absolutely necessary ingredient in all education improvement efforts" (Guskey, 2000, p. 4). In agricultural education, CASE institutes provide sustained professional development and communities of practice where teacher cohorts can gain literacy strategies for their agricultural classrooms (Hasselquist, 2017).

Since 2009, the Curriculum for Agriscience Education (CASE) professional development program has provided sustained, intense professional development to 1,828 teachers from 45 states (CASE certification, 2019). CASE has developed 11 unique curricula, each supported by required teacher professional development. Every summer, scores of practicing and preservice agriculture teachers enroll in CASE institutes, where lead teachers model both content and pedagogy to a cohort of practicing teachers. CASE institutes are delivered as sustained professional development, where teachers play the role of "student" in order to learn the curriculum. Each institute is formally planned and scripted to include collective participation, content focus, active learning, and coherence. Lead teachers are coached to intentionally demonstrate inquiry and literacy strategies and are encouraged to discuss incorporating daily literacy strategies with participants (M. Chaplain, personal communication, 29 March 2019).

Many states require coursework in reading/literacy strategies as part of their undergraduate and alternative teacher preparation programs. (L. Busdieker, personal communication, 27 Feb 2019). However, reading in the content area courses often leave students with an incomplete experience, where they are hesitant to utilize literacy in their future classrooms (Hasselquist et al., 2019). CASE is an important source of literacy strategy training for agricultural education. Recently, several universities have offered CASE training as part of their preservice preparation program. However, little is known about preservice agriculture teachers' efficacy and knowledge of literacy strategies at the conclusion of their preservice preparation program. Further, to what extent does a CASE institute at the conclusion of the preservice program further develop content knowledge, pedagogical content knowledge, literacy strategies knowledge and efficacy?

Theoretical Framework

The most beneficial professional development activities for agriculture teachers' literacy practices were content-specific ideas they could replicate in their classrooms, in addition to seeing literacy-related strategies modeled in the context (Hasselquist, 2017). Based on these findings, researchers analyzed the case through an observational learning lens (Bandura, 1969). Observational learning occurs when learners adopt a modeled behavior which would have not been possible prior to modeling (Bandura, 1969). Since CASE institutes rely heavily on overt lead teacher modeling of desired behaviors with participant rehearsal, researchers focused on lead teachers as credible models. Lead teachers intentionally planned and modeled literacy strategy integration and inquiry methods with each lesson (M. Chaplain, personal communication 29 March 2019). Researchers sought to capture changes in preservice teachers' beliefs about literacy and inquiry, and the incorporation of literacy strategies and inquiry methods to their teaching schema, as modeled by CASE lead teachers (Bandura, 1969; Rosenthal & Zimmerman, 1978).

Purpose and Objectives

The purpose of this study was to describe the process of growth of content and pedagogical strategies, including literacy strategies, for preservice agriculture teachers attending a preservice CASE institute. Research questions included:

1. What CASE institute structures and lead teacher actions do preservice CASE participants see as most impactful to their content knowledge growth?
2. In what ways do preservice teachers' pedagogical beliefs change from participating in a CASE institute?
3. How does preservice CASE institute change participants' knowledge and efficacy to integrate literacy strategies in their classrooms?

This study addresses Research Priority Area Five: Efficient and effective agricultural education programs within the American Association for Agricultural Education's National Research Agenda (Roberts et al., 2016). Researchers have conducted several studies on CASE, including the challenges of preservice implementation (Wells et al., 2019), student development of critical thinking, task value, autonomy, and science lab self-efficacy (Velez et al., 2015), science teaching efficacy (Ulmer et al., 2013), teachers' intentions to integrate science into agriculture classrooms (Pauley et al., 2019). However, limited research has been done on preservice teachers attending CASE institutes or what skills are gained through CASE professional development.

Methods

This research utilized an instrumental case study approach; the bounded system was preservice teachers participating in a preservice CASE institute during the summer of 2017. The use of a bounded instrumental case study methodology was justified as researchers were seeking to fully describe the complexity of the issues of instructional and literacy strategy modeling and behavior change within the bounded system of CASE preservice institutes (Creswell, 2013). CASE inquiry-based activities, projects, and problems depend on large amounts of student technical reading and writing, thus making literacy strategy integration a key component of CASE institute success (M. Chaplain, personal communication, 29 March 2019). Researchers were guided by the general questions about what content, literacy, and inquiry strategies were gained by preservice teachers through CASE lead teacher modeling (Stake, 1995).

Description of the Case

All study participants had completed their student teaching experience in the previous semester and were completing a traditional teacher certification program. Two separate institutes hosted at two Midwest land-grant institutions were used in data collection. Eleven participants were enrolled in an Animal Science institute, and 16 more enrolled in an Introduction to Agriculture, Food, and Natural Resources institute, for a total of 27 participants. Each CASE preservice institute consisted of an 8-day professional development opportunity for teachers. Each training was led by two certified agricultural educators who had been previously trained in the curriculum area and had taught the curriculum at their high school. As with practicing teachers, preservice teachers were placed into a "student" role to experience the curriculum by completing the lessons and labs in the curriculum, with the intention of participants replicating the curriculum precisely as modeled within their own secondary classrooms.

Data Collection

Prior to the institutes, researchers met face to face to identify objectives and data collection procedures, which were submitted and approved by local Institutional Review Board prior to data collection. For pre-post comparison, researchers collected both quantitative and qualitative data from all participants both before the start of the institute and after the end of the institute using identical data collection procedures. Researchers collected quantitative content knowledge data in the form of an electronic, CASE-generated content test and asked students to identify any previous coursework in teaching reading. Researchers also asked participants to answer the following short answer questions: 1) How do you define literacy?, 2) "Is it the job of the agriculture teacher to teach literacy to their students? Why or why not?, 3) In what ways to student reading, writing, speaking, and listening skills help students learn ag content?, and 4) please give one example of a teaching strategy you would use in the classroom and its context, as guided by Buehl (2011).

During the institute, researchers collected qualitative participant data through identical written reflective prompts every other day, five times throughout the institute. The prompts asked, "What strategies (up to 3) did you learn today that could be used in the classroom? Why did you find them useful?" The use of identical repetitive reflective prompts was employed to track items participants focused on and noticed throughout the institute. Researchers intentionally used "strategies" without a modifier to allow students to choose which instructional, literacy, classroom, or equipment management strategies they found most salient. The data collection at all collection points yielded 27 participants for a 100% response rate.

Researchers conducted field observations of lead teachers preparing and teaching lessons, noting the use of inquiry and literacy strategies modeled and student responses to those methods. Researchers also analyzed documents related to the institute for teaching methods for inquiry and literacy strategy integration, including CASE teacher notebook and the CASE lead teacher schedule. Researchers asked lead teachers on days two, five, and seven to identify which teaching/literacy strategies they had taught or modeled in the past few days. Researchers also interviewed lead teachers halfway through the institute to gain their perspective on the intentionality of modeling teaching/literacy strategies and as a member check of early findings. This study should not be generalized beyond the population of preservice CASE participants who participated in this study; researchers believe the findings can provide insight for CASE staff and agricultural teacher educators.

Data Analysis

Researchers assembled pretest and posttest content scores, literacy coursework, beliefs and practices for literacy education the agriculture teacher's role as literacy teacher, daily reflections, lead

teacher notes, document analysis, and field notes into a shared spreadsheet. Initial data coding was completed by independently reviewing responses. The results of the initial coding were reviewed via conference call between researchers, then synthesized into emergent themes. The emergent themes were reviewed by researchers and lead teachers, then merged into the final themes. Pseudonyms for participants, lead teachers, and faculty are used to report the findings (see Figure 1). To ensure qualitative rigor, methods were used based on the recommendations of Creswell (2013) and Lincoln and Guba (1985). Researchers triangulated data by using quantitative pre and post test data, field notes, lead teacher schedules, student short answer responses, student notes, printed curriculum, and lead teacher interviews. Audit trails, peer debrief, coding checks among researchers, and use of rich thick descriptions helped ensure trustworthiness.

Figure 1
Chart Of Pseudonyms Used To Report Findings

Lead Teachers	**Participants**			**Faculty**	**Grad Student**
Larry	Adam	Emily	Margo	Fred	Gus
Lisa	Ann	Emma	Marie	George	Sadie
Ralph	Anna	Faith	Mary		
Emily	Austin	Gary	Matt		
	Betty	Grace	Peter		
	Blair	Jeff	Reagan		
	Brea	Jenny	Sally		
	Carmen	Jim	Taylor		
	Carrie	John	Tim		
	Dana	Katie	Todd		
	Elsa	Kyle	Tom		

In this inquiry, researchers employed a pragmatism worldview (Guba, 1990); pragmatist researchers examine the "what" and "how" to research based on actions, situations, and practical consequences, not on antecedents (Creswell, 2013). A pragmatic paradigm is most appropriate in case study research where researchers collect both qualitative and quantitative data (Yin, 2003). Researchers attempted to bracket their experiences throughout the research by reflexively positioning themselves as former high school teachers who incorporated literacy strategies in their own classrooms. The primary researcher completed one Reading in the Content Area course as an undergraduate student. One of the secondary researchers served as a teaching intern for a college reading in the content area course. All three researchers have facilitated CASE institutes, with the lead researcher serving as a lead teacher. These experiences may have influenced the researchers' subjectivity (Creswell, 2013). However, care was taken to ensure accuracy and validity of the findings as discussed above.

Findings

The researchers utilized vignettes to help explain the emerging themes (Stake, 1995). The vignettes are based on field observations, reflective questions, lead teacher notes, and interviews woven into a narrative. The vignettes represent the participants' actual quotes and observed actions, thus facilitating a vicarious experience for the reader to better understand the time and place of the complex case (Creswell, 2013).

The vignettes represented the following themes:

1. Participants wrestled with adoption of inquiry teaching strategies as a teaching method
2. Contextualized literacy in the agriculture classroom helped preservice participants understand their role as a teacher of literacy

3. Participant content knowledge growth intertwined with self-growth in formative assessment, classroom management/grouping, and literacy strategies.

Qualitative Findings

Vignette 1: Burning Feed

CASE-Animal preservice day 3. Larry and Lisa, the lead teachers, start class promptly at 8:00 a.m., although some preservice teachers arrived as early as 7:30 a.m. As Larry sets up ring stands and clamps for burning feed, Lisa glances at her schedule, then busies herself preparing the fetal pigs for the morning dissection. The smell of formaldehyde and molasses permeates the classroom. On the front table, there's a small Ziploc of lamb feed, a bag stuffed with fresh hay, the bright yellow of field corn, and the dull grey of pelleted pig feed. Preservice teachers will venture outside for today's lab as they attempt to calculate the energy in various feedstuffs by burning feed.

Although the lead teachers have both a responsibility and vested financial interest in teaching the curriculum to these young teachers, Larry, one of the lead teachers, sees CASE certification as much more than a curriculum training: "The CASE professional development is extremely exciting to see how teachers transform over several days of training. This experience provides teachers an opportunity to utilize inquiry-based curriculum that focuses on teachers training teachers."

As Lisa begins class, students open their 300-page binders to the next lesson. The binders are flagged with colorful post-its containing student notes on how to facilitate each activity, project, and problem as modeled. More sticky notes are on the back wall in the "parking lot", which contains questions for later in the institute. The participants are almost halfway through their binders- it has been a very busy two days.

After lunch, participant enthusiasm has faded; some preservice teachers are focused on "getting it done", while others spend a few extra minutes sorting through the snack table. At the front of the room, Larry introduces the burning feed lab by modeling a literacy and instructional strategy. Students have seen literacy and instructional strategies modeled in each lesson for three straight days; they have come to expect the routine. The burning feed activity relies heavily on inquiry techniques- students will select two feeds, then weigh, burn, reweigh, and calculate the calories per gram for each sample. Although students could look up calorie content using a feedstuff table, CASE asks students to construct their own knowledge by simulating lab techniques. The inquiry process is overtly modeled by the lead teachers, and lead teachers often supplement modeling by providing pedagogical content knowledge in describing how they would teach a lesson. Larry talks about candy bars vs. celery as a metaphor for concentrates and roughages.

As participants plow into the material, Larry, gives suggestions on how to complete the math section at the end of the activity. Without their mentor's guidance, some preservice teachers might have missed one of the important outcomes of the activity: math integration in the agriculture classroom. While understanding the calorie content is important, this activity also integrates applied math skills. Many students struggle with the calculations; when questions arise, Larry directs students to follow the instructions as listed in the activity guide.

As students return from outside to weigh their charred feed remains, Larry reminds participants to complete their conclusion question, then checks each students' work, offering praise to all and suggestions to some. Some students found value in the inquiry activity through a deeper understanding of the content. Austin, a student who performed poorly on the pretest, recalled "We talked about this

process in my feeds and feeding course, so I kind of understood the concept. However, having to do the steps helped me really understand what a calorie is."

After stamping everyone's paper, Larry leads a lively discussion among the participants about the value of the lab. Finding a balance between student-centered and teacher-centered lesson was a lingering concern for participants, and there are vocal students on both sides of the issue. Several participants are stuck on the issue of allowing future students too much freedom. The preservice teachers seem content to receive the completion stamp on their papers at the conclusion of the lab, and Larry summarizes by helping teachers compare roughages and concentrates by energy density.

Theme 1- Participants Wrestle With Adoption Of Inquiry Teaching Strategies. Researchers found the greatest variation among participants when they asked preservice CASE participants about what pedagogical strategies they gained from their CASE institute. CASE lead teachers provided overt modeling many times each day in both the openness of inquiry methods and the structure of literacy strategies, teaching strategies, procedures, and conclusion questions. Although some students noticed and recognized the value of CASE inquiry-based pedagogical approach modeled throughout the 8-day in-service, others identified literacy strategies or teacher "tricks" as their most impactful strategy learned. Some students identifying literacy and teacher tricks as the most impactful outcomes reported they did not intend to incorporate inquiry-based strategies into their classrooms.

Other students appeared to readily embrace the inquiry methods found in CASE. When students were asked about teaching strategies learned in CASE at the end of the institute, Taylor reflected positively on using inquiry in her classroom: "I would use inquiry-based learning, giving case studies would be an example. This lets students discover and learn how to think on their own". When researchers asked participants for an example of how inquiry could facilitate good teaching, Adam suggested "hands-on interactive learning. Get a cow heart and have students determine the path of blood through the heart." Emma suggested "having a student read livestock markets and discuss what the numbers mean" as an authentic inquiry activity she would use in her classroom.

For other students, the foundational inquiry techniques inherent to CASE were not noticed or identified as a teaching strategy they would adopt. One group of students concluded their feed data from this activity were meaningless. "I would never do this in my classroom" says Sally, a participant. "My parents are farmers and they send their alfalfa here to the University for testing." Others chimed in, suggesting teachers should instead ask students to look up calorie values in a table for better accuracy. For this group, teacher-centered lessons remained the instructional method of choice. Emily commented "my classroom, I would use the summary teaching style, where students read a short insert, then summarize it in five sentences." Ann identified "Pre-reading an article while underlining key terms or interesting info, class discussion to gather what the students underlined" as an impactful strategy. Peter chimed in, his favorite new strategy was "using Kahoot to teach students and help students review."

Vignette 2: Floating Parasites

Day 6- Participants enter the classroom looking refreshed after a well-earned weekend break. Lisa and Larry are pleased with participant progress, and they discuss the progress of each individual student and their "check sheets". This is the sixth day the lead teachers purposefully model incorporating at least one literacy strategy for each activity. Jim, a male participant who recently graduated with his master's in Ag Education, indicated, "with CASE I have learned how to incorporate more literacy in my lessons, but also more activities. This will allow me to create a classroom that is

more about hands-on learning." Reagan, one of the participants, has made a goal of writing down the literacy strategy used with each purpose statement.

"Today we are going to learn about animal pests. Move to your 6 o'clock partners, read the purpose for 8.3.2, and write a tweet (max 140 characters) which summarizes what we're doing today" says Lisa, modeling another literacy strategy. After participants read their tweets, Lisa models an additional literacy strategy by asking them to write student-friendly definitions for key words in this activity description. In today's lab, preservice teachers will conduct a fecal float activity to look for parasite eggs in mammal waste. Lisa has set up all necessary lab equipment in the back of the laboratory, including a fresh stool sample for analysis. Preservice teachers will use the activity handout in their notebooks to guide the experiment. Each CASE lesson includes a purpose and student instructions, so literacy strategies are an important component for student success.

For most participants, this is the first time they have encountered this content, so Lisa encourages students to take procedural notes in the margins and on post-it notes in their notebooks. As the lab progresses, Lisa begins to receive a large number of questions. It seems many participants are struggling with the content. When confused by the instructions, Anna found value in the student-friendly definitions she had generated earlier as a literacy strategy: "Ag teachers should teach literacy because we have to deal with our own language and skillset that other teachers don't have to deal with." Kyle agreed and replied "It is part of the job of an agriculture teacher to teach literacy to their students. Students will be learning new terminology and concepts throughout their experiences."

"You must have a fresh sample for this to work" says Lisa. "Be sure to tell your students to fill their graduated cylinders until the meniscus is above the edge of the glass, or the test won't work." Lisa seems intent on providing procedural and pedagogical content knowledge to students as part of the laboratory. Participants are hard at work with their partners, as Lisa and Larry provide supplies and oversee the student-directed learning. Students read and perform the step-by-step directions in the CASE notebook, making much of the activity self-directed.

Lisa fields the occasional question from participants- "What do I do after I have mixed in the reagent?" asks Betty, a participant. "Look at your notebook," prompts Lisa. "Can we reuse these chemicals later?" inquires Tom, another participant. Lisa responds- "You can't reuse the chemical you mixed in today, but the bottle of unused can be kept for the following year." Lisa masterfully models student inquiry and literacy practices as the lab progresses. Questions regarding the content or activity are mostly discouraged by being reflected back to participants, whereas questions about facilitation are welcomed and answered with the wisdom of an experienced CASE teacher.

Over the course of the next hour, preservice teachers complete the four-page activity and reflection questions, mostly on their own. Some find parasite eggs in their samples, whereas others do not, despite samples being from the same animal. Lisa encourages students to refer to the content posted on the parasite chart to identify what they found when drawing results. She also tells participants it's ok if they have different answers, but the reflection questions should reference the data they collected.

Theme 2-Contextualized Literacy In The Agriculture Classroom Helped Preservice Teachers Understand Their Role As A Teacher Of Literacy. CASE lead teachers planned and modeled a literacy strategy for each activity, project, and problem, either in the purpose statement or procedure instructions, and sometimes both. In this lesson, Lisa modeled a tweet summary, student friendly definitions, lab notes, and the parasite chart as four distinct literacy strategies. The CASE preservice institute changed how many preservice teachers conceptualized content literacy and the role of the agriculture teacher as literacy instructor. Researchers asked participants both before and after the institute if they were responsible for teaching literacy (see Figure 2).

Figure 2
Participant Paired Quotes. Prompt: "Is It The Job Of The Ag Teacher To Teach Literacy? Why Or Why Not?"

Participant	Pre-survey	Post-survey
Kyle	"Literacy is something that should be learned beforehand, but teachers need to know how to work with students that struggle with it."	"It is part of the job of an agriculture teacher to teach literacy to their students. Students will be learning new terminology and concepts throughout their experiences."
Brea	"Ag teachers should promote literacy to their students. They should teach some literacy strategies to their students."	"Ag teachers should teach literacy because we have to deal with our own language and skillset that other teachers don't have to deal with."
Carmen	"Yes, the job of every teacher should be to reinforce core class standards and basic principles like literacy. If we are to prepare our students to be leaders they must also be learners which incorporates being literate."	"Yes, because literacy is a vital part of all content areas. Literacy is key to ensure students are understanding the subject matter."
Todd	"It is the job of all educators to teach literacy."	"Yes, literacy and communication is essential in all subject areas."

Some preservice teachers began to equate literacy strategies as "good teaching"; many would jot down the details of the modeled literacy strategy in their notebook next to the procedure. As supported by the paired quotes in figure 2, many preservice CASE participants moved from a broad, idealistic belief about literacy before the institute, to a more contextualized and functional definition of literacy. For many students, the CASE institute provided an awakening of how contextualized literacy strategies can help them be a more effective agriculture teacher. Faith shared, "it is part of the job of an agriculture teacher to teach literacy to their students. Students will be learning new terminology and concepts throughout their experience." Brea indicated "literacy is a vital part of content areas. Literacy is key to ensure students area understanding the subject matter." Faith's and Brea's use of literacy strategies support how contextualized literacy experience helps enhance learning outcomes. Other students saw value in literacy in preparing students for life beyond the classroom. Matt noted "Students need these skills to be able to understand and communicate the content in agricultural education." Dana reflected that "reading, writing, speaking and listening skills help students learn ag content, by providing multiple ways to take information and process it in order to learn."

Vignette 3: One Last Class

Wednesday morning, day 10, the last day of the CASE institute, and the students are putting the final touches on their peer teaching presentations. Fred and Sadie have been rushing around to various grocery stores to gather eggs, butter, cheese, meat, and supplies; they arrive early to start the BBQ grill so the meats group can start preparing samples. Larry walks by the students grilling, smiles, and says "if you could bottle that smell, you'd make a million dollars!"

Lead teachers employ a peer teaching strategy the last day- Larry, Lisa, Sadie, and Fred watch each student presentation and provide feedback, paying particular attention (and providing praise) when students correctly use inquiry-based methods. Lisa praises one group for using a literacy strategy and formative assessment strategy she previously modeled for them. After the lessons, students log in to

CASE online and complete their posttests. Lead teachers play graduation music and distribute awards (decorated paper plates) to each participant. Lead teachers complete the final checklists for certification, Fred and Sadie pack away supplies for the next institute, and participants reflect on their recent transformative experience.

Tim sits snacking on the leftover meat samples and reflects on his gains in student-centered learning strategies. "With CASE I have learned how to incorporate more literacy in my lessons, but also more activities. This will help me create a classroom that is more about hands-on learning." Margo reported growth in formative assessments. [I plan on] "using vocab for grouping students: introduced student to vocab and definitions; exit tickets to recreate an icon which represents concepts learned: a way for students to reflect on what they learned and express their creativity; Circle/Triangle/Square: way to reflect what students know or have questions about." Gary's big takeaway from CASE was classroom management and student motivation strategies. "How helpful mnemonic devices are: can be used to remember many lists of items. Instagram/twitter post: bringing social media in to connect with their lives. Use of cards rearrange groups: sitting with different people creates new discussion."

Theme 3: Participant Content Knowledge Growth Intertwined With Self-Growth In Formative Assessment, Classroom Management/Grouping, And Literacy Strategies. Both preservice CASE institutes facilitated content and pedagogical content knowledge growth through developing and implementing credible teaching models for students. Through the intentional integration of literacy, formative assessment, and classroom management ideas, the lead teachers provide more than just curriculum and technical knowledge; they are building each participants' teacher skillset. CASE lead teachers follow the recipe provided to them to help preservice teachers build their communities of practice, by connecting them with both peers and expert teachers who could provide assistance at the beginning of their career.

Quantitative And Mixed Method Findings

All participants in the study increased in their content knowledge after completing the CASE institute. For the ASA group, content knowledge increased from an average of 80.09% on the pre-test to 90.09% on the post-test. The AFNR group increased from their mean scores from 61.75% to 88.41% on the assessment. In particular, Blair (95% ASA), Carrie (89% ASA), and Mary (72% AFNR) were top scorers on the pretest. When high-score participants responded on how CASE influenced their ability to teach content at the end of the institute, each specifically reflected on inquiry. Blair commented "CASE has influenced my ability to teach content. I have learned a variety of skills, techniques, and strategies that will allow me as a teacher to take my teaching to the next level and provide an inquiry-based learning environment to all the students." Similarly, Carrie reflected she had "learned a lot about letting students be in charge of their learning while still facilitating an effective learning environment." Mary reported "I think it has given more specific strategies and a good starting place for a first-year teacher, but most of it I already had other methods of teach."

Conversely, those who showed the largest growth in content knowledge scores reflected more on generalized growth in teaching strategies. John (+38 AFNR) replied "CASE will allow me to focus more on learning and expanding upon content that I feel I need to improve upon. However, I have learned some content while here, but I have learned more teaching strategies and pedagogy." Grace (+32 AFNR) thought CASE influenced her ability to teach content through "learning materials to use in my classroom. CASE also help give me different methods of providing content to students to keep the students engaged." Elsa (+27 AFNR) reported "CASE has definitely influenced my ability to teach content. It has provided me with not only content knowledge, but also strategies to teach content through spiraling, scaffolding and many other teacher strategies."

Teachers entering CASE with relatively high levels of content knowledge reflected more on their comfort with inquiry and allowing students some freedom with the content. They also reflected on how multiple pedagogical approaches could be used to teach the same objectives, whereas teachers with high content knowledge gains were less likely to mention inquiry in their teacher growth.

When asked if students had previously completed a reading in the content area course prior to the CASE institute, 63% (n=17) had completed at least one course, 33% (n=9) had not taken a reading course, and 4% (n=1) was not sure if they had completed a course.

Discussion

The purpose of this study was to describe the process of growth in literacy strategies and content knowledge for preservice agriculture teachers attending a CASE institute. Researchers utilized multiple levels of abstraction to generate the following themes: 1) participants wrestled with adoption of inquiry teaching strategies as a teaching method, 2) contextualized literacy in the agriculture classroom helped preservice participants understand their role as a teacher of literacy, and 3) participant content knowledge growth intertwined with self-growth in formative assessment, classroom management/grouping, and literacy strategies. Although the findings from this case study should not be inferred to other situations or groups, the following naturalistic generalizations may provide a vehicle for readers to apply for themselves (Stake, 1995).

As evidenced by observations, interviews, and document analysis, lead teachers intentionally modeled inquiry methods, literacy integration, and pedagogical content strategies specific to each lesson (Bandura, 1969). After day 5, researchers observed lead teachers challenging each student to lead their peers in introducing an activity with an integrated literacy strategy as they had modeled. Lead teachers would often place students in the role of instructor; the last day of the first institute was primarily led by the students, and lead teachers gave feedback on to what extent students followed the strategies modeled by lead teachers. Researchers noted both spoken and unspoken expectations from participants that they will implement activities, projects, and problems precisely as modeled by the lead teachers.

Preservice participants, primarily those who had performed well on the pre-CASE content test, both noticed and reported they planned to implement the inquiry and student-centered style modeled by the lead teachers into their classrooms at the conclusion of the CASE institute. In contrast, other students either did not notice, did not understand, or did not adopt the inquiry style central to the CASE curriculum. Teachers with high literacy efficacy were more comfortable adopting student-centered methods and individualized literacy strategies (Hall, 2005). Herndon (2016) noted how preservice teachers struggle to find a balance between student and teacher-centered teaching. Perhaps participants did not have enough processing time to fully understand and reflect on the complex pedagogical tasks observed regarding facilitation and classroom management practices (Eraut, 1994). CASE institutes move quickly, it is possible students struggling with content knowledge may not be able to process how and where inquiry methods can best fit within their classroom. Preservice teachers are unique in they lack the context of knowing their own students and classrooms which may limit their understanding in how these strategies can be implemented or differentiated for specific learners.

These findings support Etkina's (2010) assertion that deep content knowledge is a necessary condition for development of PCK in the agricultural context. This is challenging for agricultural education, as there are many disciplines within the curriculum. Further, PCK is very context-specific; content knowledge and related PCK in animal science may not help a teacher in plant sciences. Perhaps those with lower content knowledge were focused on learning the technical material instead of processing and reflecting how to teach the material. Does their lack of content knowledge limit their

growth as teachers during CASE institutes? How much foundational content knowledge do preservice teachers need before they can develop applicable pedagogical content knowledge in inquiry-based learning? We recommend lead teachers conduct a pre-test for all preservice institutes to assess content knowledge to modify teaching strategies to facilitate pedagogical content knowledge growth. Future research should examine the role agricultural content knowledge plays in inquiry adoption techniques.

Researchers conclude CASE institutes facilitated a more contextualized understanding of the role of literacy strategies in instruction for preservice participants. Several preservice participants reported the CASE institute to be transformational in their growth as an educator. Many students began the experience parroting "literacy is important to education", perhaps reflecting something they were told as part of their preparation program. For most participants, self-identified teaching transformation was operationalized through the addition of practical strategies in formative assessment, classroom management/grouping, and literacy strategies they could immediately implement in their classrooms. For many participants, literacy strategies were a "teaching trick" they could use to better manage learning in their classroom, rather than any content or pedagogical transformation. Researchers observed lead teachers put large amounts of time and effort into modeling these strategies, using their credibility to build attention and motivation (Bandura, 1986). Would the perceived outcomes differ if lead teachers put less emphasis on literacy strategies? Are preservice teachers able to transfer their new literacy knowledge to other courses and contexts? Do preservice teachers have the content knowledge for inquiry to be deconstructed in similar ways?

Preservice CASE participants gained an appreciation of literacy and its role in classroom instruction through participation in the institute; this finding adds to previous research (Hasselquist, 2017) suggesting preservice teachers and in-service teachers both find value in CASE institutes for gaining practical literacy strategies and literacy is an important part of the high school classroom. Perhaps literacy beliefs prior to the CASE institute more closely mirrored O'Brien and Stewart's (1990) findings, suggesting preservice teachers believed literacy does not belong in the classroom because it is counter to the hands-on nature of agriculture education. The lead teachers' purposeful inclusion of literacy strategies may have helped the preservice teachers contextualize how it looked in an agriculture classroom. Researchers conclude the combination of modeled strategies coupled with preservice teachers experiencing literacy strategies from the perspective of a student impacted participant beliefs on integrating literacy strategies into the classroom. Mathematics education researchers noted similar changes once seeing literacy in the specific context of their content area (Spitler, 2011).

In this study, CASE preservice institutes participants showed increases in both content and pedagogical content knowledge domains. All students showed growth in technical content knowledge, as indicated by the pre and posttest data. By intentionally playing the role of high school agriculture teachers, the CASE facilitators helped the preservice teachers uncover new content through use of inquiry instructional techniques, while modeling how the content and procedures should look in the classroom.

Although the CASE institutes serve the purpose of distributing curriculum to agriculture teachers, researchers conclude lead teachers intentionally provided participants with far more than content knowledge. Lead teachers intentionally modeled, and students rehearsed, behaviors to reinforce content, classroom management, pedagogical, and formative assessment strategies. Preservice teachers took particular notice of strategies such as the question "parking lot", clock partner pairing, and formative review strategies, each intentionally planned and modeled by lead teachers as listed in the master schedule. Lead teachers would take time to explain each strategy and how to use these strategies in their classroom.

Lead teachers intentionally fostered a collaborative attitude and actively developed a community of practice through shared documents, grouping strategies, and active paring of the students. All participants indicated the institute was a positive experience and the institute made them feel more prepared for their first year. The participants and lead teachers continued coaching each other, answering questioning, and sharing documents beyond the conclusion of the CASE institutes, suggesting these lead teachers succeeded in building a supportive community of practice. Beginning teachers benefit from mentoring and support groups, which allow them to work through the complexities of changing classroom practices (Greiman, 2010, Sutcher, Darling-Hammond, & Carver-Thomas, 2016). To what extent do CASE cohorts support each other in non-CASE areas? Researchers should further investigate to what extent CASE institutes support job satisfaction and teacher retention.

CASE institutes provide highly focused and sustained professional development, which can be more impactful when compared to traditional one-and-done approaches (Desimone et al., 2002; Garet et al., 2001). Students viewed CASE lead teachers as content experts, future mentors, and credible models for future practice. The lead teachers' influence on the learners should not be underestimated (Borko, 2004). Through their careful modeling and discussion, lead teachers facilitated preservice teacher growth in content, pedagogical content knowledge, and classroom management, to the extent preservice teachers began to copy strategies and mannerisms of the lead teachers. Although future CASE implementation by participants was beyond the scope of this study, researchers conclude the duration, collective participation, content focus, active learning, and coherence of CASE professional development facilitates growth of content, pedagogical content, and knowledge of inquiry-based teaching practices among preservice agriculture teachers (Desimone, et.al., 2002; Garet, et.al, 2001).

This study has implications for CASE preservice institutes. Researchers recommend lead teachers include intentional, specialized, and extended reflection on content, pedagogy, and literacy strategy modeling activities, since reflection on concrete experiences is essential to learning (Kolb, 1984). It is critical preservice teachers attend specially designed CASE institutes to ensure their unique developmental needs are met. Although each activity/ project/problem includes conclusion questions and teacher-led reflection, CASE lead teachers should pay specific attention to the special needs of preservice teachers. Preservice teachers lack the depth of classroom experience and a familiarity with a variety of teaching methods of in-service teachers. Lead teachers need to be strategic and explicit when pointing out the teaching strategies modeled and how they work. Guiding preservice teachers through the reflection is also important. Their limited classroom experience may make it difficult to identify instructional practices needed to enhance student learning. Researchers suggest further inquiry on how reflection fosters growth in inquiry methods for preservice teachers.

Future research needs to focus on replicating this study with in-service teachers during an institute focusing on what knowledge and experiences they gain from the experience. Does a higher level of previous technical knowledge allow participants to better focus on pedagogical aspects, leading to a quicker adoption of inquiry instruction? What is the experience of a CASE institute for a CASE veteran teacher gaining additional certifications? Does attending a CASE institute change how teachers incorporate inquiry in their other classes? A longitudinal study could also help provide insight to what, if any, influence a CASE institute has on teacher change. Does inquiry facilitate deeper understanding and does that understanding appear in end of course STEM assessments? Finally, consideration should be given to studying if attendance in a preservice institute has an influence on stress levels, job satisfaction, and intention to stay in the career for beginning teachers.

References

Adams, A. E., & Pegg, J. (2012). Teachers' enactment of content literacy strategies in secondary science and mathematics classes. *Journal of Adolescent & Adult Literacy, 56*(2), 151-161. https://www.doi.org/10.1002/JAAL.00116

Bandura, A (1969). *Principles of Behavior Modification.* Holt, Rinehart, & Winston.

Borko, H. (2004). Professional development and teacher learning: Mapping the terrain. *Educational Researcher, 33*(8), 3-15.

Buehl, D. (2011). *Developing readers in the academic disciplines.* International Reading Association.

Cantrell, S.C., & Callaway, P. (2008). High and low implementers of content literacy instruction: Portraits of teacher efficacy. *Teaching and Teacher Education, 24*(7), 1739-1750.

Cantrell, S., David Burns, L., & Callaway, P. (2008). Middle-and high-school content area teachers' perceptions about literacy teaching and learning. *Literacy Research and Instruction, 48*(1), 76-94. https://www.doi.org/10.1080/19388070802434899

CASE certification (n.d.) Retrieved January 15, 2019 from https://www.case4learning.org/certification/

Creswell, J. W. (2013). *Qualitative inquiry & research design: Choosing among five approaches* (3rd ed.). Sage.

Darling-Hammond, L., & Bransford, J. (2005). *Preparing teachers for a changing world*. Jossey-Bass.

Darling-Hammond, L. (2010). Teacher education and the American future. *Journal of Teacher Education, 61*(1–2), 35–47. https://www.doi.org/10.1177/0022487109348024

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

Desimone, L. M., Porter, A. C., Garet, M. S., Yoon, K. S., & Birman, B. F. (2002). Effects of professional development on teachers' instruction: Results from a three-year longitudinal study. *Educational Evaluation and Policy Analysis, 24*(2), 81-112.

Edwards, M.C., & Thompson, G. (2010). Designing a technical agriculture curriculum. In R.M. Torres, T. Kitchel, & A.L. Ball (Eds.), *Preparing and advancing teachers in agricultural education (*113-128). The Ohio State University Curriculum Materials Service

Etkina, E. (2010). Pedagogical content knowledge and preparation of high school physics teachers. *Physical Review Special Topics-Physics Education Research*, *6*(2), 20-110.

Eraut, M. (1994). *Developing professional knowledge and competence*. Falmer Press.

Garet, M. S., Porter, A. C., Desimone, L., Birman, B. F., & Yoon, K. S. (2001). What makes professional development effective? Results from a national sample of teachers. *American Educational Research Journal, 38*(4), 915-945.

Greiman, B. C. (2010). Continuing Professional Development. In R. M. Torres, T. Kitchel, & A. L. Ball (Eds.), *Preparing and advancing teachers in agricultural education* (pp. 181-200). The Ohio State University Curriculum Materials Service

Grossman, P. L. (1990). *The making of a teacher: Teacher knowledge and teacher education*. Teachers College Press.

Guskey, T. R. (2000). *Evaluating professional development*. Corwin Press, Inc.

Guba, E. G. (1990). The alternative paradigm dialog. In E. G. Guba's (Ed.), *The paradigm dialog (pp.17-30).* Sage.

Hall, L.A. (2005). Teachers and content area reading: Attitudes, beliefs, and change. *Teaching and teacher education,* 21(4), 403-414. 10.1016/j.tate.2005.01.009

Handley, K., Sturdy, A., Fincham, R., & Clark. T. (2006). Within and beyond communities of practice: Making sense of learning through participation: identity and practice. *Journal of management studies, 43*(3), 641-653.

Hasselquist, L. (2017). *The process of literacy integration in agriculture classrooms: A grounded theory* (Unpublished doctoral dissertation). University of Missouri

Hasselquist, L., & Kitchel, T. (2016a). *Classroom literacy practices and factors of influence*. Paper presented at the North Central Region AAAE Research Conference, West Lafayette, IN.

Hasselquist, L., & Kitchel, T. (2016b). *Relationships among professional training factors, personal literacy preferences, professional literacy attitudes and current classroom practices of agriculture teachers*. Paper presented at The National Research Conference of the American Association for Agricultural Education, Kansas City, MO.

Hasselquist, L., Naughton, M., & Kitchel, T. (2019). Preservice teachers' experiences in a required reading in a reading in the content area course. *Journal of Agricultural Education. 60*(2), 140-152. https://www.doi.org/10.5032/jae.2019.02140

Herndon, K. D. (2016). *Examining the beliefs of preservice teachers in agricultural education toward the use of inquiry teaching: A grounded theory study*. (Unpublished master's thesis). University of Missouri.

Hill, H. C., Ball, D. L., & Schilling, S. G. (2008). Unpacking pedagogical content knowledge: Conceptualizing and measuring teachers' topic-specific knowledge of students. *Journal for research in mathematics education*, 372-400.

Hurst, S. D., Roberts, T. G., & Harder, A. (2015). Beliefs and attitudes of secondary agriculture teachers about global agriculture issues. *Journal of Agricultural Education, 56*(1), 188-202.

Kolb, D. A. (1984). *Experiential learning: Experience as the source of learning and development.* Prentice-Hall, Inc.

Lincoln, YS. & Guba, EG. (1985). *Naturalistic inquiry*. Sage.

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers college record, 108*(6), 1017.

Mueller, A., & Skamp, K. (2003). Teacher candidates talk: Listen to the unsteady beat of learning to teach. *Journal of Teacher Education, 54*(5), 428–440. 10.1177/0022487103256902

O'Brien, D. G., & Stewart, R. A. (1990). Preservice teachers' perspectives on why every teacher is not a teacher of reading: A qualitative analysis. *Journal of Literacy Research, 22*(2), 101-129.

Pauley, C.M., McKim, A.J., Curry, Jr., K.W., McKendree, R.B., & Sorensen, T.J. (2019). Evaluating interdisciplinary teaching: Curriculum for agricultural science education. *Journal of Agricultural Education, 60*(1), 158-171. 10.5032/jae.2019.01157

Putnam, R. T., & Borko, H. (2000). What do new views of knowledge and thinking have to say about research on teacher learning? *Educational Researcher, 29*(1), 4-15.

Rice, A. H. (2015). *Shaping pedagogical content knowledge for experienced agriculture teachers in the plant sciences: a grounded theory* (Unpublished doctoral dissertation). University of Missouri.

Rice, A. H., & Kitchel, T. (2015). The relationship between agriculture knowledge bases for teaching and sources of knowledge. *Journal of Agricultural Education, 56*(4), 153-168.

Rice, A. H., & Kitchel, T (2016). Deconstructing content knowledge: Coping strategies and their underlying influencers for beginning agriculture teachers. *Journal of Agricultural Education, 57*(3), 208-222. https://www.doi.org/10.5032/jae.2016.03208.

Roberts, T.G., Harder, A., & Brashears. M.T. (Eds). (2016) *American Association for Agricultural Eduction national research agenda:2016-2020*. University of Florida Department of Agricultural Education and Communication.

Roberts, T. G., & Kitchel, T. (2010). Designing Professional Knowledge Curriculum and Instruction. In R. M. Torres, T. Kitchel, & A. L. Ball (Eds.), *Preparing and advancing teachers in Agricultural Education* (pp. 101-111). The Ohio State University Curriculum Materials Service

Rosenthal, T. L., & Zimmerman, B. J. (1978) *Social learning and cognition.* Academic Press

Santamaria, L. A., Park, T. D., Keene, B. L., van der Mandele, E. S., Taylor, M. K., & Richards, A. (2010). *Teacher feedback on reading strategy use in career and technical education*. Paper presented at the Proceedings of the Annual Meeting of the Association for Career and Technical Education Research, Las Vegas, NV.

Shoulders, C. W., & Myers, B. E. (2014). Effective professional development in agriscience education: An examination of core features. *Journal of Agricultural Education, 55*(1), 167-185. https://www.doi.org/10.5032/jae.2014.01168

Shulman, L. S. (1987). The wisdom of practice: Managing complexity in medicine and teaching. In D. Berliner & B. Rosenshine (Eds.), *Talks to Teachers: A Festschrift* (pp. 369-387). Random House.

Smith, A. R. , Lawver, R. G., & Foster, D. D. (2018). *National Agricultural Education Supply and Demand Study, 2017 Executive Summary*. Retrieved from http://aaaeonline.org/Resources/Documents/NS D2016Summary.pdf

Smith, T. M., & Ingersoll, R. M. (2004). What Are the effects of induction and mentoring on beginning teacher turnover? *American Educational Research Journal, 41*(3), 681-714. https://www.doi.org/10.2307/3699442

Stake, R. E. (1995). *The art of case study research*. Sage.

Sutcher, L., Darling-Hammond, L., & Carver-Thomas, D. (2016). *A coming crisis in teaching? Teacher supply, demand, and shortages in the US.* Learning Policy Institute.

Spitler, E. (2011). From resistance to advocacy for math literacy: One teacher's literacy identity transformation. *Journal of Adolescent & Adult Literacy, 55*(4), 306-315. https://www.doi.org/10.1002/JAAL00037

Torres, R. M., Lawver, R. G., & Lambert, M. D., (2009). Job-related stress among secondary agricultural education teachers: A comparison study. *Journal of Agricultural Education, 50(3),* 100-111. https://www.doi.org/10.5032/jae.2009.03100

Ulmer, J.D., Velez, J.J., Lambert, M.D., Thompson, G.W., Burris, S., & Witt, P.A. (2013). Exploring science teaching efficacy of CASE curriculum teachers: A post-then-pre assessment. *Journal of Agricultural Education, 54*(4), 121-133. https://www.doi.org/10.5032/jae.04121

Van Driel, J. H., Jong, O. D., & Verloop, N. (2002). The development of preservice chemistry teachers' pedagogical content knowledge. *Science Education, 86*(4), 572-590.

Velez, J.J., Lambert, M.D., & Elliot, K.M. (2015). Perceptions of critical thinking, task value, autonomy, and science lab self-efficacy: A longitudinal examination of students' CASE experience. *Journal of Agricultural Education, 56*(2), 204-216. https://www.doi.org/10.5032/jae.2015.02204

Warner, A. J., & Myers, B. E. (2011). Agriscience teachers' concern profiles for content area reading strategies. *Journal of Agricultural Education, 52*(4), 109-122. 10.5032/jae.2011.04109

Wells, T., Hainline, M.S., & Smalley, S.W. (2019). Identifying challenged pre-service teachers encountered when teaching curriculum for agricultural science education (CASE) coursework during student teaching. *Journal of Agricultural Education 60*(3), 128-140. https://www.doi.org/10.5032/jae.2019.03128

Yin, R. K. (2003). *Case study research and applications: Design and methods*. Sage.